Women's health behavior in unequal gender power relations

The example of carrying heavy loads in Nepal

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Vica Marie Jelena Tomberge

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"As women achieve power, the barriers will fall. As society sees what women can do, as women see what women can do, there will be more women out there doing things, and we'll all be better off for it."

Ruth Bader Ginsburg.

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Abstract

Unequal gender power relations are a major reason for women's high health-related vulnerabilities in low-resource populations. The sociological theory of gender and power proposes a gender division of labor restricting women to lower-paid and unpaid labor, a gender division of power granting women limited decision-making autonomy, and a division of cathexis including affective attachments and norms. All these challenge women's engagement in healthy behaviors. Health psychology research can describe, explain, and promote women's health behavior but seldom integrates gendered norms, roles, and differentials in power relations. Even so, established health behavior models address certain promising factors that might be of relevance for women's health behavior in unequal gender power relations, such as self-efficacy and social resources.

One example of women's health behavior in unequal gender power relations is the frequent carrying of heavy loads in low- and middle-income countries. Many households lack improved water and energy access and thus need to carry heavy loads of water and firewood from sources off-premises. A traditional gender division of labor makes this physically demanding task women's responsibility, and it can pose a severe risk of pelvic organ disorders. Behavioral adaptations that protect the pelvic floor when carrying loads can diminish this risk. However, no studies have investigated pelvic-floor-protective carrying behaviors from a health psychology perspective such as identifying the psychosocial determinants that are essential for developing theory-based health behavior interventions promoting such behaviors.

This thesis aims to understand and address women's health behavior in unequal gender power relations with the example of carrying heavy loads in Nepal. To do so, the present research first seeks to understand women's health behavior in gender power relations by gaining knowledge on the behavior of carrying loads and its relevance for women's everyday lives and by identifying the psychosocial determinants of protective carrying behaviors. Second, it aims to identify the role of influential social partners' cognitions in women's protective carrying behaviors, specifically women's mother-in-law. Third, it aims to investigate whether interventions that promote self-efficacy and social support can enable women's protective carrying behaviors in unequal gender power relations.

Two studies in rural villages of Nepal were conducted that provided surveys and interviews to address several research questions. The first study included three investigations, all using different designs and subsamples: A first large-scale survey (N = 1001) described the physical burden of carrying loads and its correlation with women's psychosocial well-being.

Second, a mixed-methods study comprising a quantitative survey (N = 921) and qualitative interviews with women and their family members (N = 21) was conducted to understand the psychosocial determinants of pelvic-floor-protective carrying behaviors. Third, a dyadic survey with N = 476 daughters- and mothers-in-law nested in 238 dyads investigated the interrelatedness of daughters- and mothers-in-law's cognitions and behavior related to pelvic-floor-protective carrying. The findings of these investigations informed the development of a pilot intervention study. This pilot intervention study applied a 3-arm parallel nonrandomized, controlled trial with N = 300 women and their N = 300 social partners to assess whether self-efficacy and social support promotion can enable women's pelvic-floor-protective carrying behaviors.

The large-scale survey and the mixed-methods study identified the carrying of heavy loads as a highly prevalent everyday working task for women in rural Nepal, even during vulnerable periods of pregnancy. The large-scale survey further described the physical burden of this behavior and its relation with women's impaired well-being. The mixed-methods and the dyadic study identified self-efficacy, injunctive norm, and social support as the most important determinants of women's health behavior and emphasized the powerful influence of family members' cognitions and a shift in decision-making power towards them. The results of the intervention study found that promoting self-efficacy and social support can enable women's pelvic-floor-protective carrying behavior more effectively than providing only information. The intervention effects were partly explained by social support received from a social partner. In addition, women in all conditions indicated improved women's pelvic floor health and well-being over time.

Using health psychology theory and methods allowed to identify the behavioral risk factors of carrying heavy loads and the psychosocial determinants of women's protective carrying behaviors. The information obtained was useful in enabling women's protective carrying behaviors. Established health behavior models thus proved useful to understanding and changing women's health behavior in unequal gender power relations, particularly by emphasizing the role of self-efficacy and social relationships. The results of this thesis further indicate that qualitative and dyadic methodological approaches and particular theoretical adaptations may be promising in better accounting for women's limited decision-making power and a more gendered lens on social norm and structural barriers. Considering unequal gender and power relations when investigating women's health behavior in low-resource populations may contribute to overcoming gender inequalities to health and can support the development of socially-inclusive perspectives in health behavior research.

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List of abbreviations

[APIM]	Actor partner interdependence model
[BCT]	Behavior change technique
[DBCT]	Dyadic behavior change technique
[GEE]	Generalized estimating equations
[HAPA]	Health action process approach
[ICC]	Intraclass correlations
[ITT]	Intention to treat
[HIV]	Human immunodeficiency virus
[PFM]	Pelvic floor muscles
[SCT]	Social cognitive theory
[SDG]	Sustainable development goals
[SUVA]	Swiss National Accident Insurance Fund
[UNICEF]	United Nations International Children's Fund
[UNFPA]	United Nations Populations Fund
[WEIRD]	Western, educated, industrialized, rich, democratic
[WHO]	World Health Organization

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Chapter I

General introduction and overview of this dissertation

1. Gender inequality and women's health

Gender inequalities contribute to differences between genders in health behaviors, vulnerabilities, perception of illness, access to health services, treatment responses, and health outcomes (Gamper et al., 2022). Women and girls[1] in low-resource populations are disproportionately affected by gender inequality in health (Iyer et al., 2008; World Health Organization, 2010). They are more often affected by chronic and psychosomatic disorders and face increased risks of sexually transmitted infections including human immunodeficiency virus (HIV), malnutrition, gender-based violence, and depression in addition to biological risks such as cervical cancer, complications during child delivery, and unsafe abortions (Gamper et al., 2022; Iyer et al., 2008; Vlassoff, 2007; World Health Organization, 2010).

However, existing inequalities between men and women cannot be explained by biological differences (sex) alone (Morgenroth & Ryan, 2021). An increasing body of literature indicates that unequal gender power relations are one of the main reasons for women's health-related vulnerabilities (R. Connell, 1987; Garrison-Desany et al., 2021; Robinson et al., 2017; Wingood & DiClemente, 2000). Power is defined as the influence of specific groups through persuasion, authority, and coercion and leads to the creation and control of resources (Turner, 2005). Gender is defined as specific roles, behaviors, and norms that are socially designated as appropriate for women and men and shapes power relations at all levels of society, from intimate and family relationships to community and politics (Koester, 2015). Unequal gender power relations can affect women's health both directly and by challenging their engagement in health-promoting behaviors and avoidance of health-impeding behaviors (Earth & Sthapit, 2002; Wingood & DiClemente, 2000; Yount, 2002).

This thesis develops and tests theoretical and methodological approaches to consider gender power relations when investigating women's health behavior. The following sections of this introduction first describe a sociological theory to understand the concept of gender and power and map out the broad body of literature that emphasizes their relevance to women's health behavior, particularly in low-resource contexts. Subsequently, health behavior models and relevant health psychology research to understand and address women's health behavior are explained. An example of women's health behavior in gender power

[1] I recognize that gender is not binary (Galupo et al., 2017). However, this thesis uses a binary lens to focus on women and men, their contextual relationships, and the inequalities that result for people perceived as female. When referring to women and girls in the context of gender and power in this thesis, I refer to female-read and female-socialized people (Stockard, 2006). Large parts of the papers included specifically refer to individuals with female reproductive anatomy and functions because these are specifically and exclusively at risk for pelvic organ disorders such as pelvic organ prolapse (D. Chow & Rodríguez, 2013), which are highly relevant for this thesis.

relations is then introduced: the behavior of carrying heavy loads in Nepal. The last part of the introduction presents the aim and research questions of this thesis and a description of the studies conducted.

2. Theory of gender and power

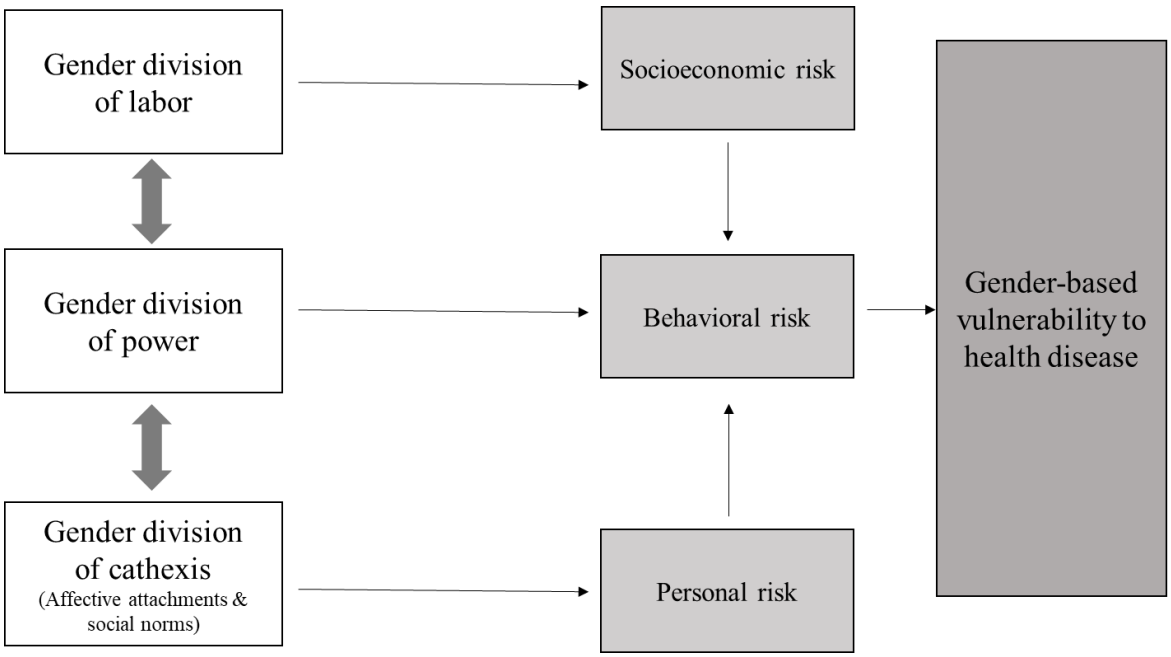
Gender power relations and their relevance to women's health can be understood with sociological theories. The theory of gender and power by Raewyn Connell (1987) outlines how the sociocultural construct of gender interplays with power and influences people's decision-making and behaviors. According to this theory, women's vulnerability to impaired health stems from gender inequalities represented in three major social structures (R. Connell, 1987): the gender division of labor restricting women to lower-paid and unpaid labor, a gender division of power granting women limited decision-making autonomy, and a division of cathexis including affective attachments and norms. Together, these lead to personal, behavioral, and social risk factors (Figure 1). Examples of these risk factors are given when outlining the theory in subsequent sections.

Gender power relations intersect with other social and economic inequalities arising from ethnicity, socioeconomic status, disability, age, and geographic location (Drever, 2004; Iyer et al., 2008). This means that women in low-resource contexts, including those characterized by financial pressure, suboptimal healthcare service delivery, underdeveloped infrastructure, lower education and literacy, restricted social resources, and geographical and environmental barriers (van Zyl et al., 2021), are particularly burdened by gender and power inequalities in health. Among other groups, this has been reported for women in rural communities in low-income countries (Iyer et al., 2008), women of color (Bentley et al., 2003), and women who have migrated (Adanu & Johnson, 2009).

Wingood and DiClemente (2000) applied Connell's theory of gender and power (1987) to women's health with the example of their high vulnerability to HIV. The following section of this thesis explains the theory of gender and power in relation to women's health as described by Connell (1987) and Wingood and DiClemente (2000) and extend their reflections on how these three structures of gender and power can impair women's health behaviors other than HIV prevention behaviors.

Figure 1

Theory of gender and power based on Connell (1987) *and Wingood & DiClemente (2000)*



2.1 Gender division of labor

One of the structures in the theory of gender and power is a gender division of labor. A gender division of labor arises because women often participate in low-paid sectors of the labor market and manage unpaid caregiving responsibilities (Chant, 2014; Matthews & Power, 2002). Women have been found to perform up to 34 hours more domestic and care work per week than men (World Bank, 2022). Wingood and DiClemente (2000) focus on the socioeconomic risks to health arising from an unequal gender division of labor. In addition, women's high physical and mental workload can also severely affect their perceived stress and psychosocial well-being (Avotri & Walters, 1999; Cramer & Hunter, 2019; Väänänen et al., 2005). A few studies also indicate associations between health behaviors and competing demands with multiple roles: Working mothers display high levels of physical inactivity (King et al., 2000; Mailey & McAuley, 2014), have poorer sleep quality than fathers (Maume et al., 2009), and report poorer dietary habits (Devine et al., 2003; Richardson et al., 2015).

As already indicated, an unequal gender division of labor can lead to women's socio-economic risks to health: Higher poverty levels in women and thus limited access to re-sources challenge health prevention and treatment. This includes impaired access to health security, education including health-related literacy (Sørensen et al., 2015), and food and housing security or specific prevention materials such as condoms (Cox et al., 2017; Ivers &

Cullen, 2011; Wingood & DiClemente, 2000). Higher poverty levels also increase women's risk of working in high-demand, low-control environments, such as working as sex workers, in the ready-made garment industry, and in vulnerable forms of employment such as informal and part-time employment (Akhter et al., 2017; International Labour Organization, 2018; Scorgie et al., 2012). In addition, women's socioeconomic risk exacerbates dependencies in intimate relationships and family systems because resources are often allocated and expressed between sexual partners and between generations (Moss, 2002). These dependencies can intensify unequal divisions of power (Osamor & Grady, 2018).

2.2 Gender division of power

The second structure in the theory of gender and power is the unequal distribution of authority, power, and control in institutions and social relationships, referred to as a gender division of power (R. Connell, 1987; Li, 2004; Wingood & DiClemente, 2000). In many countries, men are overrepresented at the political level and may decide on regulations limiting women's bodily autonomy and integrity such as abortion laws and not criminalizing marital rape and violence (Chibuike & Innocent, 2016; European Parliament et al., 2020). The gender division of power is also seen as one of the main risk factors for physical and sexualized violence against women (Zegeye et al., 2022).

At the household level, male partners may control women's access to financial and other resources such as food and education (Becker et al., 2006; Moss, 2002; Wingood & DiClemente, 2000). Wingood and DiClemente postulate that the division of power in women's health manifests predominantly as behavioral risk factors. Women may not feel confident in engaging in healthy behavior due to low perceived control over health decisions and fear of communicating their needs related to health and resources (Closson et al., 2018; Pennington et al., 2018; Wingood & DiClemente, 2000). In low-income countries, for example in Central Africa or Southern Asia, women can only participate in around 20% or 60% respectively of decisions about their own health care (World Bank, 2022).

It needs to be added to the theory, that these countries are often characterized by households in which multiple generations and married siblings of a family live together, and both male and female family members that are perceived as having higher status or of older age can hold power over decisions and resources in addition to or senior to women's male partners (Gupta et al., 2021; Mookerjee, 2019). Younger women's decisions over health or health behavior can then be partly or fully shifted to husbands and in-laws (Kumar et al., 2016; Pun et al., 2016; Raman et al., 2014; Yount, 2002). Their disapproval and decision-

making power have been found to be a major barrier for women of low socioeconomic status to screen for cervical cancer and seek antenatal care, use contraception, and reject female genital manipulation and heavy workload during pregnancy (Darj et al., 2019; Kumar et al., 2016; Megersa et al., 2020; Raman et al., 2014; Yount, 2002).

2.3 Gender division of cathexis

As the third structure in the theory of gender and power, the division of cathexis refers to affective attachments in relationships that can be associated with social norms, such as norms about femininity and expectations how a typical woman or man behaves in society and relationships (R. Connell, 1987). When women strongly identify with or internalize their role as a woman and are willing to fulfill gendered norms within relations, families, and communities, particularly when relationships are characterized by emotional dependencies (Wingood & DiClemente, 2000). This can lead to personal risk factors for women if these gendered norms are harmful. For example, an ideology in which women are of lower status, modest, subservient, caretaking, hard-working, conformist, and with a certain body type can motivate women to engage in a range of harmful behaviors such as physically demanding work, restrictive eating, avoiding negotiations over using condoms, and accepting violence against women to please an intimate partner (Doku & Asante, 2015; Garrison-Desany et al., 2021; Katabaro, 2016; Messer, 1997; Wingood & DiClemente, 2000).

The theory of gender and power indicates the intersection of these three social structures, with socioeconomic risk factors and increased cathexis exacerbating power relations and behavioral risk factors. This means that women's power over health behavior is particularly impaired in populations that have low socioeconomic resources and accept traditional gender roles that reinforce social inequalities (Wingood & DiClemente, 2000).

3. Health behavior theory addressing women's health behavior

Although the literature provides ample evidence that women's behavior in low-resource contexts is often shaped by gender power relations, few studies take all three structures into account when describing, understanding, or changing women's health behaviors, all of them studies in sexual and reproductive health behaviors (DePadilla et al., 2011; Garrison-Desany et al., 2021; Robinson et al., 2017). Another limitation is that studies considering at least one of the structures of gender and power rarely include psychological determinants (Darj et al., 2019; Doku & Asante, 2015; Kumar et al., 2016; Li, 2004; Yount, 2002). However, some studies touch on the concept of self-efficacy, belief in one's own ability to successfully organize and execute a behavior to achieve goals (Bandura et al., 1999). These

studies suggest, for example, focusing on women's empowerment by increasing self-efficacy, autonomy, and agency to improve women's health decision making (DePadilla et al., 2011; Garrison-Desany et al., 2021; Jennings et al., 2014; Robinson et al., 2017; Wingood & DiClemente, 2000). However, studies that consider gender power relations often lack empirical evidence or a theoretical rationale to fully understand individual and social aspects of women's health behavior. Theories are indispensable to studying health behavior for describing and understanding processes, gaining knowledge, and gathering evidence (Lippke & Ziegelmann, 2008).

3.1 Health behavior models

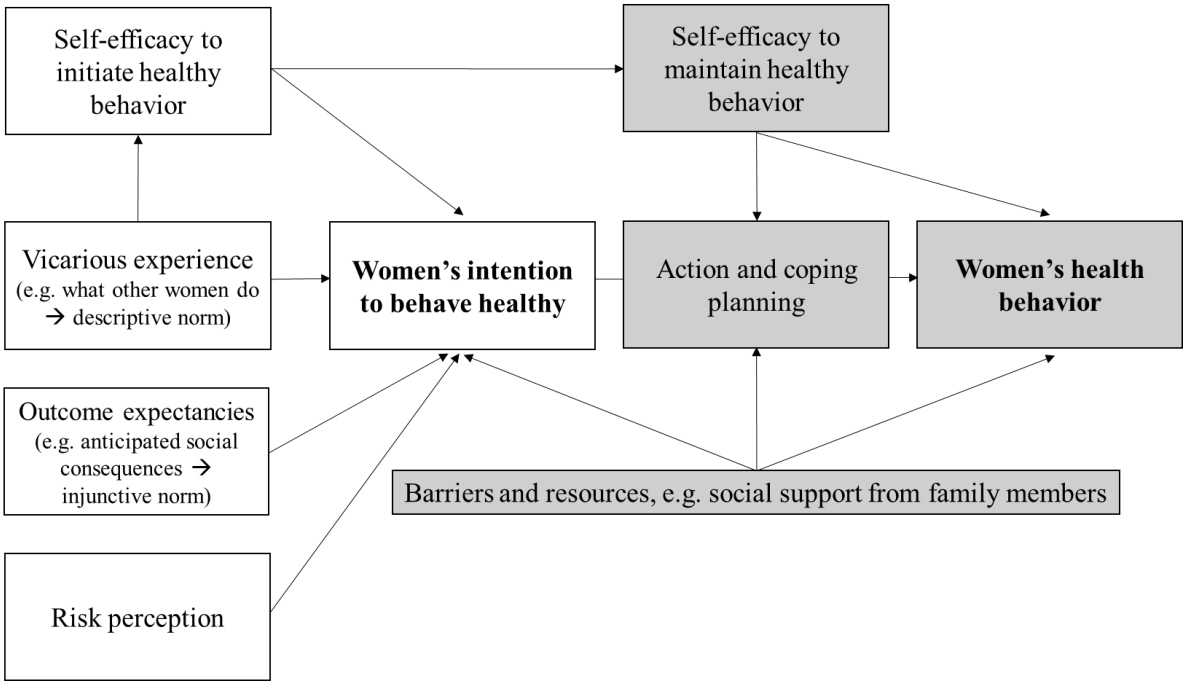
Health psychologists are experts in understanding and changing health behaviors in individuals, groups, and populations. They use health behavior models that offer a theory-based solution to identifying psychosocial determinants of behavior and thus describe, understand, predict, and change behavior (Bartholomew & Mullen, 2011). Health behavior models suggest multiple determinants that may be relevant to health behaviors and the possible relationships between determinants and health behaviors (Bartholomew & Mullen, 2011).

However, one question that needs to be discussed is whether health behavior models sufficiently address gender power relations and capture the broad range of social and psychological determinants that can influence women's health behavior in low-resource contexts. Even though some health behavior models include gender among other sociodemographic determinants (Bandura, 1998; McLeroy et al., 1988; Rosenstock, 1974), in common health psychology research practice, this factor is then often simply handled as a covariate or reported in relation to sex-disaggregated data (e.g. Anderson et al., 2006; Howland et al., 2016). Some health behavior studies investigate male and female genders as moderators of disparities in health behavior change, which is a good starting point (Alcántara et al., 2020; Schüz et al., 2021). Even so, none of these studies seems to include more specific aspects of gender, such as exposure to gendered discrimination (Alcántara et al., 2020). In addition, Alcantara et al. (2020) reviewed health behavior studies including social determinants such as gender and found them often to be atheoretical, of poor methodological quality, and focused solely on the individual level. If approaches to change health behavior do not properly take socioeconomic and demographic determinants such as gender power relations into account, they may be ineffective, unintentionally exacerbate or even cause health disparities among social groups, and thus further marginalize women (Alcántara et al., 2020; Mannell et al., 2019; Schüz et al., 2020; Sorensen et al., 2003; White et al., 2009).

Nonetheless, common health psychology models propose certain promising determinants that can be relevant to unequal gender power relations. An integrated visualization of these promising determinants can be found in Figure 2. Self-efficacy and social and structural factors have been observed to be of potential relevance for women's health behavior in unequal gender power relations (e.g. DePadilla et al., 2011; Garrison-Desany et al., 2021; Robinson et al., 2017; Wingood & DiClemente, 2000). The following section therefore outlines two health behavior models that emphasize self-efficacy and sociostructural determinants as predictors of health behavior.

Figure 2

Women's health behavior according to psychological health behavior models



Note. This figure outlines potentially relevant determinants of women's health behavior in gender power relations based on the health action process approach (HAPA). Vicarious experience theorized by the social cognitive theory (SCT) was added as it may represent descriptive norms which are missing in the HAPA.

Social cognitive theory

Bandura's social cognitive theory (SCT) was the first to emphasize the importance of self-efficacy for humans' cognition and behavior and is one of the models most commonly applied to explain psychosocial determinants of health behavior (Bandura, 1986, 1998; Davis et al., 2015). The SCT states that self-efficacy will affect health behavior both directly and

indirectly by influencing outcome expectancies, sociostructural determinants, and goals. Goals refer to behavioral goals and the commitment to achieving them and can be understood as women's intention to engage in healthy behavior (Bandura, 1986, 1989). Outcome expectancies refer to the physical, social, and self-evaluative consequences expected when behaving healthy. Physical consequences mean, for example, how women expect a certain behavior to affect their health; social consequences how they expect family members to react when engaging in healthy behavior; and self-evaluative ones how they feel about themself when they perform this behavior, for instance proud, guilty, or ashamed. Sociostructural factors can manifest in resources, such as family members who support women in healthy behavior, and barriers, such as limited access to resources. In addition to defining determinants relevant to behavior, Bandura also specifies how the most influential factor, self-efficacy, can be modified (Bandura, 1977, 1998): First, performance accomplishments promote self-efficacy through the experience of personal success: women's successful achievement in healthy behavior promotes self-efficacy for future engagement in health behavior. Second, self-efficacy can be boosted by seeing others perform a behavior successfully, referred to as vicarious experience. Third, verbal persuasion women receive as messages that they possess the capabilities to manage difficult situations are assumed to promote self-efficacy. Last, the theory assumes that emotional arousal can inform self-efficacy because women are more likely to expect to perform a behavior efficiently in the future when they are relaxed and not anxious when practicing that behavior.

To summarize, according to the SCT, women's belief in their own ability to behave healthily regulates the goals they set for themselves, the strength of commitment to these goals, and the outcomes they expect for their efforts. Their belief in their own ability will further enable them to persevere in the face of barriers and enhance their acquisition of resources to manage these barriers.

Health action process approach

The concept of self-efficacy was expanded by Schwarzer (1992) for different stages of health behavior change within the health action process approach (HAPA). The HAPA suggests that the adoption, initiation, and maintenance of health behaviors must be explicitly conceived as a process consisting of a motivation phase and a volitional or action phase. Put simply, in the first stage, women build a motivation or intention to change when risk perception makes them aware of health risks and when they have expectations, or outcome expectancies, of the positive effects of healthy behavior. At this stage, their belief in their own ability to perform healthy behavior, termed motivational or task self-efficacy, is important.

Once women are motivated to engage in healthy behavior, action planning, which is about deciding when, where, and how to engage in the healthy behavior, and coping planning, which is about anticipating barriers and making alternative plans, will help to translate intentions into action in the volitional phase. Additionally, this phase includes evaluating one's own behavior through action control and managing lapses. Again, self-efficacy is important in the volitional stage: maintenance self-efficacy is women's belief that they can maintain the behavior even if barriers arise, and recovery self-efficacy is the belief that they can return to performing the behavior after a lapse.

Although a previous version of HAPA model (Schwarzer, 2008) did not specifically address barriers to health behavior or resources for overcoming them, later versions also included contextual barriers and resources such as social support that need to be considered for the performance of behavior (Schwarzer et al., 2011). The HAPA model has proven applicable to a broad range of health behaviors, populations, and cultures, including several in the Global South (Renner et al., 2007; Zhang et al., 2019).

To summarize, health behavior models such as the SCT and the HAPA seem to propose certain promising determinants to change women's health behavior within gender power relations. Subsequently, the determinants that might be particularly important for women's health behavior are mapped out (see Figure 2).

3.2 Self-efficacy and health behavior

One of the main assumptions about women's behavior in unequal gender power relations is that women have limited decision-making power over their health (Moss, 2002; Osamor & Grady, 2016; Robinson et al., 2017; World Bank, 2022). By addressing self-efficacy, the SCT and the HAPA take account of women's feeling that they can modify behavior within limited decision-making control and maintain it even if difficulties arise, such as other people interfering with women's intention to engage in healthy behaviors. According to Bandura (1999), self-efficacy beliefs are the key factor of human agency, because if people believe they have no power, they will not even attempt to take action to reach their goals.

In general, self-efficacy is considered a universal construct that establishes meaningful relationships with other psychological constructs such as optimism, self-regulation, and self-esteem and seems to buffer depression and anxiety (Luszczynska et al., 2005). Self-efficacy has been shown to be an important determinant of women's health behaviors in low-resource settings (e.g. Chipojola et al., 2020; Khodadadi et al., 2022). Several intervention studies have shown that self-efficacy promotion can enhance health behaviors (e.g. Chipojola et

al., 2020; L.-L. Lee et al., 2007, 2012; Luszczynska, 2004; Luszczynska et al., 2006, 2016; Warner & French, 2020), including women's health behaviors (e.g. Chipojola et al., 2020; Hatamleh, 2012; Ip et al., 2009; Luszczynska, 2004; Mailey & McAuley, 2014; Robinson et al., 2017), and health behavior change in low-resource contexts (e.g. Ansari et al., 2014; Hatamleh, 2012; L.-L. Lee et al., 2007). However, other studies have found no impacts of self-efficacy-based health behavior change interventions on women's health behavior (Robinson et al., 2017; Sacomori et al., 2015).

3.3 Social relationships and health behavior

Some of the determinants proposed by the SCT and the HAPA emphasize the importance of perceived influences arising from social relationships, which might be highly relevant for women's health in unequal gender power relations (Kumar et al., 2016; Megersa et al., 2020; Raman et al., 2014; Yount, 2002). First, one way in which social relationships can affect women's cognitions and behavior is through ongoing exposure to a social partner's health cognitions or behavior, described in the SCT as social modeling and vicarious experience (Bandura, 1977; Rothman et al., 2020). Second, social relationships can influence health behavior by providing descriptive social norm about how others behave and injunctive norm about which behaviors they approve and disapprove (Cialdini et al., 1991). Descriptive norm taps into the concept of vicarious experience in SCT and is not explicitly mentioned in the HAPA, whereas injunctive norm is represented with the social dimension of outcome expectancies in the SCT and the HAPA.

In addition, the two models include sociostructural barriers and resources, for example social network factors that support or impede a women's engagement in healthy behaviors (Bandura, 1998; Schwarzer, 1992). Although not all of these are explicitly named in the SCT or the HAPA, social resources involve quantitative and structural aspects such as the number of close and extended social network partners, frequency of social contacts that can influence health behaviors, and a qualitative, functional aspect such as social exchange processes that encourage health-enhancing behaviors and discourage health-impeding behaviors (Schwarzer & Leppin, 1991). The following sections describe in more detail how social norms and social support may positively or negatively affect women's behavior.

Social norms

Social norms, specifically descriptive and injunctive norm, and conforming to these are central to the development of personal identity and thus define whether a behavior is part of a woman's self-identification (e.g. Bute & Jensen, 2010). In line with the theory of gender

and power, researchers of health behavior in low-income countries have often identified social norms as predictors of health behavior in women's health (e.g. Bute & Jensen, 2010; Lowe et al., 2016; Yount, 2002). Particularly in low-resource contexts, women are often influenced by the practices and expectations of other women, for example female family members, and may be criticized if they do not align with them (e.g. Bute & Jensen, 2010; Kumar et al., 2016; Mumtaz & Salway, 2007; Yount, 2002).

Social support

Social support is a functional and qualitative aspect of social relationships and can be defined as providing resources designed to enhance the recipient's ability to cope with environmental requirement and in times of need (Schwarzer, 2004; Schwarzer & Leppin, 1991). Social support can be divided into perceived support, the perception that social resources are available when they are needed; received support, retrospective reports of actual support received; and provided support, retrospective partner reports on actual support provided (Schwarzer & Knoll, 2007). Social support can be general as well as specific to situations and behaviors (Tay et al., 2013). General social support, the perception that one is cared for, has been reported to enable an individual's coping skills, health cognitions, health behaviors, and overall well-being (H.-H. Wang et al., 2003; Wills, 1991).

For health behavior, behavior-specific support has been reported to be more predictive than general social support (Tay et al., 2013). Just like general social support, forms of behavior-specific social support can be emotional, such as encouraging women to behave healthily or making them feel valued when they do; informational, such as giving advice on how to behave healthily; and instrumental: providing practical assistance such as taking over caretaking tasks so that women can care for their health (Schwarzer & Knoll, 2007). Fostering social support to promote women's health has been suggested for decades (Raj & Plichta, 1998; M. F. Young et al., 2019), and social support is among the behaviors most frequently targeted by change techniques in low- and middle-income countries (Cho et al., 2018; Goodwin et al., 2015; Michie et al., 2009).

Benight and Bandura (2004) outlined an enabling effect of social support in which a supporting person equips the recipient with the personal resources to cultivate their ability and self-efficacy to select and construct environments that promote successful adaptation to challenging demands; this has been labeled the enabling hypothesis. In line with the enabling hypothesis, social support may influence women's health behaviors by promoting their self-efficacy to initiate health behavior and maintain it when difficulties arise (Benight & Bandura, 2004; Chehreh et al., 2021; Schwarzer & Knoll, 2007). The enabling hypothesis has

been successfully applied to health behavior change in physical exercise, vaccine uptake, and illness management in the Global North (Banik et al., 2017; Ernsting et al., 2015; Rackow et al., 2015). Although only one of these studies experimentally manipulated social support (Rackow et al., 2015), social support interventions sometimes report increased self-efficacy among other outcomes (Vorderstrasse et al., 2016). The enabling hypothesis has also been applied and partly supported in a low-income setting, where increased social support was associated with mothers' higher self-efficacy in breastfeeding their newborns but not with increased breastfeeding (McCarter-Spaulding & Gore, 2012).

Finally, although social support often has positive effects on health behavior change, social support can also have negative consequences on a person's self-efficacy and well-being: Social support may signal to the recipient that they are incapable of coping independently with a stressful situation and that they are dependent on the provider's help (Bolger et al., 2000).

To summarize, health psychology theory provides promising determinants to understand the influence of self-efficacy and social relationships on health behavior, which may be essential to understanding women's health behavior in gender power relations (e.g. Allendorf, 2007; Hirani, 2015; Kumar et al., 2016; Raman et al., 2014; Robinson et al., 2017). Nonetheless, whether these theories can fully address the structures of unequal gender power relations remains to be tested, for example by applying them to understanding and changing women's health behaviors in low- and middle-income countries.

4. The example of carrying heavy loads in Nepal

One health-impeding behavior of particular relevance for women in low- and middle-income countries is carrying heavy loads (e.g. Geere & Cortobius, 2017; Koyuncu et al., 2021; Sorenson et al., 2011). When looking at the living conditions of households in low- and middle-income countries, the importance of carrying loads becomes quite evident. Many such households represent the 25% of households worldwide that collect water from sources off-premises, that use wood as their primary source of energy, and that use agriculture as one of their primary sources of income (Dethier & Effenberger, 2012; Kojima, 2021; World Health Organization & UNICEF, 2017). These living conditions involve carrying heavy loads of water, firewood, and agricultural items daily (Borah, 2015; K. Das et al., 2019; Earth & Sthapit, 2002; Johnston et al., 2018; S. Shrestha et al., 2019). In countries and households with a traditional gender division of labor, ensuring the household's water and food supply is often women's responsibility (Earth & Sthapit, 2002; S. Shrestha et al., 2019). Lifting and carrying

heavy loads thus forms part of many women's daily routine in low- and middle-income countries, including Nepal (see Figure 3).

Figure 3

The carrying of water (upper left), firewood (upper right), and grass (below) in Nepal

Nepal is an example of particular relevance for examining women's behavior in unequal gender power relations. The Gender Inequality Index (2022) indicates that only 69% equality in reproductive health, empowerment, and the labor market has been achieved in Nepal (World Economic Forum, 2022). Equality in health and survival is among the poorest dimensions of gender equality in Nepal: Only 57.7% of women can take decisions on their own health care (World Bank, 2022). Particularly in rural, hilly areas of Nepal, which are characterized by high male labor migration and agriculture as a main source of income, women carry heavy loads due to their high workload in productive and reproductive labor; this involves caretaking tasks

such as cooking which entail collecting firewood (Earth & Sthapit, 2002; Gurung et al., 2005; Halbrendt et al., 2014; Radl et al., 2012).

4.1 The health risks of carrying heavy loads

Carrying loads consumes time and energy and can thus limit gender equality in multiple domains, such as impeding women's access to education and to paid labor. It also poses a particular risk to their mental and physical health (Curtis, 1986; K. Das et al., 2019). Frequent carrying of heavy loads exerts significant strain on women's bodies and poses a risk of musculoskeletal disorders and injuries, spontaneous abortion, and pelvic organ disorders (Geere et al., 2010; Geere, Bartram, et al., 2018; Walker & Gunasekera, 2011). Pelvic organ disorders include urinary incontinence, bowel dysfunction, and pelvic organ prolapse, in which female pelvic organs descend into or out of the vagina (Jelovsek et al., 2007). A particular risk of pelvic organ disorders arises from carrying heavy loads during pregnancy and postpartum (Darshan, 2009; Earth & Sthapit, 2002; Koyuncu et al., 2021; MacDonald et al., 2013). On average, every fifth woman in low- and low-middle income countries is affected by pelvic organ disorders (Walker & Gunasekera, 2011).

Also in Nepal, at least 10% of women are affected by pelvic organ prolapse. What is alarming is that in Nepal, also women under 25 years of age are frequently affected by pelvic organ prolapse; in other regions, the condition is usually faced by women after menopause (B. Shrestha et al., 2015). The social consequences of pelvic organ disorders are substantial and present another risk to gender equality for Nepali women. These social consequences include physical and emotional isolation, inability to work, economic burden, and domestic violence (Darshan, 2009; Earth & Sthapit, 2002; Khadgi, Shrestha, & Shrestha, 2015). Due to the high prevalence of pelvic organ disorders in low- and middle-income countries and its severe psychosocial consequences, the present research will focus on preventing the risks of carrying behavior in relation to pelvic floor health.

4.2 Coping with the health risks of carrying heavy loads: pelvic-floor-protective carrying

Even though a couple of studies have raised awareness of the health risks entailed in carrying heavy loads, most of these studies have a structural perspective (Borah, 2015; K. Das et al., 2019; Geere & Cortobius, 2017; Johnston et al., 2018; S. Shrestha et al., 2019). Indeed, structural conditions, such as limited household water access make carrying loads largely unavoidable for women in Nepal (e.g., Geere & Cortobius, 2017; S. Shrestha et al., 2019). However, scientific evidence from physiotherapy and gynecology suggests that respecting certain

protective carrying behaviors that reduce intra-abdominal pressure when carrying loads can support the pelvic floor and thus prevent risks of pelvic organ disorders (Hagins et al., 2004; Hoff Brækken et al., 2010; MacDonald et al., 2013; Miller, 2001; Sheng et al., 2022). These are henceforth referred to as pelvic-floor-protective carrying behaviors, or simply protective carrying behavior, and include various behavioral strategies.

First, intra-abdominal pressure arising from carrying loads can be reduced by reducing the weight carried, in general, but especially during pregnancy and postpartum (Koyuncu et al., 2021; MacDonald et al., 2013; R. Sharma & Singh, 2012). During pregnancy, pelvic floor muscles are stretched beyond their capacity, resulting in weaker support of the connective tissue in the pelvic floor area, which is why they are particularly vulnerable to health risks (MacDonald et al., 2013; Van Geelen et al., 2018). After giving birth, reproductive organs require 6 months to heal (Romano et al., 2010). International weight recommendations indicate a maximum of around 7 kg or the weight of the baby should be carried for the period of pregnancy and postpartum (American Academy of Pediatrics & American College of Obstetricians and Gynecologists, 2017; MacDonald et al., 2013). A recommendation for women who are not pregnant and carry regularly is to carry no more than around 10–15 kg (R. Sharma & Singh, 2012). However, even if women are not able to meet these recommendations, any reduction in weight can reduce the risk for pelvic organ disorders (Koyuncu et al., 2021).

The second promising strategy that can enable women to cope with high intra-abdominal pressure is the contraction of pelvic floor muscles and exhaling breath while lifting; it is this that is referred to as pelvic-floor-protective lifting (Biswokarma, 2016; Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018; Sheng et al., 2022). The moment of lifting imposes the highest intra-abdominal pressure within the carrying process and thus constitutes the highest risk for pelvic organ disorders (Hagins et al., 2004; MacDonald et al., 2013). An intentional pelvic floor muscle co-contraction before and during an increase in intra-abdominal pressure can buffer the risks of heavy lifting to the pelvic floor and is likely to stabilize the lumbar spine (Biswokarma, 2016; Bø, 2004; Hoff Brækken et al., 2010; Kawabata et al., 2010; Sarno & Hameed, 2018; Sheng et al., 2022; Yakıt Yeşilyurt et al., 2022). This co-contraction is most effective when accompanied by exhaling breath because it enables a synergy between the pelvic and respiratory diaphragms (Hagins et al., 2004; Hsu et al., 2018; Sarno & Hameed, 2018).

4.3 Pelvic-floor-protective carrying behavior in Nepal

However, some studies have reported that women in Nepal and other low-income countries do not seem to follow these pelvic-floor-protective carrying behaviors (Geere, Bartram, et al., 2018; R. Sharma & Singh, 2012). They lift from the ground and carry an average of 20 kg, ranging up to 80 kg in containers or baskets filled with water, firewood, and other items, sometimes carrying them uphill (Biswokarma, 2016; Earth & Sthapit, 2002; Geere, Bartram, et al., 2018). One study indicates that 99 % of Nepali women in rural areas report having lifted and carried loads 12 hours per week or more at least once in their lifetimes, and 73% report carrying daily (Devkota et al., 2020). This practice is continued by many women during pregnancy and shortly after giving birth (Earth & Sthapit, 2002; Panter-Brick, 1989; Regmi, 2007). A retrospective study with patients with pelvic organ prolapse reported that 30% of them had returned to their physically demanding working routine as little as 14 days postpartum, 60% returned after 30 days (Marahatta & Shah, 2003). However, no research has been found to describe the techniques that Nepali women use during lifting, such as whether they usually co-contract their pelvic floor or exhale when lifting. In general, research is lacking on whether some women find and use ways to engage in pelvic-floor-protective carrying behaviors and if they do, which psychosocial determinants motivate and enable them to do so.

In the absence of research on psychosocial determinants of pelvic-floor-protective carrying behaviors, determinants of women's health behavior in Nepal in general can be summarized briefly. These have been identified mostly in qualitative studies. In line with the structures suggested by the theory of gender and power, psychosocial enablers and risk factors for women's health behavior in Nepal include access to economic resources, health literacy, social norms, social support, and women's autonomy and decision-making power within families (Allendorf, 2007; Earth & Sthapit, 2002; Edmonds et al., 2011; Gubhaju, 2009; Mullany, 2006; Radl et al., 2012; Sapkota et al., 2014; Simkhada et al., 2010; Smith-Estelle & Gruskin, 2003). Because Nepali women commonly live in joint households with their in-laws after marriage, besides their husbands, their mothers-in-law often hold key roles in household decision making, including health (Allendorf, 2017; Mookerjee, 2019; Simkhada et al., 2010). This unequal household division of power disadvantaging younger women represents a key structure of the theory of gender and power (R. Connell, 1987; Wingood & DiClemente, 2000). Whether the psychosocial determinants and decision-making structures outlined also apply to pelvic-floor-protective carrying behaviors remains to be tested with theory-based behavior change interventions confirmed in experimental studies.

4.4 Promoting pelvic-floor-protective carrying behaviors

Experimental studies that have investigated pelvic-floor-protective carrying behaviors only include one-time instructions and have focused solely on observational outcomes such as intra-abdominal pressure and pelvic floor descent during lifting (Biswokarma, 2016; Hagins et al., 2004; Hsu et al., 2018; Kawabata et al., 2010). They neither aimed to promote nor measured adoption of protective carrying behaviors as part of a behavior change intervention. Previous studies have shown that women, including women in Nepal, are interested in and able to learn health behaviors as part of interventions to prevent and reduce pelvic floor disorders (Biswokarma, 2016; Caagbay et al., 2020; Shijagurumayum Acharya et al., 2020). One study developed educational flipcharts promoting pelvic-floor-health lifestyle advice that included protective carrying behaviors among recommendations for pelvic floor exercises, diet, and smoking cessation. These educational flipcharts were successful in promoting quality of life and pelvic-floor-muscle awareness and coordination in a small clinical population in rural Nepal (Caagbay et al., 2017, 2020).

However, Caagbay et al.'s (2020) study is solely reliant on education and verbal instructions. In situations where gender power relations are particularly pronounced, women often have low effective and perceived control over health behavior, and informational interventions might not be the most effective approach to enabling health behavior (Greene & Murdock, 2013; Schüz et al., 2020; Wight et al., 2012; Wingood & DiClemente, 2000; World Health Organization, 2010). Health psychology theory proposes that interventions designed to tackle the key theory- and evidence-based determinants of behavior change, such as self-efficacy, social norms, and social support should be more effective than providing information alone (e.g. Arlinghaus & Johnston, 2018; Inauen et al., 2020; Keyserling et al., 2002). However, to the author's best knowledge, no theory-based intervention studies have been published promoting women's health in gender power relations, including pelvic-floor-protective carrying behaviors in Nepal.

To summarize, carrying heavy loads is a very clear example how unequal gender power relations can shape women's health behavior in the low-resource context of rural Nepal. However, the psychosocial determinants of women's pelvic-floor-protective carrying behaviors have not been reported in any study, either in Nepal or in any other country. Investigating these is essential to design theory- and needs-based health behavior interventions that enable women to use pelvic-floor-protective carrying behaviors (Bartholomew & Mullen, 2011). There is a clear need to look at women's pelvic-floor-protective carrying from a health psychology perspective. The next section therefore summarizes the research questions of this thesis.

5. Aims of this thesis

The overall aim of this thesis is to understand and address women's health behavior in unequal gender power relations with the example of carrying heavy loads in Nepal. To achieve this aim, this thesis will examine pelvic-floor-protective carrying behaviors in Nepal and develop and test theoretical and methodological approaches to (1) understand women's health behavior in gender power relations, (2) identify the role of an influential social partner in women's health behavior in gender power relations and (3) change women's health behavior in gender power relations.

5.1 Understanding women's health behavior in unequal gender power relations

The first step towards developing approaches that consider gender power relations in women's health behavior is to gain knowledge of a particular behavior (Bartholomew & Mullen, 2011). This involves describing the behavior and understanding its relevance to and interactions with women's everyday lives, such as its physical, psychological, and social consequences. With the example of carrying heavy loads of water, Chapters II & III (1) describe the behavioral risk factors of carrying loads. Chapter II identifies (2) how this behavior is related to women's psychosocial well-being under various environmental and health conditions. The research questions are

(1) What are the behavioral risk components of carrying loads in Nepal?

(2) How is the behavior of carrying loads related to women's psychosocial well-being?

The results of this investigation will help to objectify the behavior of carrying loads as a woman's everyday, domestic work task in our study population. Identifying the relation between the behavior and psychosocial well-being and its moderation by environmental and health conditions may provide important information about its embedding in women's life-world and identify potential risk factors that are associated with this behavior.

Chapter II provides detailed information on the relevance and impact of the behavior of carrying loads, and Chapter III aims at understanding the psychosocial determinants of women's engagement in pelvic-floor-protective carrying behaviors. These psychosocial determinants are determined with the HAPA. However, because the HAPA has not been applied to women's health behavior in gender power relations or with carrying loads, women and family members' perspectives on the behavior are assessed in qualitative interviews. This ensures that no unexpected insights are missed and cross-validates quantitative findings. These questions are of interest:

(3) What are the psychosocial determinants of the intention and behavior of pelvic-floor-protective carrying behavior?

(4) How well does an established health psychology model predict women's pelvic-floor-protective carrying behavior, and which adaptations are useful?

The insights of research questions 3 and 4 help to understand the psychosocial determinants of women's health behavior in gender power relations. They also provide information about the extent to which well-established health behavior models such as the HAPA are applicable to understanding women's health behavior in gender power relations and potentially provide context-specific adaptations and extensions.

5.2 Identifying the role of an influential social partner on women's health behavior in gender power relations

To presume, the results presented in Chapter III indicate that family members exert strong social influences on women's pelvic-floor-protective carrying behavior , with women's mothers-in-law holding an important role in the family. This led us to investigate the interrelatedness of daughters- and mothers-in-law's cognitions and behavior related to pelvic-floor-protective carrying in Chapter IV. An extended, dyadic version of the HAPA is used. The research questions are

(5) Do daughters-in-law and their mothers-in-law correlate in their cognitions of and behavior in protective carrying?

(6) How do daughters- and mothers-in-law's cognitions relate to their own and their dyadic partner's behavioral intentions and behavior beyond their own cognitions?

The results of this investigation deliver important information about the role of an influential social partners' cognitions in women's health behavior in unequal gender power relations. They also help understand whether including a dyadic perspective can add to the understanding of women's health behavior in gender power relations.

5.3 Change women's health behavior in gender power relations

Chapters III and IV identify the most influential psychosocial determinants of women's pelvic-floor-protective carrying behavior. These include social support and self-efficacy, two concepts that are also discussed as relevant to women's health behavior in unequal gender power relations and to the enabling hypothesis (e.g., Benight & Bandura, 2004; Garrison-Desany et al., 2021; Rackow et al., 2015).

Thus, in Chapter V we use the example of pelvic-floor-protective carrying behavior to test whether the promotion of self-efficacy and social support can enable women's health behavior in gender power relations. In addition, we investigate whether a potential intervention effect is explained by increased self-efficacy and social support. The research questions are

(7) Can the promotion of self-efficacy or social support improve women's pelvic-floor-protective carrying behavior over only giving information?

(8) Are the intervention effects of pelvic-floor-protective carrying behavior explained by increased self-efficacy (8a) or increased received social support (8b)?

The results of this investigation provides evidence whether self-efficacy and social network factors such as social support are indeed the determinants that enable women to change their health behavior in gender power relations.

In addition, Chapter IV aims to investigate whether the promotion of pelvic-floor-protective carrying behaviors can improve women's pelvic floor health and psychosocial well-being:

(9) Can the promotion of pelvic-floor-protective carrying behavior improve women's symptoms of pelvic organ disorders and psychosocial well-being?

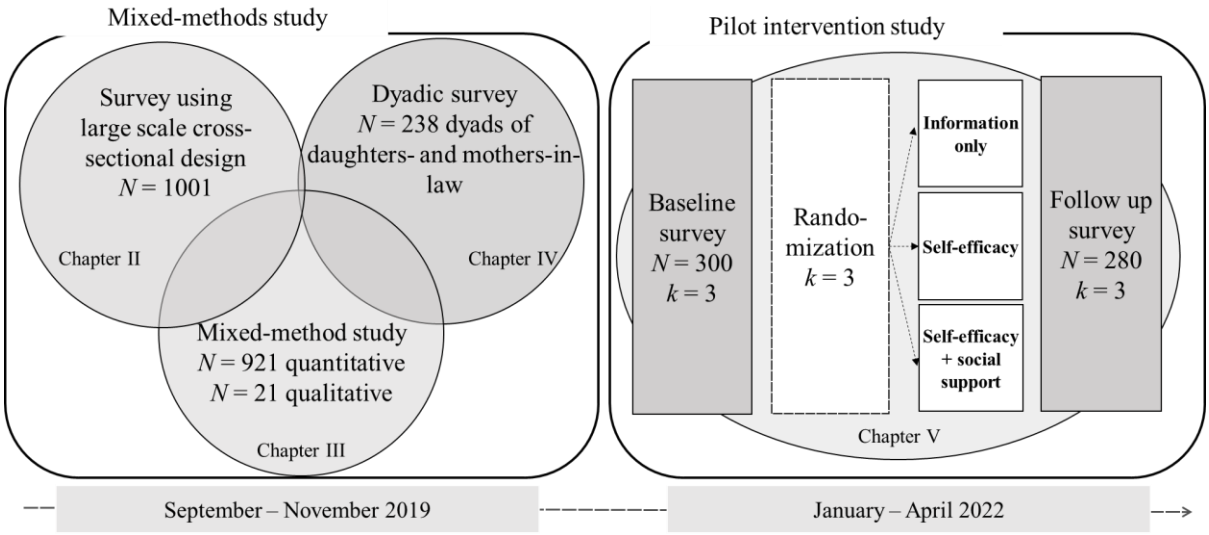
Insights from this research question help to identify whether the promotion of health behavior change can impact women's health in gender power relations.

6. Description of the studies

Two studies were conducted to understand and address women's health behavior in unequal gender power relations with the example of carrying heavy loads in Nepal. The first study was conducted from September to November 2019 and included three designs and subsamples (see under study designs). The second study was conducted from January to April 2022, after the COVID-19 measures in Nepal were lifted. See Figure 4 for the overall timeline and study designs. The following sections include the most important information about the studies conducted; for a detailed description please see Chapter II-V.

Figure 4

Overview of studies and corresponding timeline



Note. N = sample size, k = number of conditions and villages

6.1 Study designs

The first study was a mixed methods study that incorporated two surveys and one round of qualitative interviews: First, one large scale survey (N = 1001) was used to describe the physical burden of carrying loads and its correlation with women's psychosocial well-being (Chapter II). Second, qualitative interviews with women and their husbands and in-laws were conducted and analyzed in addition to a subsample of the quantitative data that represented women that had been previously pregnant (N = 921) to understand psychosocial determinants of avoiding to carry loads during pregnancy and postpartum (Chapter III). Third, a survey with dyadic design was conducted to add quantitative data on women's mothers-in-law whenever available. This resulted in N = 476 daughters- and mothers-in-law nested in 238 dyads to investigate actor and partner cognitions related to avoiding carrying loads during pregnancy and postpartum (Chapter IV). The second study was a pilot intervention study which was developed from the findings of the mixed-method study. This pilot intervention study applied a 3-arm parallel nonrandomized, controlled trial with N = 300 women and the social partners they selected, a person such as a husband or mother-in-law from the same or neighboring household that was available to provide support, and assessed the effect of self-efficacy and social support promotion on women's pelvic-floor-protective carrying behaviors (Chapter V). After a baseline assessment, the participants received an intervention according to the village of which they were resident: (1) self-efficacy (2) self-efficacy and social

support, or (3) information-only control. Intervention effects were assessed at 2-month follow-up.

6.2 Definition of pelvic-floor-protective carrying behavior

It is to note that the chapters emphasize different types of pelvic-floor-protective carrying behaviors. In line with the interest and expertise of the project partners, the first study (Chapters II–IV) focus predominantly on carrying water. After identifying the similar risk posed by other loads, such as firewood (see Chapter III), the interventions referred to all types of load (Chapter V). Chapters III and IV focus on avoiding carrying loads, specifically water, during pregnancy and 3 months postpartum as a pelvic-floor-protective carrying behavior. Based on the findings of the first study and on consulting physiotherapy expertise and literature, the research team then decided to focus on the reduction of carried weight and pelvic-floor-protective lifting techniques as pelvic-floor-protective carrying behaviors in Chapter IV. To simplify the synthesis of the studies, all carrying behaviors are termed pelvic-floor-protective carrying behavior or simply protective carrying. The terms “safe carrying behavior” and “safe carrying practices” are used in Chapter III, but these refer to the same behavior as the more scientifically precise term.

6.3 Ethical conduct

All studies were conducted in strict compliance of the ethical guidelines of the American Psychological Association, the Declaration of Helsinki, and the ethics review guidelines of the Nepal Health Research Council, Nepal and University of Bern, Switzerland. All local government entities, community leaders, and managers of the local outreach health centers of Dhulikhel Hospital gave their approval prior to the surveys and interventions. Participants’ prior informed consent was obtained and confirmed with either their signature or thumbprint after local research assistants had given them simple, nonscientific written and verbal explanations in the Nepali language.

After the follow-up survey, participants of the nonrandomized controlled trial (Chapter V) who lived in the village that had received the information-only control intervention were again visited by a health practitioner, who provided the most effective intervention to these women and their social partners. This was the self-efficacy and social support condition.

6.4 Project partners

The studies described in this thesis were planned, conducted, and analyzed with a broad range of interdisciplinary project partners from Nepal and Switzerland. The key local

collaborator was Dr. Akina Shrestha, who is now an Assistant Professor in public health at Dhulikhel Hospital, Kathmandu University. Dr. Shrestha, together with Regula Meierhofer (Eawag, the Swiss institute of Aquatic research), became aware of women's burden carrying water as a neglected research topic in Nepal during their earlier research on water and health and planned, conducted, monitored, and analyzed the first study in collaboration with my supervisor, Prof. Dr. Jennifer Inauen, and me. They were also involved in the second study, which was coordinated in collaboration with Aastha Kasaju, a local public health researcher. Dr. Anjana Dongol of the Gynecology and Obstetrics Department of Dhulikhel Hospital, Kathmandu University, trained the team to assess symptoms of pelvic floor disorders in the first study and Dr. Helena Luginbuehl of the Physiotherapy Department of Bern University of Applied Sciences was responsible for the development of pelvic-floor-protective lifting techniques and the instructions for the second study and trained the team in these areas of expertise. Furthermore, several other individuals assisted in the studies (see acknowledgement sections in Chapters II–V). Presentations about the studies were held at the local outreach health centers of Dhulikhel Hospital during the studies and discussed with local stakeholders, including village leadership, community health volunteers, and women's group's leaders.

6.5 Study sites

The studies were conducted in Kavre and Sindhupalanchowk districts in Bagmati province, a typical low-income region in Nepal where women carry heavy loads daily (Satyal et al., 2003). Many women in these areas have or are at high risk of developing pelvic organ disorders (Khadgi, Shrestha, & Acharaya, 2015; Satyal et al., 2003). In 2017 and 2018, more than 14,600 women were screened for reproductive morbidity, and 23% (3374 women) were diagnosed with pelvic organ prolapse. (Department of Health Services, Ministry of Health and Population Nepal, 2019). The study sites were selected because they had outreach centers of Dhulikhel Hospital, where Dr. Shrestha is based. The mixed-methods study was conducted in five rural villages in these districts, all of which were accessible in off-road vehicles from Kathmandu in 3–6 hours. The pilot intervention study was conducted in three of these five villages, which were selected for the similarity of their control variables. Households in these areas have a mixture of water supply off and on premises, for example private taps in the house yard, shared taps in the neighborhood, or community taps. They lack paved roads, and only a very limited proportion of households own motorized vehicles that can be used to transport materials.

6.6 Participant selection

Inclusion criteria for the first study were (1) adult women of reproductive age (2) who resided in the community permanently and (3) were involved in regular water carrying. Whenever the women had a mother-in-law available and willing to participate, she was also interviewed. The same criteria were applied for the qualitative interviews, and we targeted pregnant women, women with symptoms of pelvic organ prolapse, and their family members in accordance with a theoretical sampling strategy. Various subsamples were used for the analyses (see study design). For the second study, inclusion criteria for women who were (1) adult women of reproductive age (2) who resided in the community permanently, (3) were involved in regular carrying activities, and (4) had an adult social partner in the same or neighboring household who was available to support them. The women in both quantitative assessments were selected with the random route method (Hoffmeyer-Zlotnik, 2003). Research teams started from the outreach health centers towards different points of the compass and selected every second or third household, depending on the number of households living in one "tol," a separable section of a Nepali village.

6.7 Data collection

All quantitative questionnaires were completed in computer-assisted face-to-face interviews in Nepali. The first study also assessed objective measurements of carried weight and walking distance and the second study included structural behavioral observations of how participants lifted a heavy container. These were also partly conducted in the first study, but the results are not presented in this thesis. In both studies, six or eight female Nepali research assistants collected the quantitative data in teams of two. The qualitative interviews of the second survey were conducted face-to-face in Nepali and were recorded, transcribed, and translated verbatim into English. Before each study, the research assistants received a 1-week training course on conducting psychological surveys, including the use of a unipolar Likert scale that was supported by a visual 5-dot scale (Harter et al., 2020) ash has been used with other populations with low rates of literacy (Ambuehl et al., 2021; Ambuehl & Inauen, 2022).

6.8 Measurements

Extended questionnaires were created to collect quantitative data . A large item pool was compiled from previous literature, theoretical frameworks, and questions related to daily carrying, and these were all systematically adapted with cultural-context-specific scale adaptation, translation and back-translation from English to Nepali, content validation with the team of researchers and health practitioners, and pretesting (Ambuehl & Inauen, 2022). The

qualitative assessment in the second survey used semistructured interviews with open questions to assess women's daily routines and family members' attitudes to carrying during pregnancy and postpartum. For example, questions such as "Could you tell us a bit more about your task of carrying water?" were used to explore the individual consequences of water carrying. Through nondirective follow-up questions, we encouraged participants to articulate reasons for their thought processes and behaviors. The quantitative questionnaire of the second study was based on and adjusted to the findings of the first study.

Chapter II
The physical burden of water carrying and women's psychosocial well-being: Evidence from rural Nepal

Vica Marie Jelena Tomberge *[+1], Janine Stefanie Bischof [+1], Regula Meierhofer [2], Akina Shrestha [3], and Jennifer Inauen [1]

[+] These authors contributed equally and share first authorship
*Corresponding author

[1] University of Bern, Institute of Psychology, Department of Health Psychology & Behavioral Medicine
[2] Eawag, Swiss Federal Institute of Aquatic Science and Technology, Department of Sanitation, Water and Solid Waste for Development (Sandec)
[3] Kathmandu University School of Medical Sciences, Dhulikhel Hospital, Kathmandu

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Abstract

Many women in low-income countries carry heavy loads of drinking water for their families in difficult terrain. This can adversely affect their health and well-being. The present study is the first to investigate the physical burden of water carrying and women's psychosocial well-being, and how this relationship is moderated by environmental and health conditions.

Trained local interviewers conducted interviews with 1001 women across five rural communities in Nepal. In addition, objective measurement was used to assess the weight carried and distance from the water source. The physical burden of water carrying was calculated from weight, distance, and frequency of trips. Its association with psychosocial well-being was modeled using generalized estimating equations. Two additional models included the terrain and uterine prolapse as moderators.

The physical burden of water carrying is directly related to higher emotional distress and reduced daily functioning. This correlation was exacerbated for women carrying in hilly versus flat terrain, and for those who had uterine prolapse.

Our results underline the importance of adequate water access for women's psychosocial well-being, especially for vulnerable populations such as women with impaired health (e.g., uterine prolapse) or those living in hilly terrain. The results further highlight the interconnectedness of the Sustainable Development Goal (SDG) 6: water access, SDG 3: health and well-being, and SDG 5: gender equality.

Keywords: gender inequalities in health; water access; psychosocial well-being; unpaid work; low-income population

Introduction

Water is needed in many areas of life, such as drinking water, food production, care of domestic animals, hygiene, cleaning, and waste disposal (UN Water, 2006). In 2017, 25% of the global population collected water from sources that are located off premises (World Health Organization & Unicef, 2019). Previous research on the health consequences of sub-optimal water access has described adverse impacts of low water quality (Flanagan et al., 2012; George et al., 2014), the transport of water (Geere et al., 2010; Geere, Bartram, et al., 2018; Venkataramanan et al., 2020) water insecurity (Adams et al., 2020; Rosinger & Young, 2020), and poor menstrual hygiene management (Ademas et al., 2020; P. Das et al., 2015).

Traditionally, mostly women are responsible for collecting and providing water for their families and livestock (Geere & Cortobius, 2017; Sorenson et al., 2011). Particularly in water poor areas, the time required to retrieve water can pose barriers to other activities, such as education, paid work, and healthcare, which results in impairment of women‘s quality of life (Curtis, 1986). The responsibility of water collection can further pose a serious threat to women’s psychosocial well-being (Bisung & Elliott, 2017; S. Shrestha et al., 2018; Workman & Ureksoy, 2017).

Psychosocial well-being is an integral part of health as defined by the World Health Organization (WHO) (International Health Conference, 2002) and represents a multidimensional construct which incorporates emotional, social, and physical aspects (Eiroa-Orosa, 2020). Adverse psychosocial well-being has been associated with water insecurity (Bisung & Elliott, 2017; S. Shrestha et al., 2018; Workman & Ureksoy, 2017), with findings implying that high water insecurity relates to increased emotional distress (Bisung & Elliott, 2017; Workman & Ureksoy, 2017) and lower quality of life (S. Shrestha et al., 2018). In addition, evidence from sub-Saharan Africa shows that the risk of sexual harassment and violence on the route to, or while queueing for, water can be a source of fear and stress (Bisung & Elliott, 2017). The physical burden of carrying water may be an additional source of distress. However, studies on this are absent.

Research on carrying heavy loads in general supports a potential relationship between water carrying and psychosocial well-being (Owoo & Lambon-Quayefio, 2021; Risal et al., 2016). Excessive occupational workload adversely affects a person’s emotional or physical energy and time available for other activities. This, in turn, is linked to increased psychosocial distress (Bakker & Costa, 2014; Bowling et al., 2015).

Social and cultural norms created a gendered division of labor in many developing countries, with women being primarily responsible for unpaid domestic work (N. Rao, 2012).

Domestic work is substantial to the functioning of the household. However, women are often not being acknowledged for their work (N. Rao, 2012). Research suggests that a gendered division of housework is one of the factors that generally contributes to the differences between men and women in regard to adverse health effects, such as higher psychosocial distress for women (Bird, 1999). A study in Ghana also showed that strenuous domestic work had adverse effects on women's well-being (Owoo & Lambon-Quayefio, 2021). Moreover, a study in Nepal showed that anxiety and depression were more prevalent among people who carried heavy loads (Risal et al., 2016). In the context of water carrying, this could imply that high physical burden, due to frequently carrying heavy water containers, might relate to decreased psychosocial well-being.

Past research investigating the consequences of water carrying largely focused on physical health effects and disability (Geere, Cortobius, et al., 2018). They neglected context-specific conditions of water carrying that can pose an added risk to health (Venkataramanan et al., 2020). For example, when water containers are carried in challenging or uneven terrain, the risk of falling and injury is high (Sorenson et al., 2011; Venkataramanan et al., 2020). Hence, terrain could moderate the relationship between the physical burden of water carrying and psychosocial well-being.

Another challenge is that frequent carrying of heavy water containers exerts significant strain on women's bodies (Geere et al., 2010). This can lead to disabilities such as musculoskeletal disorders or uterine prolapse (Geere, Bartram, et al., 2018; Geere et al., 2010; Walker & Gunasekera, 2011). Uterine prolapse indicates that the uterus descends from its normal position into or out of the vagina (Walker & Gunasekera, 2011). Approximately 19% of women in low- and middle-income countries are affected by pelvic organ prolapse, which also includes uterine prolapse (Walker & Gunasekera, 2011). Uterine prolapse can severely affect women's daily lives if they are unable to work, have difficulties standing up, walking or lifting heavy loads, and are subject to social stigmatization within families and communities (Radl et al., 2012; B. Shrestha, Onta, et al., 2014). Moreover, uterine prolapse is associated with increased emotional distress and lower quality of life (Ghetti et al., 2010; B. Shrestha, Onta, et al., 2014). Irrespective of their health condition, e.g., uterine prolapse, women in rural areas are expected to complete their assigned household tasks such as fetching water (Earth & Sthapit, 2002; Schaaf et al., 2008; B. Shrestha, Onta, et al., 2014). Not being able to complete this responsibility, or having difficulties in doing so, is likely to put an extra burden on women affected by uterine prolapse (Earth & Sthapit, 2002).

The present study

In the present study, we investigate the psychosocial consequences of water carrying for women. Specifically, we investigate whether higher physical burden of water carrying relates to lower psychosocial well-being, and whether terrain or having uterine prolapse moderate this relationship. We study this at the example of Nepal. In 2017, only 26% of the population in Nepal had access to an improved water source (World Health Organization & United Nations Children's Fund, 2017). Due to the mountainous regions, women in rural Nepal have to walk on unpaved roads, often uphill while carrying water-filled containers (Komatsu et al., 2019). At least 11% of women in the reproductive age in these areas have had uterine prolapse (Meierhofer et al., 2022). Based on present literature, we hypothesize that: (1) high-objective physical burden is related to lower psychosocial well-being; (2) carrying water in hilly terrain strengthens the relationship between water carrying and psychosocial well-being, compared to carrying on a flat path; (3) having uterine prolapse strengthens the relationship between water carrying and psychosocial well-being.

Materials and methods

The present survey was conducted between September and November 2019 in five communities in the Kavre and Sindhupalanchowk district of Nepal. This is a typical rural low-income region with a mixture of water supply on and off premises, such as private taps in the court of houses, shared taps or surface water in neighborhoods, and community taps or surface water around villages. The study areas were selected because they included outreach centers of the Dhulikhel Hospital, our collaborator. Ethical clearance was given by the Ethical Review Committee of the Health Research Council Nepal [Reg No. 517/2019] and the Ethical Review Board of the University of Bern, Switzerland [2019-10-00003]. Study aims and procedure were explained to all participants in the local language. All participants provided written informed consent prior to the interview. Potential study participants who were unable to sign their names indicated consent with their thumbprint.

Survey procedure and participants

Leading to a total sample size of 1001 women, four trained local health scientists and four health practitioners selected approximately 200 women per community following the random route method (Hoffmeyer-Zlotnik, 2003). The data collectors started from a central point in an assigned area of the community and assessed if there was an eligible person living in the approached household who consented to participate. It was predetermined whether either every second or third household in the community was approached, based on the total

number of households in the community (every second household for smaller communities, every three households for larger communities). The selection criteria for respondents targeted adult women (from 16 years in Nepal) in reproductive age who permanently resided in the community, were involved in water carrying, and willingness to participate. If there was more than one woman within the household who met the selection criteria, the woman predominantly responsible for water carrying was interviewed. If no eligible person was available in that household, the data collectors assessed if there was an eligible person willing to participate in the household that was skipped before selecting the current household.

The survey consisted of a computer-assisted personal face-to-face interview and objective measurement of weight and distance. Health practitioners additionally carried out physical health examinations. When a participant indicated symptoms of uterine prolapse, a free screening at the local health center was performed, and if necessary, free treatment was offered.

Measures

The survey instruments were translated and back-translated from English to Nepali and pretested in one community not included in the analyses. Please consult Table 1 for sample items and descriptive statistics, and Table S1 in the supplementary material for all questionnaire items.

Table 1

Sample items and descriptive statistics

Concept	Items	*M*	*SD*
Objective physical burden			
Distance [1]	Enter distance between household and water source (meters)	81.3	162.0
Weight (kg, sum) [2,3]	Please indicate the number of different types of containers being carried: 30 L Gagri/Plastic bucket; 20 L Gagri/Plastic bucket; 10 L Gagri/Plastic bucket; 20 L Plastic bottle; 10 L Plastic bottle; 2–5 L Plastic bottle; others (in liters)	19.4	9.7
Trips per day	How many trips do you conduct per day to your primary drinking water source in rainy season?	2.6	2.4
Other loads carried [3], control variable	Approximately how many kilogram on average do you carry per trip?	32.6	14.8
Psychosocial well-being			
Emotional distress (Youngmann et al., 2008)	19 items (Cronbach's Alpha = 0.81), e.g., Have you lost interest in things? 0 = no; 1 = yes (19 items)	0.2	0.2
Quality of life (World Health Organization, 1998)	12 items (Cronbach's Alpha = 0.76), e.g., How would you rate your quality of life? 0 = very poor to 1 = very good	0.7	0.1
Daily functioning (de Jong et al., 2016)	Please rate the severity by which water carrying reduces your daily functioning (1 = not at all to 0 = very much)	0.8	0.3
Moderators		*f*	*f*%
Terrain	Do you have to walk uphill or downhill to carry the container filled with water from the primary water source back home?		
	uphill	159	16%
	downhill	77	8%
	uphill and downhill	42	4%
	flat path	723	72%
Uterine prolapse	Based on the examined symptoms, does the study participant have uterine prolapse? (% yes)	113	11%

Note. N = 1001, M = Mean, SD = Standard deviation, f = frequency, f% = relative frequency. All continuous items were recoded to a range between 0 to 1; [1] n = 980, n = 21 missing; [2] n = 996, n = 5 excluded (no regular carrying) [3] Outliers < 3 SD were adjusted to M + 3 SD (Tabachnick & Fidell, 1983).

Physical burden

An adapted version of the risk assessment for lifting and carrying suggested by SUVA, the Swiss National Accident Insurance Fund (SUVA, the Swiss National Accident Insurance Fund, 2019) was applied to calculate the objective physical burden of water carrying. The adapted formula includes the following weighted risk variables: (weight + environmental condition) × (carrying frequency × distance).

We assessed weight for all water containers carried in one trip (verified with a scale) and distance from the house to the water source in meters. The distance was recorded with a GPS device (Garmin CSX 60). Frequency represents the self-reported number of trips a day. For the environmental condition, we decided to categorize all women to the second out of three SUVA risk categories which includes: "Stability restricted by uneven, soft ground". The original formula presented by SUVA suggests also including body posture. As we wanted to focus on the burden of environmental factors only, we decided to exclude this variable for this analysis. Furthermore, we had many missings for this variable (n = 105).

Missings for observed weight were replaced by the average of self-reported minimum and maximum weight carried per trip, as perceived by the best guess (Acock, 2005). Values were missing due to technical difficulties (no scale unit given by interviewer, n = 76) or because of missing information on carrying behavior due to current health conditions (n = 34). To avoid bias in the statistical models, prior to modeling, outliers in weight were adapted to $M + 3\ SD$ (55.8 kg) (Tabachnick & Fidell, 1983). Missings for distance (n = 21) were not replaced. These adaptions resulted in a sample size of n = 978, which is 98% of the overall sample and likely inconsequential for biases and loss of power (Graham, 2009). Physical burden was thus used as a continuous variable with higher scores representing higher burden.

Psychosocial well-being

To assess psychosocial well-being we included measures of emotional distress (WHO's SRQ-20, World Health Organization, 1998), quality of life (WHOQOL-12, Youngmann et al., 2008) and one item on daily functioning (Functioning rating scale, de Jong et al., 2016). Emotional distress ($\alpha = 0.81$) consists of somatic, depressive/anxiety, and cognitive/decreased energy symptoms (Harpham, 2003). Quality of life assesses the domains of physical, psychological, social, and environmental well-being (World Health Organization, 1998). The goal to use all 26 items of the quality of life scale was deemed too onerous by the local partners. Some psychological items caused a feeling of redundancy because of overlap with the questions on emotional distress, which may annoy participants and limit overall data quality (Heath, 2017). Based on recommendations by the local research team and feedback

after the pretest, we selected the 12 items with the highest relevance in this context and smallest overlap ($\alpha = 0.76$).

Data analysis

To model the psychosocial consequences of water carrying, we performed generalized estimating equations (GEE), which accounted for the nested structure of the data (individuals nested in communities) (Liang & Zeger, 1986). We estimated three separate models for the outcome variables of emotional distress, quality of life, and daily functioning. We included the grand-mean centered physical burden as the predictor, which represents women's physical burden as compared to the average physical burden (i.e., the typical woman's burden). For the moderation analyses, we included terrain as three separate, dummy-coded variables (uphill, downhill, both uphill and downhill) and uterine prolapse in two additional GEE models. Carrying on a flat path and not having uterine prolapse were used as reference categories. We adjusted all models for socio-demographic measures (see Table 1), and whether women were currently pregnant or had delivered in the last three months. We adjusted for having uterine prolapse when not included as a moderator. We computed all analyses in IBM SPSS Statistics 24 (IBM Corp., Armonk, N.Y., USA). Sample syntax in SPSS can be found in supporting information S3.

Results

All sociodemographic information on our sample can be found in Table 2. The average observed carrying distance was 81.3 m (*SD* = 162 m) with an average weight of 19.4 kg (*SD* = 9.7 kg) and 2.6 trips (*SD* = 2.4) per day. On average, women reported low-to-moderate emotional distress, moderate quality of life, and moderate-to-high daily functioning related to water carrying. As can be seen in Table S2 in the supporting information, GEEs without considering terrain or health indicated that women with higher physical burden of water carrying reported 16% greater emotional distress and 39% lower functioning in daily activities (B[*SE*] = 0.16[0.07]; p = 0.029; B[*SE*] = −0.39[0.09]; p < 0.001). The physical burden of water carrying was not related to quality of life.

Table 2

Sociodemographic data

Concept	Items	*M*	*SD*
Age		33.7	9.0
Socioeco-nomic status [1]		0.5	0.1
	How much land does your family own?	56.1	75.0
	How many rooms does your house have?	2.9	1.5
	Does anyone from your household own any of these items? Radio, TV, solar panel, mobile phone, bicycle, motor bike, car, fridge, watch (sum)	3.3	1.3
		f	*f*%
	What kind of fuel do you use MAINLY for cooking?		
	Wood (= 0)	629	63%
	Gas (= 1)	372	37%
	What is the average expenditure of your family per month?		
	Less than 2400 Nepali Rupees (~20 US$)	139	14%
	2500 to 4800 Nepali Rupees (~40 US$)	104	10%
	4900 to 9600 Nepali Rupees (~80 US$)	198	20%
	9700 to 24,000 Nepali Rupees (~200 US$)	443	44%
	>25,000 Nepali Rupees (~208 US$)	117	12%
	Are you the owner of your house? (yes = 1)	980	98%
Education	Illiterate	180	18%
	Informal education	262	26%
	Pre-primary	51	5%
	Primary passed	145	15%
	Lower secondary passed	101	10%
	Secondary	123	12%
	Higher secondary and above	139	14%
Currently pregnant	1 = yes	41	4%
Delivered in last 3 months	1 = yes	24	2%
Ethnicity	Brahmin	304	30%
	Tamang	304	30%
	Newar	60	6%
	Chhetri	59	6%
	Dalit	121	12%
	Rai and Limbu	139	13%
	Others	14	1%

Note. N = 1001, M = Mean, SD = Standard deviation, f = frequency, f% = relative frequency. Sociodemographic data were used as control variables in all analyses. [1] An index (0.0–1.0) was calculated using principle component analysis (Krishnan, 2010).

Moderation by terrain

There were multiple interaction effects for physical burden and terrain, see Table 3. The main effects in Table 3 indicate the terrain comparisons for women carrying water with average physical burden. Among those women, those carrying on a flat path showed no differences in emotional distress or functioning related to physical burden compared to those carrying in hilly areas (see Table 3), although they showed 17% increased quality of life (p = 0.029). Women carrying with average physical burden uphill reported only slightly lower quality of life (2%, $p < 0.001$) and daily functioning (5%, $p < 0.001$) compared to women walking on a flat path. Similarly, women carrying with average physical burden walking downhill reported 4% greater emotional distress ($p < 0.001$) and 9% lower functioning ($p <$ 0.001), compared to those carrying on a flat path. However, of the women carrying with above-average physical burden, those who carried uphill reported 33% greater emotional distress (p = 0.019) and 25% lower quality of life (p = 0.006) compared to those walking on a flat path (moderation effect). Women with above-average physical burden reported 16% lower quality of life (p = 0.001) but 64% higher functioning (p = 0.008) when carrying downhill compared to walking on a flat path. Women with above-average physical burden carrying both uphill and downhill reported 30% greater emotional distress (p = 0.017) compared to women walking on a flat path.

Table 3

Generalized estimating equations of objective physical burden of carrying water and psychosocial well-being (emotional distress, quality of life, and daily functioning) and its moderation by the terrain

	Emotional distress					Quality of life					Functioning in daily activities				
			95% CI					95% CI					95% CI		
	Estimate	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*
Intercept	0.37	0.07	0.22	0.51	<0.001	0.60	0.03	0.54	0.66	<0.001	0.92	0.07	0.78	1.06	<0.001
Physical burden (carrying on flat path [1])	−0.01	0.04	−0.09	0.07	0.786	0.17	0.08	0.02	0.32	0.029	−0.33	0.17	−0.66	<0.01	0.053
Carrying uphill	0.03	0.02	<0.01	0.07	0.052	−0.02	<0.01	−0.03	−0.01	<0.001	−0.05	0.01	−0.06	−0.04	<0.001
Carrying downhill	0.04	0.01	0.03	0.05	<0.001	<0.01	0.01	−0.02	0.01	0.635	−0.09	0.02	−0.14	−0.04	<0.001
Carrying uphill and downhill	0.01	0.02	−0.02	0.05	0.459	−0.02	0.01	−0.05	0.01	0.119	−0.10	0.04	−0.17	−0.03	0.003
Physical burden *Carrying uphill	0.33	0.14	0.06	0.61	0.019	−0.25	0.09	−0.43	−0.07	0.006	−0.22	0.17	−0.55	0.11	0.189
Physical burden *Carrying downhill	−0.08	0.10	−0.28	0.11	0.409	−0.16	0.05	−0.27	−0.06	0.001	0.64	0.24	0.17	1.11	0.008
Physical burden *Carrying uphill and downhill	0.30	0.13	0.06	0.55	0.017	<0.01	0.06	−0.11	0.12	0.980	−0.12	0.15	−0.43	0.18	0.428
Age	<0.01	<0.01	<0.01	<0.01	0.973	<0.01	<0.01	<0.01	<0.01	0.699	<0.01	<0.01	<0.01	<0.01	0.414
Education [2]	−0.01	<0.01	−0.02	<0.01	0.19	0.01	<0.01	0.01	0.02	<0.001	<0.01	<0.01	−0.01	0.01	0.728
Socio-economic status [3]	<0.01	<0.01	<0.01	<0.01	<0.001	0.10	0.03	0.05	0.15	<0.001	0.21	0.10	0.01	0.40	0.041
Currently pregnant	<0.01	0.02	−0.03	0.03	0.994	0.03	0.02	−0.01	0.07	0.120	−0.06	0.02	−0.10	−0.01	0.017
Delivered in last 3 months	0.01	0.04	−0.07	0.09	0.830	<0.01	0.03	−0.07	0.06	0.888	<0.01	0.05	−0.09	0.10	0.951
Other loads carried (in kg)	−0.01	0.02	−0.05	0.02	0.496	0.01	0.02	−0.03	0.05	0.510	0.01	0.10	−0.18	0.21	0.896
Uterine prolapse	0.12	0.02	0.07	0.16	<0.001	−0.05	<0.01	−0.06	−0.05	<0.001	−0.06	0.01	−0.08	−0.03	<0.001

	Emotional distress					Quality of life					Functioning in daily activities				
			95% CI					95% CI					95% CI		
	Estimate	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*
Ethnicity [4]															
Brahmin	0.03	0.01	<0.01	0.05	0.057	−0.02	0.01	−0.04	0.01	0.145	−0.14	0.01	−0.16	−0.13	<0.001
Tamang	−0.03	0.01	−0.05	−0.01	0.001	−0.02	0.01	−0.04	−0.01	0.010	−0.16	0.01	−0.19	−0.13	<0.001
Newar	0.02	0.01	−0.01	0.04	0.166	<0.01	0.01	−0.02	0.02	0.931	−0.14	0.03	−0.19	−0.09	<0.001
Chhetri	0.02	0.02	−0.02	0.05	0.324	−0.01	0.02	−0.05	0.04	0.739	−0.16	0.06	−0.27	−0.05	0.003
Dalit	0.07	0.02	0.02	0.11	0.008	−0.01	0.01	−0.02	<0.01	0.156	−0.08	0.02	−0.11	−0.04	<0.001
Rai and Limbu	−0.02	0.01	−0.04	<0.01	0.020	−0.01	0.01	−0.04	0.01	0.330	−0.06	0.01	−0.08	−0.03	<0.001

Note. n = 978 (n = 21 distance missing, n = 2 information on uterine prolapse missing). Five communities. *Estimate* = Parameter Estimates. *SE* = Standard Error. CI = Confidence interval. Probability distribution: normal, link function: identity. All p-values are two-tailed. [1] Reference category. [2] Higher values refer to a higher level of education: 0 = Illiterate, 1 = Informal education, 2 = Pre-primary, 3 = Primary passed 4 = Lower secondary passed, 5 = Secondary, 6 = Higher secondary and above. [3] An index (0.0–1.0) was calculated using principle component analysis (Krishnan, 2010). [4] Reference category = other

Moderation by uterine prolapse

There were significant interactions of physical burden and uterine prolapse for emotional distress and quality of life, but not for daily functioning, see Table 4. Women with uterine prolapse and average physical burden reported 11% greater emotional distress ($p < 0.001$), 6% lower quality of life ($p < 0.001$), and 7% lower functioning in daily activities ($p < 0.001$) compared to women without uterine prolapse. Women with uterine prolapse and above-average physical burden reported 19% more emotional distress ($p = 0.028$) and 14% higher quality of life ($p < 0.001$) compared to women without uterine prolapse.

Table 4

Generalized estimating equations of objective physical burden of carrying water and psychosocial well-being and its moderation by uterine prolapse

	Emotional distress					Quality of life					Functioning in daily activities				
			95% CI					95% CI					95% CI		
	Estimate	*SE*	LL	UL	*p*	*Estimate*	*SE*	LL	UL	*p*	*Estimate*	*SE*	LL	UL	*p*
Intercept	0.39	0.07	0.25	0.53	<0.001	0.57	0.03	0.52	0.63	<0.001	0.85	0.08	0.68	1.01	<0.001
Physical burden (without uterine prolapse [1])	0.07	0.06	−0.06	0.19	0.293	0.04	0.06	−0.09	0.16	0.577	−0.42	0.11	−0.64	−0.20	<0.001
Uterine prolapse	0.11	0.02	0.07	0.15	<0.001	−0.06	0.01	−0.07	−0.05	<0.001	−0.07	0.02	−0.11	−0.04	<0.001
Physical burden *uterine prolapse	0.19	0.09	0.02	0.36	0.028	0.14	0.04	0.06	0.22	<0.001	0.23	0.13	−0.03	0.49	0.077

Note. n = 978 (n = 21 distance missing, n = 2 information on uterine prolapse missing). Five communities. *Estimate* = Parameter Estimates. *SE* = Standard Error. CI = Confidence interval. Probability distribution: normal, link function: identity. All p-values are two-tailed. [1] Reference category. These results were adjusted for the same sociodemographic variables as displayed in Table 3 but not reported in this table.

Discussion

The present study indicates how the physical burden of water carrying relates to psychosocial well-being. It highlights that context-specific factors may potentially exacerbate this relationship. In line with our hypotheses, our results indicated that hilly terrain and uterine prolapse aggravate adverse psychosocial consequences of water carrying.

The physical burden of water carrying is directly related to women's higher emotional distress and reduced functioning in other daily activities besides water carrying. Due to its undeniable necessity, carrying water is an everyday work task (Ademas et al., 2020; P. Das et al., 2015; B. Shrestha, Onta, et al., 2014). Our results are in line with those from high-income populations that showed that high chronic physical burden in the working environment adversely affects functioning and emotional distress (Owoo & Lambon-Quayefio, 2021; Risal et al., 2016), especially with challenging environmental demands and low resources (Alarcon, 2011).

Interestingly, quality of life was not related to the physical burden of water carrying. Quality of life represents a more general concept of well-being including physical, social, and environmental aspects (World Health Organization, 1998), whereas emotional distress measures the psychological state specifically (Harpham, 2003). The reason why physical burden was not directly related to quality of life may be that many other individual and contextual factors can influence quality of life (Ohkura et al., 2020; Q. Wang et al., 2014).

Our moderation analyses indicated that the relationship between physical burden and psychosocial well-being depended on terrain and personal health. Even greater emotional distress was observed for women who carried heavy loads uphill, or uphill and downhill. While the physical burden of water carrying was not related to quality of life, a relation was observed between the terrain and quality of life: lower quality of life occurs among those who carry uphill or downhill. Interestingly, higher functioning in daily activities was found for women carrying downhill. These findings align with previous studies that showed that certain terrains can put an added risk to physical health (Venkataramanan et al., 2020). Beyond previous results, our study showed that terrain also moderates the relationship between physical burden and psychosocial well-being. Future studies might explore whether further characteristics of the physical environment (e.g., poor roads or weather conditions, Venkataramanan et al., 2020) or other contextual factors when retrieving water, such as violence, sexual assault, or dangerous animals, might increase the adverse impact of water carrying on psychological well-being (Bisung & Elliott, 2017; Sorenson et al., 2011).

Women with uterine prolapse reported lower psychosocial well-being which is consistent with previous research (Ghetti et al., 2010; B. Shrestha, Onta, et al., 2014). More importantly, consistent with our hypothesis, uterine prolapse acted as a moderator of the relationship between the physical burden of water carrying and psychosocial well-being. Physical burden related to greater emotional distress for women with uterine prolapse than those without. Since families often depend on women's ability to work in terms of providing water and food (Blackden & Wodon, 2006; Halbrendt et al., 2014; Radl et al., 2012), women may still need to collect water even if affected by uterine prolapse (Radl et al., 2012; Schaaf et al., 2008). This responsibility possibly adds to the already great psychosocial burden of women with uterine prolapse (Earth & Sthapit, 2002). Considering that uterine prolapse is also a physical health consequence of frequent water carrying (Walker & Gunasekera, 2011), the fact that it additionally seems to exacerbate the emotional burden of water carrying is alarming. Due to the symptoms of uterine prolapse, such as difficulty and pain while walking and lifting, the work performance is not only reduced but also handicapped, which can relate to greater emotional distress (Radl et al., 2012; B. Shrestha, Onta, et al., 2014).

Interestingly, for women with uterine prolapse, higher physical burden of water carrying was related to higher quality of life. This result can be an indicator that women who are still able to perform a high physical workload despite suffering from uterine prolapse are likely to be less affected in other areas of life, e.g., economic activities and family life (Earth & Sthapit, 2002; Radl et al., 2012; Schaaf et al., 2008). This sublines that having access to a close water source is particularly relevant for vulnerable groups. Improvements in infrastructure can support women with uterine prolapse in completing their usual working routine to maintain their social and economic role, improve their quality of life, and reduce emotional distress. For future research, we suggest to also consider other prevalent health conditions, e.g., spinal axial compression, which is more prevalent in African countries due to head-carrying (Geere, Bartram, et al., 2018) as a moderator on how stressful women perceive the physical workload of water carrying.

Strengths, limitations, and future directions

The present study is the first to use observed physical variables related to water carrying, e.g., weight and carrying distance, to study its relation to psychosocial well-being. As a limitation, we conducted the study shortly after a rainy season, which may have led to an underestimation of carrying distances and physical burden as many women use farther sources during dry season (Meierhofer et al., 2022). Future studies should aim to observe water carrying during both seasons. As a limitation in the measurement, we did not use all items of the

quality of life scale to prevent redundancy with questions on emotional distress. This variable may therefore not cover all aspects of quality of life. The cross-sectional nature of our data does not allow causal conclusions. Future randomized and controlled trials may investigate whether the reduction in physical burden can increase women's psychosocial well-being.

Conclusions

Overall, the findings of the association between the physical burden of water carrying and psychosocial well-being bring a new perspective to health research related to water access. They demonstrate not only the complexity, but also the multiple impacts in life that water provision can have for women, and how this interacts with environmental and health factors. Our results underline the interconnectedness of the Sustainable Development Goal (SDG) 6: access to safe water, SDG 3: ensure healthy lives, and SDG 5: gender equality (United Nations, 2015).

This study highlights the importance of adequate access to water for women to prevent health impacts such as uterine prolapse and facilitate the quality of life of those already affected. Improvement in the water supply infrastructure, promotion of intermediary solutions such as carts, bicycles, and self-supply options (Mustafa et al., 2011), especially for women living in hilly areas, or interventions on behavioral changes, e.g. respecting a water load limit, can hopefully reduce the physical burden of water carrying (R. Sharma & Singh, 2012).

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Ethics statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethical Review Committee of the Nepali Health Research Council [Reg No. 517/2019] and the Ethical Board of the University of Bern, Switzerland [2019-10-00003].

Informed consent statement

All participants provided written informed consent prior to their interviews and objective measurement of weight and distance. Potential study participants who could not sign their names were permitted to indicate consent with a thumbprint.

Data availability statement

The data is available from V.M.J.T at request.

Conflicts of interest

The authors declare no conflict of interest.

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Chapter III
Understanding safe water-carrying practices during pregnancy and postpartum: A mixed-methods study in Nepal

Vica Marie Jelena Tomberge [1], Akina Shrestha [2], Regula Meierhofer [3], Jennifer Inauen [1]

*Corresponding author

[1] University of Bern, Institute of Psychology, Department of Health Psychology & Behavioral Medicine

[2] Kathmandu University School of Medical Sciences, Dhulikhel Hospital, Kathmandu

[3] Eawag, Swiss Federal Institute of Aquatic Science and Technology, Department of Sanitation, Water and Solid Waste for Development (Sandec)

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Abstract

Daily carrying of heavy loads of domestic water, especially during pregnancy and postpartum, bears a threat to maternal health in low-income countries. Using an extended health action process approach (HAPA), we examined women's reasons for and psychosocial determinants of safe water-carrying during pregnancy and postpartum.

In a mixed-methods study, trained local interviewers conducted 1001 quantitative interviews with women of reproductive age (n = 921 analyzed) and 21 qualitative interviews with women of reproductive age, in-laws, and spouses in rural Nepal. We analyzed the quantitative data with generalized estimating equations to model the HAPA-based psychosocial determinants of avoiding water-carrying during pregnancy and postpartum. Subjective perspectives were investigated with thematic analysis.

Outcome expectancies (B = 0.24), self-efficacy (B = 0.20), and injunctive norms (B = 0.23) were significantly associated with the intention to avoid water-carrying. Self-efficacy (B = 0.36) and instrumental support (B = 0.05) are related to behavior (all $p < 0.05$). Women explained water-carrying during pregnancy by a lack of family support, a shift of health decision-making power to in-laws, and low behavioral control.

Overall, the necessity of water, family decision making structures, and low support make it difficult for women to discontinue water-carrying. Additionally to infrastructural improvements, behavioral interventions may increase women's self-efficacy for safe water carrying (e.g. reducing weight) and social support.

Keywords: Access to water, convergent mixed-methods design, health action process approach, low-income population, psychosocial determinants of health, women's health

Introduction

The need for water poses an emotional and physical burden on women's daily work in low-income countries (Geere, Bartram, et al., 2018; R. Sharma & Singh, 2012). Water is needed for drinking, hygiene, and food preparation for household members and for livestock. It can involve lifting and carrying 20-kg water containers several times per day (Geere et al., 2010). Many women in rural areas retain the responsibility for carrying water during their pregnancies (Regmi, 2007). Although reproductive organs require 6 months to heal postpartum (Romano et al., 2010), Nepali women in rural areas return to their physically demanding working routine shortly after giving birth, as little as 7- to 30-day postpartum (Earth & Sthapit, 2002; Panter-Brick, 1989).

Handling heavy items such as water containers during pregnancy and postpartum poses a range of risks for maternal and child health, including increased demands on the musculoskeletal system, increased uterine contractility, threats to fetal growth, preterm delivery, spontaneous abortion, and uterine prolapse (Darshan, 2009; Earth & Sthapit, 2002; Juhl et al., 2013; Koyuncu et al., 2021; MacDonald et al., 2013). The social consequences of prolapse are substantial and include physical and emotional isolation, low self-esteem, inability to work, lack of economic support, and domestic violence (Darshan, 2009; Gunasekera et al., 2007). The United Nations Population Fund estimates that 10 per cent of women in Nepal suffer from uterine prolapse, and heavy lifting is one of the main causative factors (Gunasekera et al., 2007). Encouraging behaviors that prevent these physical health impacts and their psychosocial consequences might help to minimize adverse health outcomes and enhance women's quality of life.

Safe water-carrying

No international recommendations or specific guidelines are available for Nepal, but the American Institute for Occupational Safety and Health recommends weight limits for pregnant workers that can be acceptable to 90 per cent of healthy women and were designed as a guideline for employers (MacDonald et al., 2013; T. R. Waters et al., 2014). It recommends maximum load of 15 kg in the first half of pregnancy and up to 11 kg in the second half with an ideal posture for repetitive lifting. These maximum weight recommendations can only be considered safe for an ideal lift: infrequent two-handed lifting of compact loads close to the body without twisting, stooping, or reaching up or forward. Because the ideal pose for lifting the object close to the body might be obstructed in the second half of pregnancy, a reduction to 7 kg may be considered. Additionally, objects should not be lifted from the ground. The recommended load is lower for specific work tasks and body conditions

(MacDonald et al., 2013), for instance, when carrying water during pregnancy in hilly areas such as Nepal. Regular bending of the waist as when lifting loads from below midshin (e.g. water containers from the ground) results in a three-times-higher risk of preterm labor and miscarriages (Bonzini et al., 2009).

No evidence-based recommendations are available for the postpartum period, but guidelines (Howard County General Hospital & John Hopkins Medicine, n.d.; Oxford University Hospitals, 2016) suggest that no loads heavier than the baby should be carried until 6-week postpartum and no "very heavy loads" (not further specified) should be carried until 3-month postpartum.

Many women in low-income countries do not meet these safe carrying strategies (Geere, Bartram, et al., 2018; R. Sharma & Singh, 2012). They are often required to carry water, firewood for cooking, grass and leaves for animal feed, and farm produce to the house and market. Depending on the circumstances, women may fetch 15 to 40 L of water in one trip (R. Sharma & Singh, 2012). In Nepal, the daily routine of lifting 20-kg water containers from the ground and sometimes carrying them uphill is continued by many women during pregnancy and shortly after giving birth (Earth & Sthapit, 2002; Geere, Bartram, et al., 2018).

Explaining safe water-carrying practices during pregnancy and postpartum

It is necessary to understand women's lifeworld and why they apply unsafe or safe carrying strategies. To date, only a small number of qualitative studies and no quantitative studies have sought to explain why women in general continue heavy work in the vulnerable periods of pregnancy and postpartum. These studies found that sociostructural factors that perpetuate unsafe working behavior during pregnancy and postpartum include economic disadvantages, social norms, and expectations about the division of labor within families and partners' lack of economic support or willingness to reduce their wives' workloads during pregnancy (Lowe et al., 2016; Mullany, 2006; Panter-Brick, 1989). In addition, individual psychological determinants may steer water-carrying practices. Literature on uterine prolapse indicates that one possible psychological factor may be insufficient perception of the risk of carrying heavy loads during pregnancy and postpartum (B. Shrestha, Onta, et al., 2014).

Health behavior models such as the health action process approach (HAPA) may provide a more comprehensive understanding of the sociocognitive determinants of safe water-carrying as a health behavior (Schwarzer, 2008). The HAPA model posits predictors that facilitate the formation of intention and the planning and realization of behavior such as safe water-carrying. Predictors leading to intention formation include risk perception, outcome expectancies such as beliefs about the consequences of safe water-carrying, and self-efficacy,

such as belief in the ability to perform safe water-carrying. Predictors of behavior include intention, action planning, such as when, where, and how to safely carry water, and coping planning, which involves anticipating barriers and making alternative plans. Finally, the HAPA also foresees contextual barriers and resources such as social support that need to be considered for the performance of behavior.

The HAPA model has proven applicable to a broad range of health behaviors, populations, and cultures, including the Global South (Renner et al., 2007; Zhang et al., 2019). In addition to the HAPA factors, researchers of health behavior in low-income countries have often identified social norms as predictors of health behavior (Harter et al., 2020; Reid et al., 2010; Tumwebaze & Mosler, 2014). These include injunctive norms, which are conceptions of what significant others approve of, and descriptive norms, which are what significant others do (Cialdini et al., 1991). Hence, social norms within Nepali families, predominantly the husband and the mother-in-law, and communities might predict women's workload during pregnancy and postpartum (Lowe et al., 2016; Mullany, 2006; Panter-Brick, 1989). Considering family members' perspectives on safe water-carrying might therefore provide insight not offered by former studies.

The present study

In summary, no studies have investigated the psychosocial determinants of safe water-carrying practices during pregnancy and postpartum. The HAPA model's broad applicability indicates that it may provide a useful framework for predicting safe water-carrying. This study will be the first based in theory to test the psychosocial determinants of maternal workload in low- and middle-income settings. However, because the HAPA has not been applied in this setting, women and family members' perspectives should also be considered in qualitative interviews so as not to miss unexpected insights and cross-validate quantitative findings. This mixed-methods study aims to explain the psychosocial factors of safe water-carrying during pregnancy and postpartum by addressing these two research questions. Quantitatively, what are the psychosocial determinants of the intention (I) and behavior (II) of safe water-carrying? Qualitatively, how do women and their family members explain women's water-carrying during and after pregnancy?

Methods

This mixed-methods study was conducted in 2019, in five communities in the Kavre and Sindhupalanchowk districts of Nepal, which are in a typical rural low-income region with a mixture of at-house and off-plot water supplies such as water sources in yards and neighborhoods and communal sources.

We used a convergent mixed-methods design (Creswell, 2015) to investigate the reasons for unsafe water-carrying in low-income Nepal, which referred specifically to water-carrying during pregnancy and postpartum. The narrative structure of qualitative data allows it to highlight women's and their family members' subjective perspectives without superimposing any theory. In contrast, the quantitative data allow a more generalizable theory-based test of psychosocial determinants of the intention and behavior to carry water safely. We paired the results to identify areas that converged and diverged across the two methodologies (Creswell, 2015) and thus to arrive at strong conclusions about the psychosocial factors that can explain safe water-carrying during pregnancy and postpartum. All participants provided written informed consent prior to their interviews. If during the interview a participant indicated symptoms of reproductive health problems, a free screening at the local health center was performed, and if necessary, free treatment was offered.

Quantitative methods

Participants and procedures

Eight female Nepali data collectors were trained to carry out a cross-sectional structured survey. They interviewed a random sample of approximately 200 women in each of five communities (N = 1001) using the random route method (Hoffmeyer-Zlotnik, 2003). The study areas were selected because each had an outreach center of Dhulikel Hospital. The data collectors presented themselves and the aim of the study when arriving at the house and started the interview when a woman in the household was willing to participate and met the selection criteria: being adult—from 16 years in Nepal—and of reproductive age, permanently residing in the community, and being involved in water-carrying. When more than one woman met the criteria, the data collectors interviewed the woman predominantly responsible for water-carrying.

As our main outcome focused on carrying behavior during pregnancy, we excluded 80 women (8%) that had never been pregnant. This resulted in a sample size of n = 921 for all analyses. The survey was conducted in Nepali and supervised by the first and second authors. To ensure participants' privacy, they were interviewed inside the house in case other adults gathered outside the house.

Measures

The interviews assessed details of carrying behavior, women's mental and physical health, social context, psychosocial determinants of water-carrying during and after pregnancy, and standard demographic measures. Please consult Table S1 in the supporting information for all measures and individual items, descriptive statistics, and internal consistencies. Consult Table S3 for bivariate correlations. All survey instruments were translated and back-translated from English to Nepali and adapted to the local context in close collaboration with our Nepali partners before and after a pretest.

The target behavior of safe water-carrying was defined as avoiding carrying water during pregnancy and 3 months postpartum. This was assessed by a self-report behavior index that measured the water-carrying frequency in one typical week during pregnancy and one typical week at 3 months postpartum, referring to the previous pregnancy, for example, "How often in 1 week did you carry water in the 3 months after delivery?",1= "every day" to 5 = "no days". The answer given was then reverse coded to represent avoidance.

The survey instruments assessing psychosocial determinants of safe water-carrying were developed based on the theoretical framework of the HAPA model (Schwarzer, 2008) and social norms (Cialdini et al., 1991). They included risk perception, outcome expectancies, self-efficacy, behavioral intention, instrumental support, action planning, coping planning, injunctive norm, and descriptive norm. Internal consistencies for the constructs were high, with Cronbach's alpha $0.83 < \alpha < 0.91$ except for the injunctive norm. At the first field site, the injunctive norm exhibited low internal consistency, but it achieved satisfactory consistency when excluding this site ($\alpha = 0.72$). As the results did not change when excluding the site from analyses, we reported the results for all sites. Unipolar 5-point Likert scales were used to assess psychological constructs. Data collectors used a visual scale of five dots of increasing size to visualize answer categories, which ranged from "I do not at all agree" to "I agree very much" (Harter et al., 2020).

Data analysis

To model the psychosocial determinants of intentions and behavior of avoiding water-carrying during pregnancy and postpartum, we performed two generalized estimating equations (GEE). GEE can estimate the parameters of a generalized linear model and serve as a flexible generalization of ordinary linear regression (Nelder & Wedderburn, 1972). The GEE accounted for the structure of the data, which was nested as households in communities (Liang & Zeger, 1986). We included the following predictors: risk perception, outcome expectancies, self-efficacy, injunctive norm, descriptive norm, and instrumental support, as

psychosocial determinants of intention (Model 1) and self-efficacy, injunctive norm, descriptive norm, behavioral intention, instrumental support, action planning, and coping planning as psychosocial determinants of behavior (Model 2). Both models included the following control variables: age, socioeconomic status, historical pregnancy, living condition, ethnicity, education, and type of water source. We computed all analyses in IBM SPSS Statistics 24 (IBM Corp., Armonk, N.Y., USA). All variables and sample syntax can be found in the supporting information.

Qualitative methods

Participants

To gain the best possible insights, we used theoretical sampling to understand all aspects of women carrying water during pregnancy and 3-months postpartum (Glaser, 1999). The initial approach was to interview women of reproductive age and women who had a daughter-in-law to include the perspectives of mothers-in-law. The initial plan was to interview six women from different age groups in different areas in each of the five communities to cover a heterogeneous sample. After identifying some key concepts in a first round of interviews, we specifically approached daughter–mother-in-law and wife–husband dyads to gain a deeper understanding of family decision-making and responsibility structures. This resulted in a total of 44 transcripts.

The final sample size for the qualitative analysis was then determined by data saturation, which was reached after analyzing 21 interviews. This final sample included five daughter-mother-in-law dyads (n = 10), three wife–husband dyads (n = 6), one wife–mother-in-law husband triad (n = 3), and two single women (n = 2). The qualitative sample therefore included 21 interviews.

Data collection and measures

The first author, the second author, and a Nepali public health graduate student conducted the first half of the semistructured qualitative interviews together. After having assisted in four interviews, a Swiss psychology master's student conducted the second half of the interviews with the Nepali graduate student. The Nepali researchers translated the interview questions and responses simultaneously to the non-Nepali speaking researcher. All interviewers engaged in constant reflective exchange to ensure sensitivity towards the interviewees and themselves. The team audiorecorded the interviews. The second author transcribed and translated them into English ad verbatim.

A sample guideline for the qualitative interviews can be found in Table S4 of the supporting information. We used semistructured interviews to ask explicitly about women's daily routines and family members' behaviors and attitudes during pregnancy and postpartum, and we encouraged participants to articulate the reasons for their behavior and thinking with non-directive follow-up questions. Further, we developed a narrative storytelling task that used two pictures illustrating a fictitious scenario of a woman with a newborn child, either carrying water or not. On presenting the pictures, we asked open questions, such as “what kind of woman is she?”. We used this task to stimulate discussion about more implicit thoughts on the sociocultural norms, values, and expectations about this situation (find information on storytelling in Feldman et al., 2004).

Data analysis

For the qualitative analyses, we used a systematic, iterative approach of inductive reasoning, by which a theory forms from the data (Charmaz & Henwood, 2017). To ensure comparability with the quantitative data, the analysis focus was set on women in reproductive age. Additional information was gained by analyzing the transcripts of family members. Transcripts were analyzed until theoretical saturation was reached and no additional insight or new codes were found. We conducted a bottom-up thematic analysis (Braun & Clarke, 2006), which includes familiarization with all transcripts, generation of initial codes, search for themes, review of themes, definition and naming of themes, and writing up the themes analyzed. The first author first read all transcripts, familiarizing herself with the data, and writing down initial codes. She then searched for themes that represented some level of patterned response or meaning within the data set in relation to the research question. These themes and assigned codes and quotations were reviewed and discussed with the last author and the second author separately in order to validate them. The first author then identified relationships between themes, and combined them to larger themes wherever necessary. All authors then reviewed the themes and relationships again until they reached consensus. In order to validate the results, the first author examined all transcripts a second time, looking for contradictory evidence, also termed deviant cases (C. Anderson, 2010). The first author then wrote up the analyzed themes, including the most representative quotation in order to provide evidence to the reader. Then, the coauthors reviewed a first report of the results and discussed feedback in light of the research questions and the reliability of the findings.

Results

Quantitative results

The women interviewed were around 35 years old (*SD* = 9 years), half of them (45%) had an average monthly household income of 9600 NPR or less (≈80 US$), 89 per cent received less than 24,000 NPR (≈200 US$), and half (53%) of them did not pass primary school. The average number of pregnancies per interviewee was 2.9 (*SD* = 1.6). All other sample characteristics can be found in Table S2 of the supporting information.

Safe water-carrying (avoiding carrying during previous pregnancy and postpartum) (*M* = 0.40, *SD* = 0.38) and intention of avoiding carrying (*M* = 0.63, *SD* = 0.29) was around the midscale. The mean weight carried by nonpregnant women was 20 kg (*SD* = 10 kg) per trip; women currently pregnant or postpartum (*n* = 65) carried 18 kg (*SD* = 11 kg). Some 55 per cent and 51 per cent of women reported carrying smaller quantities of water during pregnancy or postpartum respectively. Women also reported carrying other heavy loads (*M* = 36 kg, *SD* = 12 kg), 65 per cent of them daily. On average, women reported high risk perception (*M* = 0.70, *SD* = 0.33) and outcome expectancies (*M* = 0.78, *SD* = 0.25) and low-to-moderate self-efficacy (*M* = 0.42, *SD* = 0.34) and injunctive norms (*M* = 0.56, *SD* = 0.25) for avoiding water-carrying during pregnancy and postpartum. Most women (89%) received instrumental support in carrying water (see all descriptive statistics in supporting information Table S1).

As shown in Table 5, the higher the self-efficacy, the more positive were the outcome expectancies and the more favorable the injunctive norm to avoid water-carrying, the higher was the intention of doing so.

Table 5

Generalized estimating equations of psychosocial determinants of intention and behavior to avoid water carrying during pregnancy and postpartum

	Behavioral intention for safe water-carrying					Safe water-carrying behavior				
			95% CI					95% CI		
Parameter	*Estimate*	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*
Intercept	0.21	0.08	0.05	0.37	0.011	-0.09	0.10	-0.29	0.10	0.341
Risk perception	0.06	0.03	< 0.01	0.12	0.052	-	-	-	-	-
Outcome expectancies	0.24	0.06	0.13	0.34	< 0.001	-	-	-	-	-
Self-efficacy	0.20	0.06	0.08	0.31	0.001	0.36	0.05	0.25	0.46	< 0.001
Injunctive norm	0.23	0.10	0.04	0.43	0.019	0.09	0.05	< 0.01	0.18	0.056
Descriptive norm	0.02	0.04	-0.05	0.09	0.666	0.04	0.05	-0.05	0.13	0.388
Behavioral intention	-	-	-	-	-	0.20	0.06	0.09	0.31	< 0.001
Instrumental support	0.05	0.03	-0.02	0.11	0.160	0.05	0.02	0.01	0.10	0.031
Action planning	-	-	-	-	-	-0.02	0.04	-0.09	0.05	0.627
Coping planning	-	-	-	-	-	0.02	0.03	-0.04	0.07	0.575
Age	< 0.01	< 0.01	< 0.01	< 0.01	0.047	< 0.01	< 0.01	-0.01	< 0.01	0.224
Socioeconomic status	< 0.01	< 0.01	< 0.01	< 0.01	0.056	< 0.01	< 0.01	< 0.01	< 0.01	< 0.001
Living without husband	-0.01	0.02	-0.04	0.03	0.719	0.03	0.01	< 0.01	0.05	0.044
Currently pregnant[1]	0.03	0.03	-0.03	0.08	0.323	-0.02	0.03	-0.08	0.03	0.421
Currently delivered[2]	-0.01	0.02	-0.05	0.03	0.663	-0.03	0.04	-0.10	0.04	0.436
Education	< 0.01	< 0.01	-0.01	0.01	0.459	0.01	0.01	-0.01	0.02	0.238
Ethnicity[3]										
Brahmin	-0.02	0.01	-0.05	0.01	0.150	0.11	0.06	-0.01	0.22	0.072
Tamang	-0.04	0.03	-0.08	0.01	0.167	0.09	0.05	< 0.01	0.17	0.059
Newar	-0.04	0.03	-0.10	0.03	0.305	0.10	0.03	0.04	0.17	0.002
Chhetri	0.06	0.03	0.01	0.11	0.017	0.09	0.07	-0.04	0.22	0.156
Dalit	-0.01	0.01	-0.04	0.02	0.397	0.05	0.05	-0.05	0.15	0.323
Rai and Limbu	-0.02	0.03	-0.07	0.04	0.546	0.12	0.05	0.02	0.23	0.016
Water source[4]										
Household tap	-0.03	0.03	-0.09	0.03	0.357	0.01	0.06	-0.10	0.13	0.832
Shared tap	-0.05	0.03	-0.12	0.02	0.150	-0.02	0.04	-0.10	0.07	0.716
Community tap	-0.04	0.02	-0.08	< 0.01	0.046	-0.02	0.04	-0.11	0.06	0.592

Note. *N*= 921. 5 communities. *Estimate* = Parameter Estimates. *SE* = Standard Error. CI = Confidence interval. Probability distribution: normal, link function: identity. All *p*-values are two-tailed. All variables were recoded to a range between 0 to 1. [1] Are you currently pregnant? [2] Have you delivered in the last 3 months? [3]Reference = other, [4]Reference = Source further than village.

For behavior, the analyses showed that higher self-efficacy and intention and more instrumental support from any family member were associated with less frequent water-carrying during pregnancy and postpartum.

Qualitative results

The analyzed interviews included 12 women (*M* = 33 years, monthly expenses *M* = 20,791 NPR [≈ 173US$], 50% no primary education), 4 husbands (*M* = 50 years, monthly expenses *M* = 21,705 NPR [≈ 180 US$], 50% no primary education), and 5 mothers-in-law (*M* = 57 years, monthly expenses *M* = 9900 NPR [≈ 82US$], 100% no primary education). Further sample characteristics can be found in Table S5 of the supporting information. The perspectives of women and their family members on women's behavior and its reasons converged. Therefore, we present the quotation that best illustrates each of the themes below. More quotations for each theme and additional subthemes can be found in supporting information Table S6.

Carrying behavior during pregnancy and postpartum

All the women interviewed indicated moderate to high risk behavior during their pregnancy and/or 3 months postpartum (see Table S5). Some women carried during pregnancy but not postpartum. Some carried throughout the whole period of pregnancy; some carried only until a certain month. In addition to water, women carried other heavy loads for agricultural purpose: “When doing fieldwork, we have to carry crops, corn, and fertilizers. And we also carry other loads like grass and firewood. We have to carry.” 5_daughterinlaw: 27. Further, it became apparent that whether they carried water or not depended on women's physical ability. In cases of sickness, they would not carry. But as long as they were able to, women carried water during pregnancy and postpartum: “I do whatever I can, and what I can't do I don't do. I'm not able to carry loads anymore, so my body does not feel weak.” 1_woman: 31. In cases of pregnancy- or delivery-related difficulties, they did not carry water: “Even though I like carrying water, I can't at the moment [Note. respondent is pregnant]. ... If I could do it, I would have felt nice. Now I need to tell others. If I could, I would have brought the water myself.” 2_woman: 98.

High risk perception but low personal vulnerability

The perception of the risks of water-carrying in general and water-carrying during pregnancy and postpartum was high in most family members. Risks mentioned included pain, burden to mental health, complications during pregnancy, and concerns about child health and uterine prolapse: “It's risky. They may get uterine prolapse, bleeding, headache, and back

pain. The effects are not known when she carries, but later it may cause health hazards" (6_husband: 91).

Some women considered themselves less vulnerable to developing uterine prolapse due to their good health condition or past experience: "I have three babies. I don't know, nothing happened. We also carried gagris [water containers], used to work a lot, nothing happened to us" (3_woman: 178).

Negative and positive outcome expectancies for the avoidance of carrying during pregnancy and postpartum

Both negative and positive outcome expectancies were mentioned. The advantages of not carrying during pregnancy and postpartum mentioned were the prevention of adverse health effects, uterine prolapse specifically, and bearing a healthy child. Two women mentioned this: "We can be protected from diseases during pregnancy if we don't have to carry loads" (12_daughter: 185); "We shouldn't work if we want our uteruses to be safe. We shouldn't carry heavy loads. During pregnancy too, we shouldn't work a lot these days" (1_woman: 285).

Advantages of carrying during pregnancy and postpartum mentioned included the need to provide food and water and the belief that carrying is convenient for women's and children's health and would facilitate the delivery:

> It's said that the more I work, the more my health will be good and my baby will be energetic. So, when you're pregnant, if you don't work then you'll have problems during the delivery. So, if I work, then I'll have an easy delivery. The more I work, the easier it will be for my body. (3_woman: 174).

Other women indicated that they carried because of favorable affective attitudes: "Actually, it's not obligatory [to carry in this period], but I like to do that. My heart doesn't allow me to stay and do nothing. I'm carrying out of choice" (2_woman: 223–241). Some women reported feeling "bad" or "odd" when not able to perform the behavior: "It was hard [to carry during pregnancy], but I felt rather odd not carrying water while living here" (8_daughterinlaw: 101).

Some women reported a low response efficacy of avoiding carrying: "In some cases, even if women do nothing. then there is uterus prolapse" (7_daughterinlaw: 220).

Belief in karma

Finally, the belief in karma that good people deserve well was also given as a reason for carrying water during pregnancy, mostly in the picture task: "She [carrying woman] is a blessed woman. It can be understood just by looking who is blessed and who has bad family"

(13_motherinlaw: 297). “She might be blaming her luck and karma” (11_daughterinlaw: 121).

Lack of options and necessity of carrying water

A lack of options was mentioned, associated with necessity: “Without water there's no food. So we decided [that] after delivery she carried water after 10-15 days. What can be done? We needed water” (6_husband: 75–81). Obligation was also mentioned: “Even though we feel it to be difficult, we need to [carry water]. We have no option” (1_woman: 229).

The availability of household taps and vehicles was mentioned as one reason why women carried loads during pregnancy and postpartum or not (Table S6). However, household taps were not always reliable and not all water was carried from there. Some families needed to switch to other sources during the dry season; one husband said: “Six months [in dry season], we have to carry water from a well rather far away” (12_husband: 21).

Social influence and decision-making

Family members and their attitudes were frequently mentioned as contributing to women's water-carrying during pregnancy and postpartum. When getting married, women might be expected to work in their in-laws house: “When I was 15 years old, I got married and then started lifting heavy loads” (1_woman: 71); “Daughters-in-law do household work, agricultural work and take care of the cattle,[...]. I expect them to help more, take care of the cattle, cook food, cut grass, and collect firewood” (5_motherinlaw: 59–61).

Injunctive norms were also mentioned. Avoiding work was disapproved, for instance, when women did not assume their familial responsibility to bring water: “She [mother-in-law] didn't say much to me, but she was angry when I didn't work. ... They [family members] sometimes behave rudely, saying that I'm taking rest [postpartum] while they have to work” (11_daughterinlaw: 173–181). Conversely, other women mentioned that family members approved of their avoiding carrying during pregnancy and postpartum: “Others also said that we should rest two months, so I did.” 10_daugtherinlaw: 170, or that they were without any expectations: “She [mother-in-law] is happy with whatever I do. She is happy with me” (5_daughterinlaw: 79).

In the picture task, some women expressed approval and admiration of the women who carried postpartum for fulfilling their responsibilities in this period: “I think she [carrying woman] is brave and daring” (11_daughterinlaw: 111). “She [carrying woman] must be a very good woman. At the time when she has to rest ... she is carrying water” (9_wife: 109).

Some women reported that their in-laws or husbands told them what to do or not to do: “If things are like that [that I am pregnant] then they [in-laws] need to agree [not to

carry]. Sometimes if they don't agree, then I need to work. That's it. Mostly, they agree" (1_woman: 257). One husband said: "We didn't let her carry heavy loads, loads from far away; we didn't let her carry water or firewood. We only let her do easy work"(12_husband: 122).

Descriptive norms about carrying during pregnancy and postpartum were mentioned by all family members: "In the villages, we carry even when we're pregnant" (8_daughterinlaw: 87). On the other hand, descriptive norms about avoiding carrying were mentioned in the picture task: "People don't work for one month when they are in the postpartum phase" (14_woman: 130).

Social support as a resource for avoiding water-carrying

Women received instrumental, informational, and emotional support from their social environment. Instrumental support was mostly provided by and expected from family members: "[After delivery] my husband and father-in-law helped [to carry water]. ... After I gave birth and was bleeding for some time, my sister's daughters helped me a lot" (12_wife: 167–173). This support was described as reciprocal within families: "When I'm unable, then my mother-in-law takes care, and when she's unable, I help out. It's just natural" (5_daughterinlaw: 43). In turn, help with water-carrying from people outside the family was not common: "No, no one [other villagers] brings water for us, and we don't have to help others" (6_wife: 97).

However, support from family members was not always consistent or was insufficient for women to rest completely during pregnancy and postpartum (Table S6). For example, one woman said: "He [the husband] has to go to work, and there's nobody who works in the home, so I need to do it. Sometimes if the gagri [water container] is big, then he (husband) helps; the smaller one I need to bring myself" (3_woman: 73). One woman said that her husband did not help at all: "He doesn't work at all and doesn't do any chores; I have to do it all myself"(8_motherinlaw: 83).

Family members gave informational support to the woman with advice about how to behave during pregnancy and postpartum and in case of sickness "Everyone in the family helped and supported her [my wife, when she was pregnant]. They gave her advice about childbirth" (11_fatherinlaw: 125); "He [my husband] will say not to carry heavy loads, exercise, eat nutritious food; he says things like that" (2_woman: 297). Additionally, people outside the family might give informational support, for instance about health risks: "I would tell [other women] not to carry too much load" (10_motherinlaw: 170).

Finally, women reported receiving emotional support during pregnancy and postpartum from friends, neighbors, and their biological mother (see additional quotations in Table S6): “I had a buffalo, and goats, even though my child was very small. During that time [postpartum] the mother-in -law and father-in -aw never helped. They really made my life difficult. But other friends were sympathetic to me and [...] the kids. They used to say ‘you faced lots of problems, your mother-in-law could take care of your children’” (8_motherinlaw: 160).

Making plans and overcoming barriers

There were strategies for carrying less weight with smaller vessels and making fewer trips during pregnancy and postpartum: “[During pregnancy I carried] a little less but three times a day” (5_daughterinlaw: 138–139); “I told her [daughter in law] to do less work. She brought water one or two times per day [during pregnancy]. [On normal days she carried] five or six times a day” (5_motherinlaw: 135–137). In contrast to this, other women mentioned that they carried the same quantity at the same frequency. Regardless of pregnancy, several strategies were mentioned as safe carrying techniques (see quotations in Table S6): body postures, using helping tools, and reducing loads, for instance, by using a small water container of 10 L rather than the usual size of 20 L.

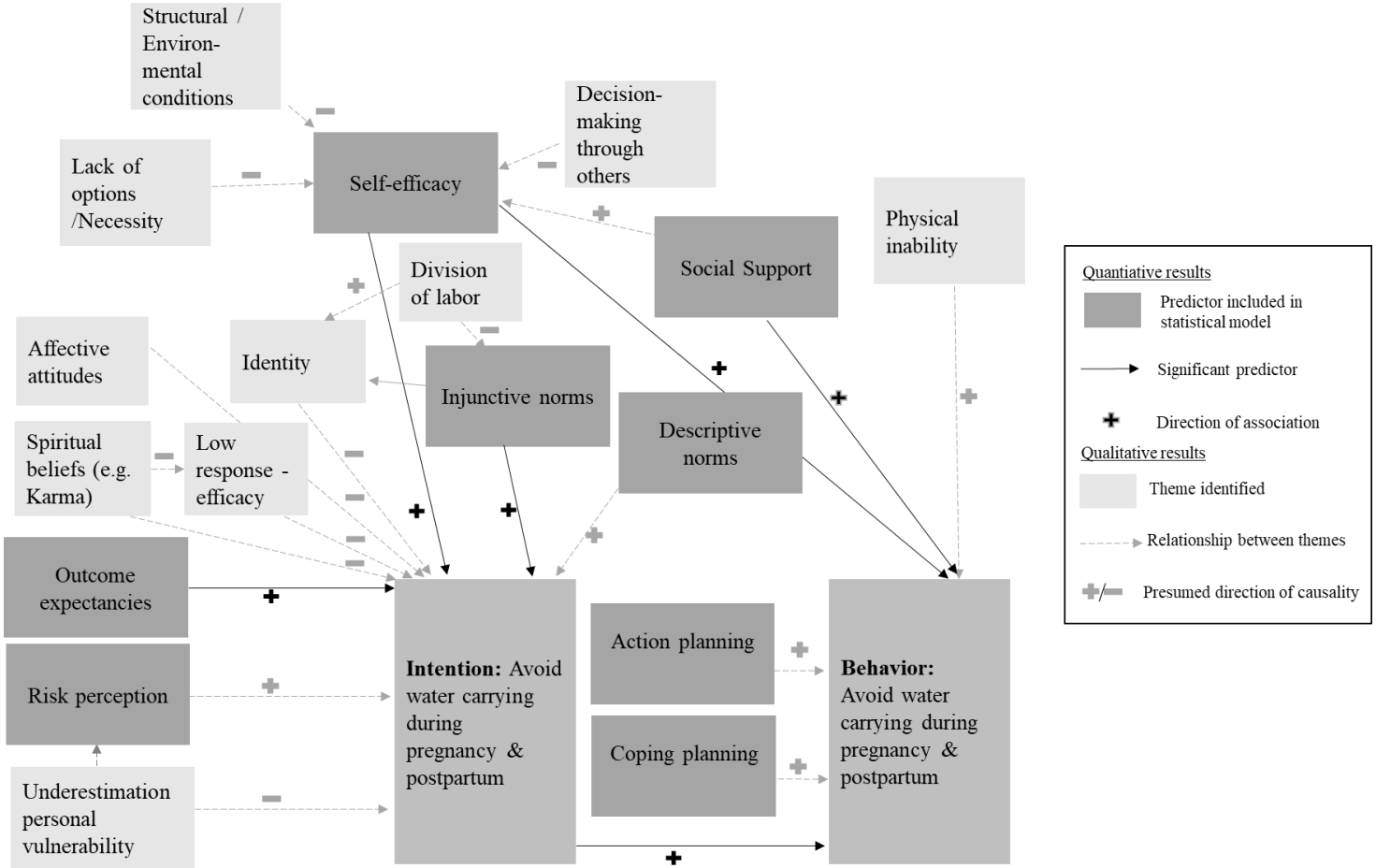
Women mentioned difficulties that may arise and plans to overcome these. If other people told them to carry water, one strategy mentioned was not listening to others. If no one helped to carry, they might also ask for help or pay someone: “If no family members will [help postpartum], then I can use money and make people help me by paying them. I can pay people to carry water, grass and other loads” (11_daughterinlaw: 193). Additionally, structural improvement was mentioned as a strategy for reducing carrying: “They can use pipes to bring water inside and use sacks and busses to bring loads instead of carrying [during pregnancy and postpartum]” (10_daugtherinlaw: 225).

Discussion

Combining a theory-based approach with women's and their family members' subjective experiences, this mixed-methods study provided convergent evidence of the determinants of safe water-carrying practices in a low-income setting. Consistent with previous research, we found that at least half of the women in rural areas of Nepal engaged in high-risk behavior by carrying water and other heavy loads during pregnancy and postpartum (Earth & Sthapit, 2002; Geere, Bartram, et al., 2018). As indicated by GEE, outcome expectancies, self-efficacy, and injunctive norms were associated with the intention to use safe water-carrying strategies. In turn, behavioral intention, self-efficacy, and instrumental social support were associated with safe water-carrying behavior. The qualitative findings corroborate these psychosocial factors and supplement them by in-depth insights into how women explain their water-carrying practices. Figure 5 shows a summary of the determinants of safe water-carrying identified by quantitative and qualitative findings.

Figure 5

Summary of the quantitative and qualitative results indicating psychosocial determinants of safe water-carrying



Note. The quantitative findings on the theory-based predictors are dark-gray colored. Black arrows indicate significant associations, and signs indicate their directions with safe water-carrying derived from generalized estimating equations. The themes found in the qualitative analysis are represented by light-gray squares. Gray arrows and signs indicate causal relationships assumed based on the qualitative findings.

Women's motivation to engage in safe water-carrying

Even though respondents associated a large range of different health risks with water-carrying, our results indicate that knowledge of these risks does not keep women from carrying water during pregnancy and postpartum. This converges with evidence from meta-analyses that risk perception is the weakest predictor of health behavior (e.g. Zhang et al., 2019). Underestimating personal risk because of good health condition or previously escaping the consequences of risky behavior is a possible reason identified in our study. This optimism bias is a common phenomenon in social psychology and has also been documented for other water-related health risks, such as arsenic (Flanagan et al., 2015).

Going beyond the outcome expectancies of safe water-carrying assessed in the quantitative analysis, the qualitative data yielded the insight that women also expected positive outcomes for carrying during pregnancy and postpartum, such as a stronger body, an easier delivery, and positive feelings associated with water-carrying. This is in line with previous research indicating that affective attitudes are important predictors of health behavior and can have independent and more powerful effects on intentions and behavior than instrumental attitudes (Lawton et al., 2009). Water-carrying is a source of emotional distress for many women worldwide (Sultana, 2011), yet some women may like carrying water during pregnancy and postpartum, perhaps because they enjoy social interaction at the tap or the opportunity to spend time outside the household (Sultana, 2011). Future quantitative research should consider these themes as additional outcome expectancies.

Another motivational factor, injunctive norms were significantly associated with the intention of safe carrying. Women may be motivated to assume their responsibilities within the family's division of labor even during pregnancy, because studies have found that traditional Nepali families approve of equal engagement in day labor without regard to age, sex, physical fitness, or maternal status (Panter-Brick, 1989). The finding that some women felt “odd” when not carrying water might support the interpretation that the task of water-carrying is part of their social identity (Moran & Sussman, 2014; Verplanken & Orbell, 2003). Social norms and identity might therefore be considered to be additional factors motivating behavior that are not included in the HAPA model (Freivogel & Visschers, 2020).

The qualitative results also indicated that safe water-carrying had low response efficacy because some women believed they might suffer from uterine prolapse even when resting after pregnancy. Further, beliefs about karma may entail the idea that health outcomes are predominantly related to people's deeds and God's will instead of attributing the outcomes to health behavior (Colditz, 2015). Such spiritual beliefs may be also considered in the HAPA

model as an integral part of outcome expectancies for intention formation. Recommendations for interventions include recognizing these beliefs and incorporating them in health behavior intervention planning for Buddhist and Hindu communities (Colditz, 2015).

Sociostructural barriers and resources related to safe water-carrying behavior

Although the motivational factors mentioned above can explain women's intention to carry water safely, we identified various sociostructural barriers that can prevent even motivated women from pursuing their goal in the volitional phase of behavior (Schwarzer, 2008). The quantitative results indicated that self-efficacy was the weakest of all psychosocial determinants but the strongest predictor of intention and behavior. A self-efficacious person responds confidently with strategies to implement an intended behavior and overcome barriers through coping planning (Schwarzer, 2016). Many women had specific plans for reducing unsafe water-carrying, which included reducing the weight to be carried. However, our qualitative results indicated that lack of social support, family members' decisions and expectations, and poor household water access might diminish self-efficacy in implementing these plans. This is in line with other studies which found that sociostructural barriers, especially social expectations, can reduce the decision-making control of women over their health behavior in low-resource populations (S. Lewis et al., 2015; Wight et al., 2012; Wingood & DiClemente, 2000; World Health Organization, 2010).

Conversely, our quantitative and qualitative findings converged to show that family members, mostly husbands and mothers-in-law, provided valuable social support to overcoming barriers. The qualitative results also indicated that emotional and informational support was given by people outside the household as well but only rarely help with carrying.

Women's social networks can therefore both support and impede their health behavior (Hohl et al., 2018, 2019). Other studies on prevention of uterine prolapse in Nepal insist on increasing the involvement of their social environment to help women adopt low-risk behaviors (Earth & Sthapit, 2002; Radl et al., 2012). A more generalizable insight into the influence of family members on safe water-carrying (e.g. mothers-in-law attitudes on their daughters-in-law) requires quantitative dyadic approaches to health behavior change models such as the HAPA. Such approaches have been shown to be valuable in encouraging health behavior change in romantic couples (Berli et al., 2018).

We identified the frequent absence of the husband and other family members as a barrier for support. This emphasizes that interventions aiming to prevent adverse health effects of carrying during pregnancy and postpartum should consider single women as an especially vulnerable target group.

The necessity of water and other agricultural supplies for daily life further highlights the need for infrastructural improvements in the study area. Examples of such improvements include bringing the water and other loads closer to the households by constructing piped water supplies to household taps and roof ropeways and cable cars. However, even when household taps exist, it is moments of lifting and lowering heavy loads that pose the highest risks for maternal and child health (MacDonald et al., 2013; T. R. Waters et al., 2014). Behavior change to safe-lifting strategies, such as applying specific lifting postures and reducing loads (MacDonald et al., 2013; T. R. Waters et al., 2014), might therefore complement infrastructural improvements.

Strengths and limitations

This mixed-methods study is the first to triangulate generalizable individual data (N = 921) regarding maternal water-carrying strategies with comparative in-depth information about family members' attitudes in a rural low-resource population. The results showed that health behavior models such as the HAPA are applicable in settings such as this, especially when complemented by social influences.

Even though measures and transcripts were carefully translated using forward- and backtranslation, divergent interpretations by the participants or the researchers may have biased the findings. This divergence may limit the generalizability of the qualitative results in particular. Some results are likely culture specific (e.g. beliefs about karma), and the findings may not be readily transferable to women from other cultures. It is also important to note that the study is limited by its cross-sectional design. Therefore, no conclusions may be drawn from the quantitative data about the causality of relationships between psychosocial factors and safe water-carrying intentions and behavior. Although some of the qualitative results strengthen causal interpretations, longitudinal studies and particularly randomized controlled trials are needed as a next step.

Further, the data were self-reported, and we cannot exclude the possibility of social desirability, especially when discussing sensitive family dynamics. Finally, future research should investigate carrying behavior during pregnancy and postpartum as separate determinants. Although our quantitative data indicated a strong correlation between the two behaviors (r = 0.7), the qualitative data revealed that these may differ.

In the present manuscript, we focused on carrying frequency. However, some women also mentioned reducing weight of load during pregnancy. We therefore recommend to include this variable in future research. To do so, specific national guidelines on weight limits

during pregnancy and postpartum are needed, considering that western guidelines might not be fully transferrable to the Nepali context.

Conclusions

In conclusion, health psychology theory and methods proved useful in investigating water-carrying practices in a low-income setting, provided that they are carefully adapted to the local context. We found strong convergent evidence that women in rural Nepal are aware of the risk factors entailed in carrying water during pregnancy and postpartum. However, low self-efficacy in avoiding risky behavior due to the necessity of providing water, family decision-making structures, and low support make it difficult for women to discontinue water-carrying during this vulnerable period. Although structural improvements will likely facilitate safe water-carrying, behavior change interventions are needed. These might focus on increasing women's self-efficacy and behavioral intentions at the individual level and improving the social acceptance and support from family and community of not carrying loads during pregnancy and postpartum. Future randomized controlled trials are needed to test whether such interventions can promote safe water-carrying practices, prevent uterine prolapse, and improve women's health and well-being.

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Ethics statement

Ethical clearance was given by the Ethical Review Committee of the Health Research Council Nepal (Reg No. 517/2019) and the Ethical Review Board of the University of Bern, Switzerland (2019-10-00003).

Data availability statement

The quantitative data described in this article and the qualitative transcripts are not openly available only to ensure confidentiality and anonymity of participants. We went through the informed consent sheets again and realized that we may not make data openly available. “I know that all personal data will be kept confidential and will not be shared with anyone other than members of our survey team. I do agree that the researchers involved in this study, public authorities, and the members of the ethical review boards in Nepal and in Switzerland while keeping confidentiality can access original data. I was informed that any information about me will have an identification number on it instead of my name. I can request the deletion of my personal data until the link between my name and the data will be deleted.”

Conflict of interest

None.

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Chapter IV

Women's cognitions on reproductive health behavior are interrelated: A dyadic study

Short title: Women's interrelatedness in reproductive health

Vica Marie Jelena Tomberge *[1], Akina Shrestha [2], Regula Meierhofer [3], Jennifer Inauen [1]

*Corresponding author

[1] University of Bern, Institute of Psychology, Department of Health Psychology & Behavioral Medicine

[2] Kathmandu University School of Medical Sciences, Dhulikhel Hospital, Kathmandu

[3] Eawag, Swiss Federal Institute of Aquatic Science and Technology, Department of Sanitation, Water and Solid Waste for Development (Sandec)

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Abstract

Although decisions about reproductive health are often influenced by women's female family members', previous research has primarily focused on individual behavioral determinants. For the first time, we investigated the interrelatedness of women's reproductive health behavior based on a dyadic version of an extended health action process approach. We investigated this for carrying heavy loads of water during pregnancy and postpartum, a risk factor for pelvic organ prolapse.

This cross-sectional study included dyads of daughters-in-law and mothers–in-law in rural Nepal (*N*=476, nested in 238 dyads). Dyads of daughters-in-law and mothers–in-law were surveyed about avoiding carrying heavy loads during pregnancy and postpartum and their related cognitions. The effects of a woman's cognitions (actor effects) and her female dyadic partner's cognitions (partner effects) on their intention and behavior of avoiding carrying loads were estimated using linear-mixed models.

The results showed that a woman's cognitions related to her dyadic partner's intention to avoid carrying during pregnancy and vice versa. The mother-in-law's cognitions were related to the daughter-in-law's behavior. For example, partner's self-efficacy and injunctive norm related to women's behavioral intention and behavior over and above women's own self-efficacy and injunctive norms.

Female family members' cognitions about reproductive health behavior are interrelated and can have a motivating effect. Including women's female family members in interventions to help women manage their reproductive health seems promising. More broadly, these findings add to the growing body of research indicating the importance of including a dyadic perspective when understanding and changing health behavior.

Keywords: reproductive health, actor partner interdependence model, health action process approach, social influence, low-resource populations, dyadic data

Introduction

Improving women's reproductive health and reducing related mortality is a global priority (United Nations, 2015). Reproductive health includes freedom to choose whether and when to reproduce and a healthy pregnancy, childbirth, and postpartum period (UN Population Fund, 1994). Women's ability to make decisions about their reproductive health is crucial for achieving gender equality and global access to sexual and reproductive health (Hameed, 2019).

Engaging in reproductive health behaviors such as using contraception, caring for fertility, seeking professional maternity care, and reducing heavy work in the perinatal period are major factors in reducing these risks (Gunasekera et al., 2007; Sieverding, 2001).

Previous research has been directed at describing women's barriers to and resources for reproductive health behaviors, including structural (e.g., geography and financial means), social (e.g., social status, gender-related social expectations) and the individual-level determinants of these behaviors (e.g., risk knowledge, individual motivation, and self-regulation) (Bute & Jensen, 2010; Hirani, 2015; Kumar et al., 2016; Mumtaz & Salway, 2007; Sieverding, 2001; D. K. Thapa & Niehof, 2013; Tomberge, Shrestha, et al., 2021; Yount, 2002). Less attention has been directed to understanding how women's cognitions interact with social influences and expectations.

Understanding social-cognitive determinants of reproductive health behavior

The health action process approach (HAPA) is a well-evidenced and cross-culturally valid model of health behavior change that provides a good understanding of the social–cognitive determinants of health behavior (Schwarzer, 2008; Zhang et al., 2019), including reproductive health behavior (Tomberge, Shrestha, et al., 2021). The HAPA model posits that people are more likely to form an intention to change their behavior if they have high risk perception, favorable outcome expectancies arising from beliefs about the consequences of protective behavior, and higher self-efficacy stemming from belief in the ability to perform protective behavior. In turn, people with stronger intention, detailed action planning about when, where and how to manage protective behavior, and coping planning that anticipates barriers and makes alternative plans are more likely to realize a behavior. Although the HAPA is a cross-culturally valid model (Zhang et al., 2019), it shares a limitation with many other health behavior models that it is mostly focused on individuals and largely overlooks social determinants of behavior change.

Extending the HAPA with social norms such as perceptions of what others do and what others approve of has been shown to provide insights (S. Chow & Mullan, 2010;

Tomberge, Shrestha, et al., 2021; Zhang et al., 2020). Social norms have been found to be relevant predictors for many health behaviors (Reid et al., 2010) and may explain some of the variance of intention and the transition from intention to behavior (S. Chow & Mullan, 2010; Tomberge, Shrestha, et al., 2021; Zhang et al., 2020). However, studies that include social norms to explain behavior take an actor's perspective and fail to consider the perspectives and cognitions of a social partner.

Some studies have recently extended individual-focused health behavior models such as the HAPA to include a dyadic perspective that accounts for bidirectional effects in interpersonal relationships (e.g., romantic partners, close friends, and family members) that mutually influence behaviors (Berli et al., 2018; Howland et al., 2016; Joyal-Desmarais et al., 2019; Kenny et al., 2006). Using dyadic frameworks is an innovative conceptual and methodological approach that can account for both the interrelatedness and the bi-directional influences of two persons (Kashy & Kenny, 2000). Adding a partner perspective can give greater fidelity to the individual data by providing a genuinely interpersonal, ecologically valid context of health cognitions and behavior (Kashy & Kenny, 2000; Sadler et al., 2011; Sadler & Woody, 2003). Until now, however, no research has examined women's reproductive health behavior using dyadic health psychology models.

Dyadic reproductive health behavior: Women's interrelatedness

Considering that women's decisions affecting their reproductive health are seldom made in isolation (Benyamini et al., 2009; Hirani, 2015; Kumar et al., 2016; Mumtaz & Salway, 2007; Raman et al., 2014; Tomberge, Shrestha, et al., 2021; Yount, 2002), dyadic approaches in this context might be of particular relevance. Women are influenced by the practices and expectations of their social environment: their family, peers, and communities (Benyamini et al., 2009; Hirani, 2015; Kumar et al., 2016; R. Lee et al., 2013; Mumtaz & Salway, 2007; O'Connell et al., 2021; Plourde et al., 2017; Raman et al., 2014; Sapkota et al., 2014; Tomberge, Shrestha, et al., 2021; Yount, 2002).

One central social source of influence and support in the realm of reproductive health are women's social relationships with other women (Mumtaz & Salway, 2007; Raman et al., 2014). Women-to-women bonds such as mother–daughter dyads, sisters, and female peers can offer a low-threshold, safe space in which to exchange personal experiences, advice, and expectations; they thus serve as a key social resource for women's assertion of individual agency and autonomy in accessing reproductive health (Hirani, 2015; R. Lee et al., 2013; Mumtaz & Salway, 2007; O'Connell et al., 2021; Plourde et al., 2017; Raman et al., 2014; Sapkota et al., 2014; Tomberge, Shrestha, et al., 2021). For example, women have been

reported to exchange information and experiences on contraception methods and infertility care (O'Connell et al., 2021; Plourde et al., 2017). Furthermore, during pregnancy and the postpartum period, younger women base their own maternal behavior on female relatives' accounts and advice (Mumtaz & Salway, 2007; Pun et al., 2016; Raman et al., 2014; Sapkota et al., 2014; Tomberge, Shrestha, et al., 2021). Particularly in the Global South, female family members' were found to interrelate in many cognitions and behaviors related to reproductive health, including age at marriage and first sexual intercourse, desired family size, workload during pregnancy and postpartum, and circumcision status (Kumar et al., 2016; Pun et al., 2016; Tomberge, Shrestha, et al., 2021; Vladimirova & Amudzhiyan, 2020; Yount, 2002).

Daughter- and mother-in-law dyads in the Global South

In many South Asian cultures, for example Nepal, one female dyad has been described as of particular relevance to reproductive health: daughters-in-law and their mothers-in-law. At least 30% of South Asian women move in with their mother-in-law after getting married (Bietsch et al., 2021). Daughters- and mothers-in-law typically live and work together in proximity with clear areas of responsibility (Allendorf, 2017). Former research has shown that particularly during pregnancy and postpartum, the mother-in-law is an important to provide support but can also be a source of stress. For instance, the mother-in-law can decide the daughter-in-law's workload during pregnancy by allocating tasks to other family members (Raman et al., 2014; Tomberge, Shrestha, et al., 2021).

However, harmful and discriminatory social norms or cultural ideologies and beliefs may cause women to pressure younger female relatives to risky behaviors such as undergoing female genital cutting, having many children, and working very hard (Kumar et al., 2016; Pun et al., 2016; Tomberge, Shrestha, et al., 2021; Yount, 2002). Conversely, increasing education and disapproval of health-harming practices in the younger generation can also be transmitted to older family members (Allendorf, 2017; Kumar et al., 2016; Yount, 2002), and thus the daughter-in-law's increased risk perception may influence her mother-in-law's cognitions on reproductive health behaviors, possibly facilitating a change in family norms towards healthy behaviors.

The quality of the relationship can be a moderating factor that explains whether a relationship is characterized by support or pressure (Howland et al., 2016). For example, tentative evidence from India has shown that women who experience high-quality relationships with their mothers-in-law often receive their support, whereas women in relationships characterized by hurtful exchanges and periods of not speaking receive less support (Allendorf, 2017). In conclusion, consistent with research on other social relationships, women-to-

women bonds can both support and impede health behavior (Hohl et al., 2018, 2019; Raman et al., 2014). However, research on this interrelatedness in reproductive health is sparse.

The present study

Since no study has used dyadic health psychology methods in a low resource setting or in mother-and daughter dyads, basic research in this field is needed to understand whether there is a correlation of health cognitions and behavior of women and their female partners in this setting. This study is the first to examine women's reproductive health behavior and related cognitions in intergenerational female dyads using a dyadic version of the HAPA model and thus including a social perspective often neglected in health behavior models. As an example, we focus on a low-resource setting in which social influence on women's reproductive health behavior has been shown to be particularly pronounced (Allendorf, 2017; Earth & Sthapit, 2002; Raman et al., 2014; Regmi, 2007; Sapkota et al., 2014; Sieverding, 2001; Simkhada et al., 2010; Tomberge, Shrestha, et al., 2021). We selected Nepal, a country where UNFPA (2011) estimated a maternal mortality ratio of 380 per 100,000 pregnancies. Further, every 10th woman in Nepal has pelvic organ prolapse (pelvic organs' descent into or out of the vagina, Jelovsek et al., 2007), which has been partly attributed to physically demanding work such as carrying heavy agricultural items and water during pregnancy and postpartum (Earth & Sthapit, 2002; Gunasekera et al., 2007; Meierhofer et al., 2022). Carrying heavy loads, falls within the daily routine of many women in the Global South (Geere & Cortobius, 2017). For example, 25% of households worldwide, usually women, collect heavy water containers from sources off-premises (World Health Organization & UNICEF, 2017). Decisions on whether a woman carries heavy loads of water during pregnancy and postpartum as well, similarly to many other reproductive health behaviors, are made in accordance with women's family members, often their mothers-in-law (Allendorf, 2017; Pun et al., 2016; Raman et al., 2014; Sapkota et al., 2014; Simkhada et al., 2010; Tomberge, Shrestha, et al., 2021).

The present study aims to extend previous research by examining the dyadic influences of the intentions and behaviors of daughters- and mothers–in-laws about reproductive health with the example of avoiding carrying heavy loads of water during pregnancy and postpartum. Working from previous dyadic health behavior research (Berli et al., 2018; Howland et al., 2016), we asked how daughters- and mothers-in-law's cognitions relate to their own and their dyadic partner's behavioral intentions over and above their own cognitions (see Figure 6, Model 1). We further aimed to identify how daughters- and mothers-in-law's cognitions relate to the daughter-in-law's behavior (see Figure 6, Model 2). Considering that the

mother-in-law was often beyond reproductive age, we only investigated the intentions, but not the behavioral effects, of the daughter-in-law's cognitions on her mother-in-law.

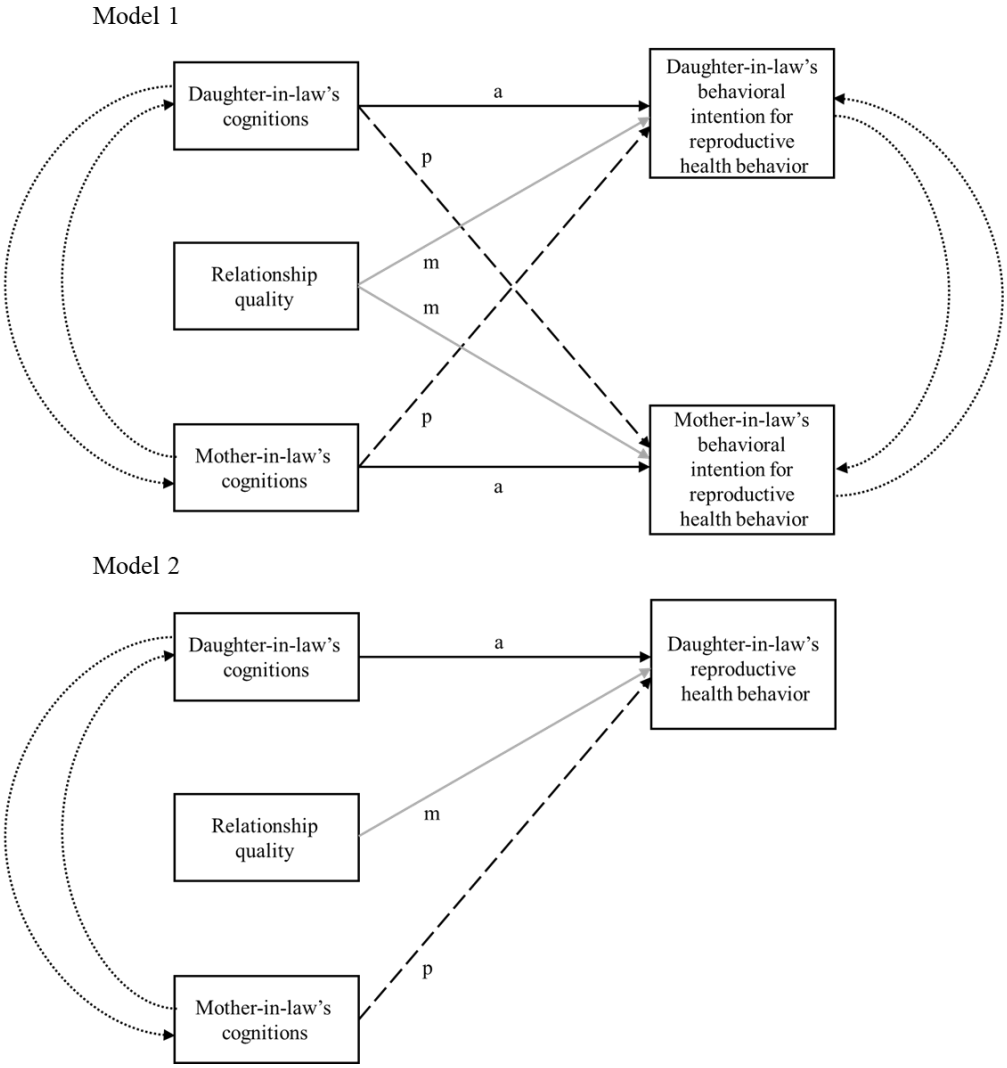
As summarized in Figure 6, we hypothesized that (H1) daughters- and mothers-in-law's cognitions and behaviors correlate about avoiding carrying heavy loads of water during pregnancy and postpartum. We further hypothesized that (H2) a woman's own cognitions, of risk perception, outcome expectancies, self-efficacy, and injunctive and descriptive norms are positively associated with behavioral intention to avoid carrying loads during pregnancy and postpartum (Figure 6, Model 1). Additionally, we hypothesized that (H3) the daughter-in-law's own self-efficacy, injunctive and descriptive norms, and action and coping planning are positively associated with her behavior to avoid carrying loads during pregnancy and postpartum (Figure 6, Model 2). These intrapersonal paths, which we term *actor effects*, are depicted as solid lines in Figure 6. Due to the dyadic nature of our analyses, these paths are statistically adjusted for the woman's dyadic partner's scores on the same cognitions: we control the daughter-in-law's cognitions for the mother-in-law's cognitions and vice versa.

We further investigate what we term *partner effects* (Figure 6, dashed lines); we hypothesize that the woman's dyadic partner's cognitions relate positively to their own intentions (H2 partner) and behaviors (H3 partner) in avoiding carrying loads during pregnancy and postpartum. To investigate whether the mother-in-law's cognitions relate to the daughter-in-law's intentions in a different way than the daughter-in-law's cognitions to the mother-in-law's intentions, for hypothesis H2, we explore family role as a moderator. Note that for behavior (H3), we investigate only daughter-in-law's behavior because mothers-in-law are mostly beyond reproductive age.

Given the importance of relationship quality to dyadic influences on health behavior (Allendorf, 2017; Howland et al., 2016), we further explore how the quality of the relationship between the two women can moderate the actor and partner effects, such that the intention and behavior in lower-quality relationships were more strongly influenced by the dyadic partners'. However, studies on relationship quality and reproductive health are rare in this context, so we cannot postulate the direction of this relationship.

Figure 6

Hypothesized actor and partner effects in reproductive health intentions and behavior and moderator effects of relationship quality



Note: Model 1 depicts two dyad members, daughter-in-law and mother-in-law, within the actor–partner interdependence framework of the health action process approach (HAPA), with the cognitions (risk perception, outcome expectancies, self-efficacy, injunctive norm, descriptive norm to avoid carrying during pregnancy and postpartum) of each member as predictors and maternal behavioral intentions of each member as outcomes (avoiding carrying during pregnancy and postpartum, Hypothesis 2). Model 2 also uses a dyadic version of the HAPA model, including both members' cognitions (self-efficacy, injunctive norm, descriptive norm, action planning, coping planning) but looking at daughters-in-law's maternal behavior as an outcome only (Hypothesis 3). This is because, in our example, mothers-in-law are typically beyond reproductive age, and this health behavior is therefore not relevant for mothers-in-law. Actors' cognitions (actor effects, black solid lines) and their dyadic partner's cognitions (partner effects, dashed lines) associate with their reproductive health behavioral intentions (Model 1 upper part of the figure), and daughters-in-law's behavior (Model 2 lower part of the figure) and the moderation by relationship quality (moderator, grey solid line) are visualized. Dotted lines represent the interrelatedness of cognitions.

Methods

This dyadic cross-sectional survey of daughters- and mothers-in-law was part of a larger study conducted from September to November 2019 in the hilly regions of five rural communities of Bagmati province whose health centers were affiliated to the Kathmandu University Hospital. The overall study investigated individual predictors and consequences of women's water-carrying practices in daily life (Meierhofer et al., 2022; Tomberge, Shrestha, et al., 2021; Tomberge et al., 2022). Ethical clearance was given by the Ethical Review Committee of the Nepal Health Research Council [514/2021] and the Ethical Board of the University of Bern, Switzerland [2021-10-00005].

Participants and procedures

A random sample of women was selected with the random route method (Hoffmeyer-Zlotnik, 2003): Four teams of trained local research assistants started from the local health center in different directions and randomly approached one in two or three households, depending on number of households in the compound. Selection criteria were being 16 to 50 years old, residing permanently in the community, and being involved in water carrying. Whenever a mother-in-law was available in the compound and willing to participate, she was included as a dyadic counterpart of their daughter-in-law. This resulted in 238 dyads (N = 476: 238 daughters-in-law and 238 mothers-in-law). All participants provided written informed consent or fingerprint, before the research assistants interviewed both women separately in computer-assisted structured face-to-face interviews.

Measures

The structured questionnaire included questions on women's cognitions and behaviors related to reproductive health. All items were carefully adapted to the local context and had been translated from English to Nepali and back-translated. All items were discussed with the local research assistants in a one-week training program and pretested in mock sessions between team members and in two villages not part of the analyses. Psychological constructs were assessed using unipolar 5-point Likert scales supported by a visual 5-dot scale (Harter et al., 2020), which had previously been used in this and other low-resource populations. The items measuring a construct were averaged and recoded into a range from 0 to 1. Please consult Table 6 for example items, descriptive statistics, and internal consistencies. Consult Table S1 in the supplementary materials for all items used.

As an example of a contextually relevant reproductive health behavior, we asked participants about a physically demanding everyday task (Geere, Bartram, et al., 2018): carrying water containers with an average weight of 20 kg during pregnancy and postpartum (Earth &

Sthapit, 2002; Regmi, 2007; Tomberge, Bischof, et al., 2021; Tomberge, Shrestha, et al., 2021). We used a self-report behavior index to measure water-carrying frequency in one week during pregnancy and three months postpartum, referring to the previous pregnancy with answer options 1 = carrying no days to 5 = carrying every day. The answers were then reverse- to measure the protective reproductive health behavior of avoiding carrying during pregnancy and postpartum.

We measured the psychosocial cognitions about avoiding carrying water during a prospective pregnancy and postpartum from the mothers-in-law's and daughters-in-law's perspectives with the HAPA constructs by Schwarzer (Schwarzer, 2008). For instance, for behavioral intention, the participant was asked: "How strongly do you intend to always avoid water carrying during and after pregnancy?" and answered between 1 = "intend not at all" and 5 = "intend very much." Triangulation with qualitative data has been described in detail elsewhere and provided high convergent validity (Tomberge, Shrestha, et al., 2021). Since many mothers-in-law were beyond reproductive age we asked their intention to carry water during a hypothetical future pregnancy. Relationship quality was measured as a moderator with the Perceived Relationship Quality Components inventory (Fletcher et al., 2000) from the perspective of the actor: for instance, "How much do your trust your mother-in-law [daughter-in-law], 1 = "do not trust at all" to 5 "trust very much".

Data analysis

To examine the interrelatedness of daughters- and mothers-in-law's cognitions and behavior, we calculated within-couple correlations (intraclass correlations: ICC) for behavioral intention and behavior as well as for all other HAPA predictors related to avoiding carrying water during pregnancy and postpartum (Berli et al., 2018). See Table 6. To test our hypotheses, we computed two models (see Figure 6).

Behavioral intention (Model 1)

Given the dyadic interdependence of daughters- and mothers-in-law in behavioral intention, we used the actor–partner interdependence model (APIM) (Kashy & Kenny, 2000) to analyze the data for model 1. To investigate the actor effects of the woman's cognitions and the partner effects of her dyadic partner's cognitions on behavioral intention, we followed established approaches for testing dyadic health behavior models that have successfully used the APIM to analyze dyads (Berli et al., 2018; Howland et al., 2016). In the APIM, the dyad is treated as the unit of analysis. Our covariance structure assumes that within the dyad, the two members' observations are equally correlated, but there are no correlations between members of different dyads (Kenny et al., 2006). First (Model 1a), we included actors' and

partners' risk perception, self-efficacy, outcome expectancies, and descriptive and injunctive norms as independent variables to model their links with the behavioral intention to avoid carrying water during pregnancy and postpartum (dependent variable).

Second (Model 1b), we included family role as a moderator, coded 0 for daughter-in-law and 1 for mother-in-law. This allowed us to estimate actor and partner effects separately for daughters- and mothers-in-law (distinguishable dyads). This approach is analogous to dyadic studies of heterosexual couples, where gender is used as a moderator to distinguish the dyadic partners (Howland et al., 2016).

Third (Model 1c), given the importance of relationship quality in dyadic influences on health behavior (Allendorf, 2017; Howland et al., 2016), we included relationship quality to investigate whether this can moderate the impact of a partner's influence on the actor's behavioral intentions. We investigated significant interactions further by analyzing simple slopes (*M* +- 1 *SD*).

Behavior (Model 2)

We tested a dyadic model to explain the daughter-in-law's behavior. This model did not include the interrelationship between her and her mother-in-law's behavior, because mothers-in-law's previous pregnancy most likely occurred when the daughter-in-law was not yet present. Bidirectional interdependence, which is a central component of the APIM (Kashy & Kenny, 2000; Kenny et al., 2006), is therefore not provided for behavior. Thus, actor effects and partner effects were only investigated for the daughter's behavior using multiple linear regressions.

We included the daughter-in-law's actor cognitions and the mother-in-law's partner cognitions as independent variables (Model 2a): self-efficacy, action planning, coping planning, and descriptive and injunctive norms for avoiding carrying water during pregnancy and postpartum. The dependent variable was the daughter-in-law's behavior, frequency of avoiding carrying water during pregnancy and postpartum. We further tested the moderating effects of relationship quality (Model 2b): whether the degree of mother-in-law's influence on daughter-in-law's behavior differed in dyads with lower or higher relationship quality.

The models were computed using SPSS software (version 21), modifying a syntax by Howland et al. (Howland et al., 2016; Kenny et al., 2006) that uses cross-sectional dyadic data to study interpersonal influence processes that occur within relationships. A sample of the syntax can be found in the supplementary material (S2). Simple slopes for interactions were calculated in R using the interaction package (Long, 2021).

Table 6

Example items and descriptive statistics

Concept	Example items		Daughter-in-law		Mother-in-law			
		Cronbach's alpha	*M*	*SD*	*M*	*SD*	ICC (*M*)	ICC (Min-Max)
Avoid carrying pregnancy/ postpartum	How often in one week did you carry water during pregnancy? / in the three months after delivery? 0 = every day to 1 = no days	0.79 , 2 items	0.48	0.37	0.04	0.14	0.04	-0.24 -0.24
Risk perception	Compared to other women with the same age, how much higher or lower are your chances of getting uterine prolapse? 0 = lower to 1 = higher[1]	1 item	0.72	0.31	0.60	0.38	0.31**	0.10-0.46
Outcome expectancies	I would prevent uterine prolapse if I avoided water carrying during pregnancy 0=agree not at all to 1 = agree very much	0.88, 2 items	0.82	0.22	0.65	0.33	0.16	-0.09–0.35
Self-efficacy	How sure are you that you can always avoid to carry your water during and after pregnancy even if it might be difficult for your household to have enough water?[1]	0.85, 3 items	0.46	0.32	0.19	0.25	0.26**	0.05 -0.43
Behavioral intention	How strongly do you intend to always avoid water carrying during and after pregnancy? [1]	0.85, 2 items	0.67	0.27	0.34	0.28	0.20*	-0.04-0.38
Action planning	Can you tell me what you can do to avoid carrying water during and after pregnancy? 1 = Ask for help; Carry less water; Tell other people I don't want to carry water; Buy water; other specific plan; 0 = No plan	1 item	0.90	0.30	0.54	0.50	0.25*	0.03-0.42
Coping planning	How can you overcome difficulties that prevent you from avoiding to carry water during and after pregnancy? 1= Ask someone for help; Tell that I do not want to carry water; other specific coping plan; 0 = No plan	1 item	0.50	0.50	0.26	0.44	-0.27	-0.64-0.02
Injunctive norm	How much would people who are important to you approve if you carry water during and after pregnancy [for mother-in-law: how much would they have approved if you had carried during your pregnancy]? [1]	0.69, 3 items	0.60	0.23	0.32	0.24	0.16	-0.08-0.35
Descriptive norm	How many women in your community carry water during and after pregnancy? 0 = Almost nobody (0%) to 1 = almost all of them (100%)[2]	1 item	0.57	0.26	0.64	0.26	-0.01	-0.31-0.21
Relationship quality	How much do you trust your mother-in-law / daughter-in-law? [1]	0.94, 7 items	0.67	0.22	0.70	0.25	0.35***	0.21-0.45

Note. N = 476, *M* = Mean, *SD* = standard deviation, Min, Max = minimum and maximum of the within-couple correlation (ICC). All items used a 5-point Likert scale and were recoded to a range between 0 and 1; [1]*0 = not at all,* 0.25 = *somewhat* 0.5 = *rather* 0.75 = *quite 1 = very much.*

Results

For daughters-in-law, avoiding carrying water during pregnancy and postpartum was around the midscale (M = 0.48, SD = 0.37), and intention to avoid carrying was moderate to high (M = 0.67, SD = 0.27). In contrast, mothers-in-law reported having carried almost every day (M = 0.04, SD = 0.14), and their intention to avoid was low to moderate (M = 0.34, SD = 0.28). See Table 6 for all descriptive statistics, internal consistencies, and within-couple correlations.

Supporting our H1, the dyads correlated significantly in behavioral intention. However, they did not correlate significantly in behavior. However, as shown in Table 6, the range of within-couple correlations was high. Regarding the HAPA predictors of intention and behavior, within-couple correlation between daughters- and mothers-in-law's risk perception, self-efficacy, and action planning were significant. For outcome expectancies, coping planning, and injunctive and descriptive norms, we did not find significant correlation but very broad ranges of within-couple correlations.

Intention to avoid carrying during pregnancy and postpartum

Our second hypothesis investigating women's intention was also supported for the effect of some of women's cognitions (H2, actor effects) and some of the women's dyadic partner's cognitions (H2, partner effects). As shown in Table 7 (Model 1a), the higher the woman's self-efficacy and injunctive norm, the higher was her behavioral intention to avoid carrying during pregnancy and postpartum (actor effects), independent of partner's social cognitions. The main effect of partner's self-efficacy indicates that partner's self-efficacy negatively related to behavioral intention. Additionally, we found a positive synergistic actor–partner interaction effect for self-efficacy (Figure 7, Table 7, Model 1a). Simple slope analysis indicated that higher partner's self-efficacy related to lesser behavioral intention when the actor's self-efficacy was below average (M – 1 SD) (B = −0.21, p < 0.001), or average (B = −0.11, p < 0.001) but had no impact when actors had high self-efficacy (B = -0.02, p = 0.770). Conversely, the relationship of actor's self-efficacy and behavioral intention was highest when partner's self-efficacy was also high (low partner self-efficacy: B = 0.44, p < 0.001, average partner self-efficacy: B = 0.53, p < 0.001, high partner self-efficacy: B = 0.63, p < 0.001).

Table 7

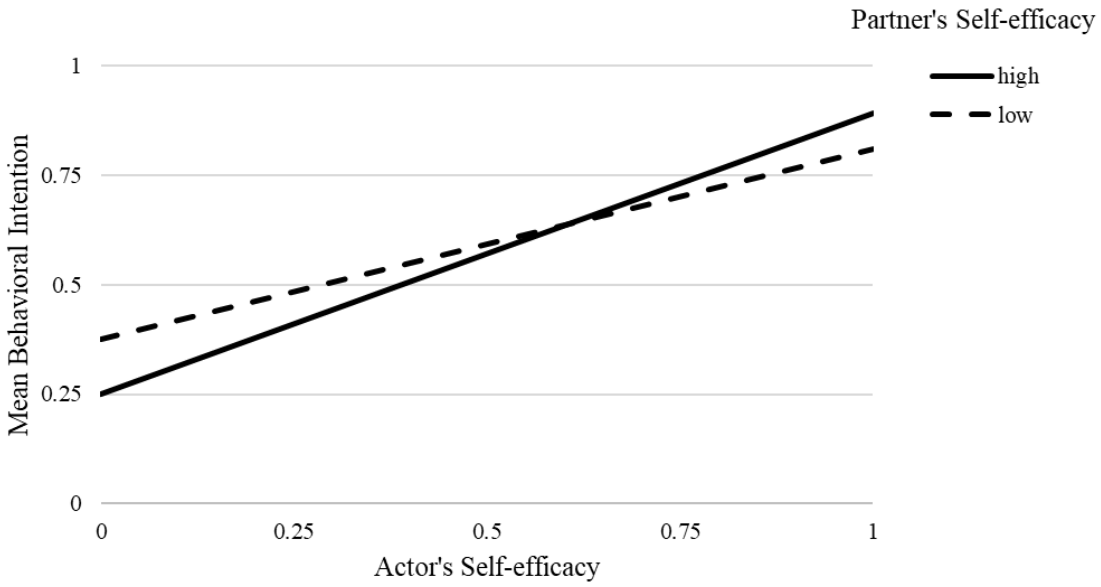
Generalized linear mixed models of daughter- and mother-in law's intention of carrying during pregnancy and postpartum within a dyadic version of the health action process approach

Parameter	Model 1a Estimate (SE)
Intercept	0.16 (0.13)
Actor effects	
Actor_risk perception	0.01 (0.08)
Actor outcome expectancies	0.11 (0.12)
Actor self-efficacy	0.13 (0.07)*
Actor injunctive norm	0.40 (0.10)***
Actor descriptive norm	-0.02 (0.12)
Parter effects	
Partner risk perception	-0.08 (0.08)
Partner outcome expectancies	-0.01 (0.12)
Partner self-efficacy	-0.20 (0.07)**
Partner injunctive norm	0.04 (0.10)
Partner descriptive norm	0.11 (0.12)
Actor Partner Interactions	
Actor risk perception*Partner risk perception	0.09 (0.10)
Actor outcome expectancies*Partner outcome expectancies	0.08 (0.15)
Actor self-efficacy*Partner self-efficacy	0.40 (0.13)**
Actor injunctive norm*Partner injunctive norm	-0.11 (0.17)
Actor descriptive norm*Partner descriptive norm	-0.09 (0.18)

Note. Outcome: actor's behavioral intention to avoid carrying loads of water during pregnancy and postpartum. *$p < .05$, **$p \leq 0.01$, ***$p \leq 0.001$. Model 1b (moderation by family role) and Model 1c (moderation by relationship quality) are not displayed here but can be found in detail in the supplementary material Table S3 and S4.

Figure 7

Interaction effect of actor's and partner's self-efficacy on behavioral intention to avoid carrying loads during pregnancy and postpartum

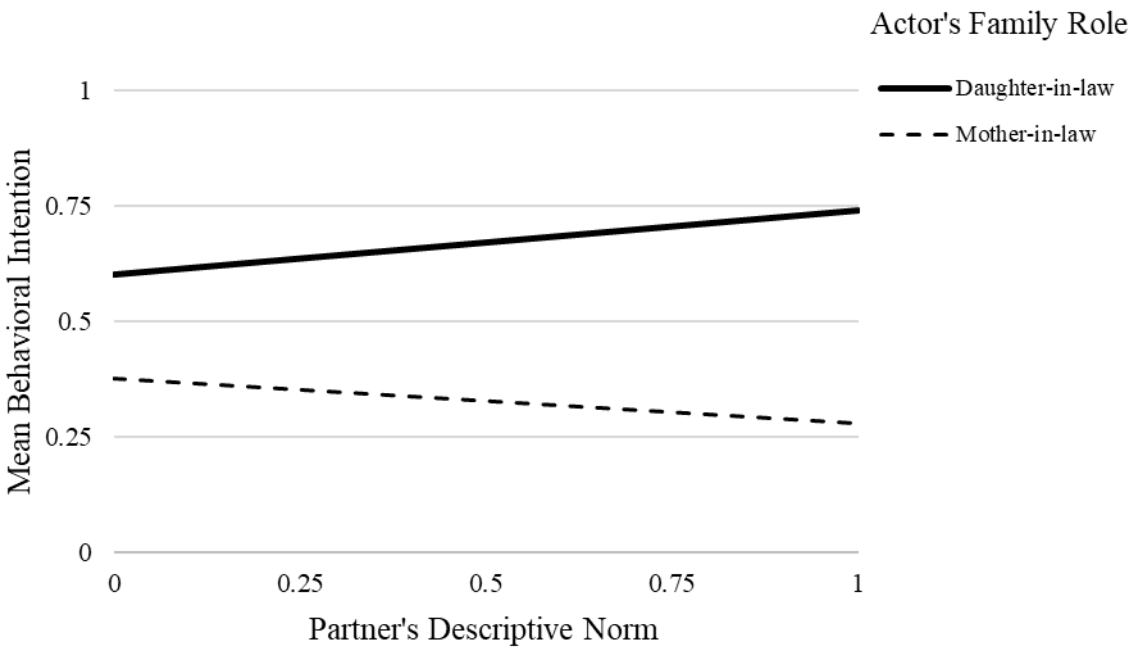


Note. High / low designations reflect one +/- 1 standard deviation from the mean. A graph with observation points can be found in the supplementary material (Figure S1).

When looking at moderation by family role (Model 1b), we found differing effects for daughter-in-law and mother-in-law in actor and partner effects (see Table S3). Regarding actor effects, the relationship between outcome expectations and intention was significantly less for mothers-in-law than for daughters-in-law (*Estimate* [*SE*] = -0.22 [0.11], $p = 0.041$), although for both dyadic partners, outcome expectations related positively to intention (mothers-in-law: $B = 0.21$, $p < 0.001$; daughters-in-law: $B = 0.39$, $p < 0.001$). Regarding role differences in partner effects, the mother-in-law's descriptive norm related significantly to her daughter-in-law's higher intention (slopes: $B = 0.16$, $p = 0.02$, see Figure 8) whereas the daughter-in-law's descriptive norm was not linked to her mother-in-law's intention (slopes: $B = -0.04$, $p = 0.500$; interaction: *Estimate* [*SE*] = -0.18[0.09], $p = 0.036$)

Figure 8

Moderation effects of the actor's family role and partner's descriptive norm on actor's behavioral intention to avoid carrying loads during pregnancy and postpartum



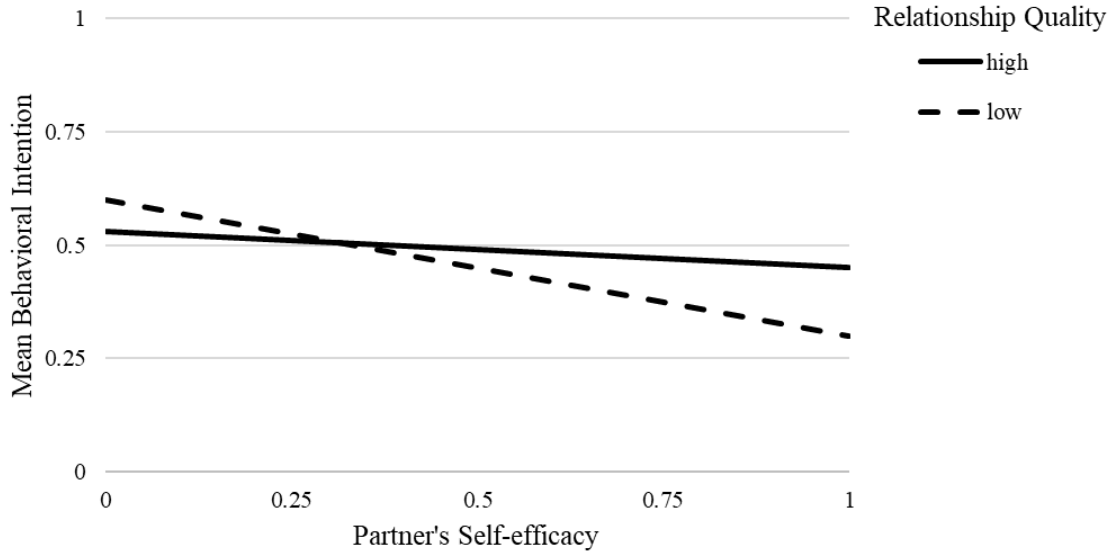
Note. High / low designations reflect one +/- 1 standard deviation from the mean. Graphs with observation points can be found in the supplementary material (Figure S2).

As another exploratory analysis we looked at relationship quality as a moderator and found one significant result: Relationship quality moderated the association of partner's self-efficacy with behavioral intention (Table S4, Model 1c, *Estimate* [*SE*] = 0.53[0.23], p = 0.020). The effect that the partner's self-efficacy reduced the actor's intention came into play only when the relationship quality was below average (M – 1 *SD*) (B = −0.22, $p < 0.001$) or average (B = −0.15, $p < 0.001$) but had no impact when the women's relationship was characterized by high quality (B = -0.09, p = 0.180; see Figure 9). Relationship quality did not moderate any of the other associations of cognitions on behavioral intention. Summarizing our hypothesis 2 that assessed actor's and partner's cognitions related to behavioral intention to avoid carrying, daughter-in-law's own increased self-efficacy and injunctive norms and their mother-in-law's lower self-efficacy and higher descriptive norm related to the daughter-in-law's higher behavioral intention. A Mother-in-law's own increased self-efficacy and injunctive norms and her daughter-in-law's lower self-efficacy related to mother-in-law's increased

behavioral intention. Moderation effects revealed that partner's self-efficacy had no negative impact when actor's self-efficacy was high and the relationship characterized by high quality.

Figure 9

Moderation effects of relationship quality on the role of partner's self-efficacy in actor's behavioral intention to avoid carrying loads during pregnancy and postpartum



Note. High / low designations reflect one +/- 1 standard deviation from the mean. A graph with observation points can be found in the supplementary material (Figure S3).

Behavior related to avoiding carrying during pregnancy and postpartum

Our third hypothesis investigating daughters-in-law's behavior was also supported for the effect of certain of their own cognitions (H3) and certain cognitions of their mothers-in-law (H3 partner) (see Table 8 and Table S5, Model 2a). Actor effects showed that the higher the daughter-in-law's self-efficacy and behavioral intention to avoid carrying, the less she carried during pregnancy and postpartum. Regarding partner effects, the higher the mother-in-law's self-efficacy to avoid carrying, the less her daughter-in-law carried during pregnancy and postpartum. However, when the mother-in-law reported a higher injunctive norm to avoid carrying during her pregnancy, the daughter-in-law carried more. For hypothesis H3, we explored relationship quality as a moderator as well: Relationship quality did not moderate any of the associations of cognitions on carrying behavior (see Table S5, Model 2b). Summarizing our results for the third hypothesis, daughters-in-law's own increased self-efficacy and behavioral intention and their mothers-in-law's higher self-efficacy and lower

injunctive norms related to daughters-in-law's lesser carrying during pregnancy and postpartum. We did not find any moderating effects of relationship quality.

Table 8

Results related to daughter- in-law's behavior of carrying during pregnancy and postpartum within a dyadic version of the health action process approach

Parameter	Model 2a Estimate (SE)
Intercept	0.12 (0.11)
Actor effects	
Actor self-efficacy	0.36 (0.09)***
Actor behavioral intention	0.29 (0.09)**
Actor injunctive norm	0.06 (0.12)
Actor descriptive norm	-0.03 (0.08)
Actor action planning	0.02 (0.08)
Actor coping planning	-0.03 (0.04)
Partner effects	
Partner self-efficacy	0.31 (0.12)**
Partner behavioral intention	-0.16 (0.09)
Partner injunctive norm	-0.30 (0.12)*
Partner descriptive norm	0.05 (0.09)
Partner action planning	0.05 (0.05)
Partner coping planning	-0.07 (0.05)

Note. Outcome: Daughters-in-law's behavior: Avoid carrying loads of water during pregnancy and postpartum. *$p < 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$. Model 2b (moderation by relationship) was not significant for any of the effects and is not displayed here but can be found in detail in the supplementary material Table S5.

Discussion

This is the first dyadic investigation of how women's reproductive health cognitions and behavior interrelate. We studied this using a dyadic version of an extended HAPA model with the carrying of heavy loads during pregnancy and postpartum by Nepali daughters-in-law and their mothers-in-law as an example. The main findings are that mothers-in-law and daughters-in-law are similar in their behavioral intentions but can greatly vary in their behavior towards carrying during pregnancy and postpartum, which partly supports our hypothesis H1. Results for our hypotheses H2 (behavioral intention) and H3 (behavior) show that partner cognitions can relate both positively and negatively to both intentions and behavior. The mother-in-law's self-efficacy, injunctive and descriptive norm related to her daughter-in-law's intentions and behavior over and above her own self-efficacy, intention, and injunctive norm. Similarly, the daughter-in-law's self-efficacy and injunctive norm related to the mother-in-law's behavioral intentions towards avoiding to carry during pregnancy and postpartum. Finally, relationship quality moderated the association of partner's self-efficacy and behavioral intention to avoid carrying, but no other associations.

How similar are Nepali daughters- and mothers-in-law in their cognitions and behavior related to reproductive health?

Consistent with previous research, at least half of the daughters-in-law and almost all mothers-in-law in rural areas of Nepal indicated risk behavior by carrying water during pregnancy and postpartum (Earth & Sthapit, 2002; Geere, Bartram, et al., 2018). In contrast with dyadic health behavior change research in romantic couples (Berli et al., 2018), we found no within-couple correlation in reproductive health behavior. One explanation may be a ceiling effect in mothers-in-law's behavior, because most of them reported having carried heavy loads during pregnancy and postpartum, whereas daughters-in-law's behavior was more varied. This may mark an intergenerational change towards healthier reproductive health behavior (Allendorf, 2017; Pun et al., 2016; S. Thapa et al., 2019; Yount, 2002).

Significant within-couple correlations were found for social cognitions about reproductive health behavior, indicating that family members have similar risk perception, self-efficacy, and action planning for reproductive health behavior. This supports our hypothesis that the dyad members may influence each other's health-related cognitions.

Furthermore, different patterns of interrelatedness were found between dyads. Some dyads covaried highly and positively in their behavior during the previous pregnancy (Berli et al., 2018), whereas other dyads covaried in the opposite manner: the more the mother-in-law carried during her pregnancy, the less the daughter-in-law carried during her pregnancy.

Similarly, and confirming previous dyadic studies, the interrelatedness of women's social cognitions, measured as intention, outcome expectations, coping planning, and injunctive and descriptive norms, varied strongly between dyads, ranging from strongly positively related couple patterns to patterns that covaried contrariwise (Berli et al., 2018; Kenny & Ledermann, 2010; Ledermann et al., 2017). Further research is needed to investigate these differences by incorporating other moderators, i.e. health impacts by one of the women that may affect the other woman's cognitions (Humpel et al., 2007; Pun et al., 2016).

How are a woman's and her dyadic female partner's cognitions, intentions and behavior related to reproductive health interrelated?

The results of the dyadic analysis indicated that over and above the actor's cognitions, the dyadic partner's cognitions were linked to the woman's behavioral intention and reproductive health behavior. Consistent with previous research (Hohl et al., 2018, 2019; Raman et al., 2014; Tomberge, Shrestha, et al., 2021), this relationship can be both positive (i.e. the mother-in-law's confidence to avoid carrying may spill over to the daughter-in-law), and negative (i.e. the mother-in-law may expect her daughter-in-law to carry loads because she also did during pregnancy).

A particular importance was found not only in actor's but also in partner's self-efficacy. Higher partner's self-efficacy to avoid carrying was related to the actor's lower behavioral intention to avoid carrying during pregnancy and postpartum. Potentially explaining the effect of partner self-efficacy, the simple slopes for actor–partner interactions revealed that partner's self-efficacy predominantly had a negative effect when the actor's self-efficacy was low. A healthy behavioral intention towards avoiding to carry loads was strongest when both the own self-efficacy and the partner's self-efficacy were high. Regarding behavior, the mother-in-law's self-efficacy resulted important in supporting her daughter-in-law in engaging in lesser carrying behavior during pregnancy and postpartum.

The importance of self-efficacy for behavior change and persistence has been discussed in health psychology research and practice over decades and its relevance for low-resource populations has been frequently emphasized (Bailis et al., 2001; Bandura, 1977; Murray et al., 2012; Schwarzer, 2016). Health behavior theories suggest that self-efficacious women are likely to respond confidently with strategies to avoid carrying loads and overcome barriers such as lack of household water infrastructure or gender-specific expectations towards carrying loads (Benight & Bandura, 2004; Earth & Sthapit, 2002; Pun et al., 2016; Tomberge, Shrestha, et al., 2021). In the same way that self-efficacious individuals feel a higher capability to cope with barriers themselves, they are more likely to take action and

provide assistance to others, for instance by providing social support (Silver et al., 1990). However, as supported by the finding that mother-in-law's self-efficacy can negatively relate to daughter-in-law's behavioral intention, social partners' positive cognitions towards protective health behaviors can also negatively impact women's self-efficacy and motivation to change (Hohl et al., 2018). This may be the case when social partners apply social pressure to change (Hohl et al., 2018).

Including relationship quality as a moderator in our analyses gave more detailed information on these contradictory effects of partner self-efficacy: the moderator revealed that the effect of partner's high self-efficacy on actor's low behavioral intention was predominantly observed for lower-quality relationships. The booster effect of partner's self-efficacy on actors who had high self-efficacy was found predominantly in higher-quality relationships. This is in line with former research indicating that partner's social support enables women by promoting their self-efficacy and motivates them to engage in healthy behavior most in high-quality relationships. In contrast, low-quality relationships may be characterized by social control that weakens self-efficacy and motivation to engage in healthy behavior (Allendorf, 2017; Hohl et al., 2018, 2019; Raman et al., 2014; Tomberge, Shrestha, et al., 2021). These results suggest that interventions aimed to promote safe carrying practices should promote both dyads member's self-efficacy simultaneously. Bandura's sources of self-efficacy (Bandura, 1977), verbal persuasion of capability, focus on past success, and model learning such as other women practicing reproductive health behavior, are promising for increasing the self-efficacy of dyad members and might thus bring out the positive side of social influence (Bandura, 1977; L. E. Connell et al., 2019; Michie et al., 2013).

Another partner effect was found for social norm, the mothers-in-law's higher descriptive norm related to daughters-in-law's higher behavioral intention towards lesser carrying during pregnancy and postpartum. However, the mother-in-law's higher injunctive norm related to her daughter-in-law's more actual carrying behavior during pregnancy and postpartum. The relation of mother-in-law's social norm with women's intention and behavior further confirms the assumed importance of the social context for women's reproductive health behavior. Women in low-resource settings may conform to the perceived authoritative injunctive norm and align their behaviors with expectations, for instance to avoid feeling rejected by their social group (Bute & Jensen, 2010; Prentice & Miller, 1993). However, in our study, the partners' injunctive norms were associated with directly opposite behavior. To understand this result, further investigation is needed of underlying mechanisms such as mediators. One explanation might be that when the mother-in-law had experienced disapproval of resting

behavior from her family when she had been pregnant, she might rather support her daughter-in-law rather than to replicate this experience of disapproval. However, these are just first speculations that would benefit from qualitative examinations of our result.

The large variability that we found in within-dyad correlations, requires further consideration of the fact that partner effects are not equal across dyads (Berli et al., 2018). Future studies may systematically investigate these patterns of heterogeneity.

Strengths, limitations and future directions

This study provides quantitative dyadic data on reproductive health behavior for a large, randomly selected sample from a rural Nepali population. It is the first study to test dyadic health psychology models in a non-WEIRD (western, educated, industrialized, rich and democratic) sample, and the first to examine in-laws' perspectives. Whereas studies with a focus on actor and partner perspectives tend to include romantic couples, or intergenerational relationships in the parental context (Joyal-Desmarais et al., 2019; M. A. Lewis & Rook, 1999), the fact that 12% of women worldwide, and 30%-50% of South Asian women, live with their in-laws (Bietsch et al., 2021; Huber et al., 2017) indicates necessity of filling this research gap.

One limitation may be the generalizability of the results. We focused on the specific reproductive health behavior of carrying heavy loads like water during pregnancy, which is particularly relevant for women in the Global South. Future studies should determine whether these findings are transferable to women from other cultural contexts and to other reproductive health behaviors.

Another limitation of the study is its cross-sectional design: No conclusions about the causality of relationships between actor and partner cognitions and behavior can be made. However, as this is the first dyadic study on women's reproductive health behavior in a low-resource setting, these results provide highly valuable evidence for the interrelatedness of women's health behavior in this context. This research goal is also in line with the original idea of the APIM was to investigate whether (and which), partners' cognitions are related to one's behavior (i.e., partner effect) in addition to one's personal cognitions (Ackermann et al., 2010). Now, based on our results, longitudinal studies and randomized controlled trials seem warranted to further investigate the directionality of these relationships.

Conclusion

Our results showed that women's reproductive health behaviors and cognitions can be interrelated; our findings thus indicate the importance of including a dyadic perspective for understanding and changing reproductive health behavior. From our results, we can more

specifically recommend targeting women's and their close female family members social norms and self-efficacy for decisions about their reproductive health. Self-efficacious families may be central for enabling women to overcome sociostructural barriers to sexual and reproductive health and rights (Hameed, 2019; World Health Organization, 2010).These hypotheses need to be verified in intervention-based randomized controlled trials.

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Ethical statement

The study was approved by the Ethical Review Committee of Nepal [Reg No. 517/2019] and the Ethical Board of the University of Bern, Switzerland [2019-10-00003]. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research commit-tee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent statement

All participants provided written informed consent prior to their interviews and observations. Potential study participants who could not sign their names were permitted to indicate consent with a thumbprint.

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Chapter V

Self-efficacy and social support enable women to take care of their pelvic floor health: A non-randomized controlled trial in rural Nepal

Vica Marie Jelena Tomberge *[1], Akina Shrestha [2], Helena Luginbuehl [3], Aastha Kasaju [1] , Chiara Scarnato [1], Regula Meierhofer [4], Jennifer Inauen [1]

*Corresponding author

[1] University of Bern, Institute of Psychology, Department of Health Psychology & Behavioral Medicine

[2] Kathmandu University School of Medical Sciences, Dhulikhel Hospital, Kathmandu

[3] Bern University of Applied Sciences, Department of Health Professions, Division of Physiotherapy

[4] Eawag - Swiss Federal Institute of Aquatic Science and Technology, Department of Sanitation, Water and Solid Waste for Development (Sandec)

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Abstract

Pelvic organ disorders affect one in three women worldwide. Carrying heavy loads such as water daily increases the risk of pelvic organ disorders, particularly in low-income countries. Low self-efficacy hampers adoption of pelvic-floor-protective behaviors. The enabling hypothesis suggests that social support may strengthen women's self-efficacy and support them in pelvic-floor-protective behaviors. We developed an intervention based on the enabling hypothesis to quasi-experimentally examine whether self-efficacy and social support promotion can enable women to protect their pelvic floor health in low-resource settings.

A three-arm parallel non-randomized controlled trial with 300 women and their social partners was conducted in rural Nepal. Three villages received either promotion of (1) self-efficacy (2) self-efficacy and social support, or (3) information only control. Intervention effects were calculated by repeated-measures analyses of covariance and planned contrasts. The co-primary outcomes were reduced weight carried and using protective lifting techniques at 2-month follow-up. Secondary outcomes included health outcomes.

On average, women in all conditions used 23–33% more protective lifting techniques ($\eta^2 = 0.50$), reduced weight carried by 3–6 kg ($\eta^2 = 0.20$), and showed decreased symptoms of pelvic organ disorders at follow-up ($\eta^2 = 0.10$). Self-efficacy promotion increased the use of protective lifting techniques 9% more than information only ($d = 0.28$). Weight was reduced by 3 kg more when additionally promoting social support compared to self-efficacy ($d = 0.39$).

Self-efficacy and social support promotion enable women to better protect their pelvic floor health and may complement educational approaches to health behavior change in populations with socioeconomic disadvantages.

Keywords: Women's health, pelvic floor muscles, health behavior change intervention, self-efficacy, social support, low resource populations

Introduction

Pelvic floor muscle (PFM) disorders affect one in three women worldwide and include urinary incontinence, bowel dysfunction, and pelvic organ prolapse (pelvic organs' descent into or out of the vagina) (Jelovsek et al., 2007). Carrying heavy loads is one of the main modifiable risk factors for pelvic organ disorders (Caagbay et al., 2020; Geere et al., 2010; Koyuncu et al., 2021), particularly in low- and middle-income countries. Households often rely on water sources off premises and wood as primary energy source, which entails women carrying heavy loads such as 20 kg water containers and firewood to provide for their families (Earth & Sthapit, 2002; Geere et al., 2010; Koyuncu et al., 2021; Meierhofer et al., 2022). In rural Nepal, for example, high workloads in productive labor such as agriculture and reproductive labor such as cooking with wood and lack of infrastructure make carrying loads largely unavoidable for women (Earth & Sthapit, 2002; Gurung et al., 2005; Tomberge, Shrestha, et al., 2021). At least 10% of Nepali women are affected by pelvic organ prolapse (Meierhofer et al., 2022; United Nations Population Fund, 2006).

Adopting pelvic-floor-protective carrying behaviors can reduce intra-abdominal pressure and support PFM when carrying loads and thus reduce the risk of damaging the pelvic floor (Hagins et al., 2004; MacDonald et al., 2013; Sheng et al., 2022): First, carrying less weight reduces intra-abdominal pressure and thus represents one approach to pelvic-floor-protective carrying (Caagbay et al., 2020; Koyuncu et al., 2021; MacDonald et al., 2013). A second protective carrying behavior is to apply pelvic-floor-protective lifting techniques (Biswokarma, 2016; Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018; Sheng et al., 2022). Protective lifting techniques include co-contracting the PFM when lifting, a maneuver named "the Knack," which prevents PFM descent during high intra-abdominal pressure (Bø, 2006). The PFM co-contraction is most effective when accompanied by exhaling while lifting (Biswokarma, 2016; Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018; Sheng et al., 2022).

Previous studies have shown that women are interested and able to learn health behaviors to prevent pelvic floor disorders as part of an intervention (Biswokarma, 2016; Caagbay et al., 2020; Due et al., 2016; Tomberge, Shrestha, et al., 2021). In Nepal, for example, Caagbay et al. developed an educational flipchart promoting behavioral life style advice, including protective carrying behavior, which was successful in promoting quality of life and PFM awareness in a small clinical population in rural Nepal (Caagbay et al., 2017, 2020). However, informational interventions alone might not be effective in enabling women's

health behavior in low-resource populations, because sociostructural barriers may also limit actual and perceived control to change behavior (Greene & Murdock, 2013; Schüz et al., 2020; Tomberge, Shrestha, et al., 2021; Wingood & DiClemente, 2000). One study in Nepal, for example, showed that women's awareness of carrying risks is high but women have low self-efficacy, which prevents them from engaging in protective carrying behaviors (Tomberge, Shrestha, et al., 2021).

Self-efficacy signifies an individual's self-confidence in their capacity to prepare, initiate, and maintain behavior, even if obstacles emerge (Bandura, 1977). Bandura specifies four major sources of self-efficacy: performance accomplishments, in which individuals experience that they can successfully perform protective carrying; vicarious experience, which involves awareness that meaningful others successfully practice protective carrying; verbal persuasion, which is delivered through positive feedback and encouraging messages; and emotional arousal, which entails feeling relaxed rather than aversively aroused when practicing protective carrying (Bandura, 1977).

In addition, social support may strengthen women's self-efficacy by facilitating their adaptive capabilities to cope with environmental requirements and thus enable them to behave healthily (Benight & Bandura, 2004; Schwarzer & Knoll, 2007). Social support can be defined as resources provided by others, coping assistance, or an exchange of resources. It can be emotional (e.g. encouraging women to practice protective carrying and making them feel valued when they do), informational (e.g. giving advice on how to practice protective carrying), and instrumental (practical assistance, e.g. taking over parts of the carrying tasks) (Schwarzer & Knoll, 2007). Social support has been described as a direct predictor of health behavior and is among the most frequently used behavior change techniques in low- and middle-income countries (Goodwin et al., 2015).

The indirect, enabling function of social support as a facilitator of self-efficacy has been postulated as the enabling hypothesis (Benight & Bandura, 2004; Schwarzer & Knoll, 2007). The enabling hypothesis has been tested in other contexts promoting health behavior change (Banik et al., 2017; Ernsting et al., 2015; Rackow et al., 2015). However, only one of these studies experimentally manipulated social support (Rackow et al., 2015). Intervention studies have shown that self-efficacy and social support promotion can enhance multiple health behaviors (Chipojola et al., 2020; Goodwin et al., 2015; Luszczynska et al., 2006, 2016), but no such studies have promoted pelvic-floor-protective behaviors or protective carrying behaviors in low-resource settings.

Aims of the present study and hypotheses

In this study, we aim to test for the first time whether the promotion of self-efficacy and social support based on the enabling hypothesis can enable women's pelvic-floor-protective behaviors in a low-resource setting. We aim to increase pelvic-floor-protective carrying behaviors to reduce the health risks of carrying heavy loads in rural Nepal (i.e. reducing weight carried and applying pelvic floor protective lifting techniques). This is the first analysis involving carrying behaviors from the perspective of health behavior theory. We tested a series of preregistered hypotheses. First, to test whether a psychological intervention that promotes self-efficacy can promote women's use of protective carrying behaviors, we hypothesized that women who received self-efficacy interventions either alone or with social support exhibit increased use of protective lifting (H1a) and greater reduction in weight carried (H1b) compared to an information-only control condition. We also used the enabling hypothesis, to investigate whether including a social partner in the intervention is more effective than individual psychological intervention. We therefore hypothesized that women who received self-efficacy and social support indicate increased use of protective lifting (H2a) and greater reduction of weight carried (H2b) than women who received the self-efficacy-only intervention condition. We additionally investigated the mechanisms of the intervention. To do so, we tested the hypotheses that increased self-efficacy (H3) or increased received social support (H4) explain the intervention effects on the use of protective carrying behaviors. Finally, we explored whether the reduction of weight carried relates to increased carrying frequency as a coping mechanism and whether the participation in the study improves women's psychosocial well-being and symptoms of pelvic organ prolapse over time.

Methods

A nonrandomized controlled trial with a three-arm parallel group design was devised and preregistered (https://clinicaltrials.gov/ct2/show/record/NCT05154006). The three intervention conditions provided self-efficacy, self-efficacy and social support, and information only (control). The village-based allocation of interventions prevented the transfer of information within villages (Benjamin-Chung et al., 2018). The study was conducted from January to April 2022 in three rural villages in the Kavre and Sindhupalanchowk districts of Nepal. This is a typical low-income region with health centers affiliated to Kathmandu University Hospital, where the second author is based. All national COVID-19 restrictions had been lifted at that time. The Ethical Board of University of Bern, Switzerland [2021-10-00005] and the Ethical Review Committee of the Nepal Health Research Council [514/2021] approved this study. We used 'Guidelines for Reporting Non-Randomized Studies' to report the methods of this study (Reeves & Gaus, 2004).

Population and sample

Three out of five villages from a previous study on water carrying (Meierhofer et al., 2022; Tomberge, Bischof, et al., 2021; Tomberge, Shrestha, et al., 2021) were purposely selected to ensure their similarity in carrying behavior (kg per trip, carrying during pregnancy/postpartum, breathing during lifting, awareness of PFM) and living conditions. Inclusion criteria for participants were being an adult woman of reproductive age (18–49 years), involved in carrying loads, permanently living in the project area, and having a social partner such as husband or mother-in-law from the same or neighboring household to support them. In the self-efficacy-only condition, two village sections needed to be skipped because of COVID-19 cases, and women living in these sections were not included.

The sample size was estimated at $N = 300$ by an a priori power analysis for a repeated-measures analysis of covariance for three conditions with a desired power of > 80%, a significance level of $\alpha = 0.05$, the assumption of medium effects (based on another study (Ernsting et al., 2015)), and allowing for an expected dropout rate of up to 20% from baseline to follow-up (Faul et al., 2009). Figure 10 provides the participant flow. From each of the three villages, 100 women and the social partners they had selected were surveyed before and after the intervention, resulting in a total sample size of $N = 300$ dyads of women and social partners. The present paper focuses solely on the data from the women. Of the 300 women, 20 dropped out at follow-up, mostly because women were travelling (12 cases or 60%, see Figure 10 for details). Women who dropped out used less protective lifting techniques than completers at baseline.

Figure 10

Participant flow chart

Note. ITT = Treating missing values with intention to treat.

Measures

See Table S1 in the supplementary material for detailed item wordings. We mostly used existing measures (Barber et al., 2001; Grøn Jensen et al., 2022; Hagen et al., 2009; Kaz de Jong et al., 2016; Moss-Morris et al., 2002; Pathak et al., 2018; Rocha et al., 2012; Schwarzer et al., 2003; Schwarzer & Knoll, 2007) that were adapted to the local context and piloted within a mixed methods study in the study area (Tomberge, Shrestha, et al., 2021). Items using unipolar Likert scales as answer options were augmented with a visual 5-dot scale, which was developed to support responding populations with low literacy (Harter et al., 2020). All items were translated and back-translated from English to Nepali and discussed and pretested in two villages not part of the analyses. The local research assistants who delivered the questions using computer-assisted face-to-face interviews had been trained in depth for 1 week. All measures were assessed at baseline and at 2-month follow-up.

Co-primary outcomes: Pelvic-floor-protective carrying behaviors

Weight carried. This was assessed by averaging two self-reported open questions about the average weight of water and the average weight in kg of other loads (e.g. firewood), carried per trip in the preceding week.

Protective lifting techniques. In the absence of an existing measure, these were assessed with an index that examined correctness and frequency of protective lifting, created from recommendations in physiotherapy literature (Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018). To assess correctness, the women were asked to lift a filled water container of the size they usually carry and then asked what they did with their pelvic floor and how they breathed during lifting using open questions with precoded answer options: 0 = “inhale”; 1 = “exhale”, 0 = “hold breath”, 0 = “not aware of”; 0 = “other”. The frequency items referred to the proportion of times they used protective lifting in the last week, with answer options from 1 = “(almost) never (0%)” to 5 = “(almost) always (100%)”. The index was calculated using the following formula: (Tightens PFM + exhales while lifting) × Mean frequency (Frequency of tightening PFM when lifting in the last week; frequency of exhaling when lifting in the last week). The index showed acceptable internal consistency of the four items ($\alpha = 0.67$), and high convergent validity: the self-reported breathing was strongly correlated ($r = .75$) with breathing observations made by the researchers during the behavioral demonstration.

Secondary outcomes

Before assessing psychosocial determinants of protective carrying behaviors such as self-efficacy and after the behavioral assessment, a short explanation of the protective carrying behaviors was given at baseline in order for the participants to understand these questions as well.

Self-efficacy. Self-efficacy in reducing weight carried and using protective lifting techniques was calculated from a mean of five items each (α = .91-.95) (Schwarzer et al., 2003). This was also assessed by one item immediately after the intervention (in addition to the 2-month follow-up, not preregistered).

Social support. Social support in reducing weight carried and using protective lifting techniques was calculated from a mean of six items each on informational, emotional, and instrumental received social support (α = .91-.94) (Schwarzer & Knoll, 2007). Social support in using protective lifting techniques was assessed only at follow-up. We decided this after the pretest because women and others that might have supported them did not know really anything about protective lifting at baseline, with the result that they were unable to report received support for this.

Carrying frequency per week. This was calculated by the product of self-reported carrying trips per day by days carried per week.

Physical health. We assessed pain in the pelvic/urogenital area with the mean of three items with the revised Faces Pain scale and the Numerical Pain Rating scale (Pathak et al., 2018; S. Sharma et al., 2017), symptoms of pelvic organ prolapse with The Pelvic Organ Prolapse Symptom Score (Hagen et al., 2009) and urinary incontinence (occurrence and frequency based on the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (Grøn Jensen et al., 2022). The impact of these symptoms during activities such as lifting and coughing was assessed based on the Pelvic Floor Impact Questionnaire (Barber et al., 2001). The physical health measures indicated acceptable to good internal consistency (α = 0.69-0.75) except for pelvic organ prolapse and pain at follow-up (α = .60).

Psychosocial well-being. This was assessed by the following measures: illness-related personal control (α = .73/.77), a subscale of the revised Illness Perception Questionnaire (Moss-Morris et al., 2002), quality of life (EUROHIS Quality of Life 8-Item Index, α = .83/.85) (Rocha et al., 2012) and one item on daily functioning (functioning rating scale) (Kaz de Jong et al., 2016). Additional psychosocial determinants of protective carrying

behaviors were preregistered and assessed (Schwarzer et al., 2003; Tomberge, Shrestha, et al., 2021). They are reported in the supplementary material (Table S14).

Covariates. These included age, socioeconomic status calculated by income per household member, ethnicity, education and pregnancy status (pregnant or up to 3 months postpartum/neither of these).

Procedures

A research assistant unrelated to this project randomly allocated the villages to one of the three conditions by drawing lots. The allocation was concealed in sealed envelopes until the night before the intervention delivery. Participants were blinded to condition.

After obtaining approval from local leadership and presenting and discussing the study goal (increasing protective carrying behaviors to enable women to care for their pelvic floor health) and general procedures of the study with local stakeholders and community health volunteers, six trained Nepali research assistants enrolled participants following the random route method (Hoffmeyer-Zlotnik, 2003). After obtaining participants' written informed consent by signature or thumbprint, two researchers simultaneously conducted structured computer-assisted personal interviews using tablets and structured behavioral observations with the women and their social partners (details under measures). In the week after the baseline assessments, a trained health practitioner from a different team than the interviewers visited the household and delivered the assigned interventions. After two months, the research assistants revisited their households for follow-up assessment. The households were then debriefed by revealing their assigned condition. The first, fourth, and fifth authors monitored the quality of data collected and ensured correct and complete intervention delivery.

Interventions

A detailed overview of the intervention activities can be found in Table S3 and Table S4 in the supplementary materials. All activities were delivered by health practitioners. They were intensively trained in PFM co-contraction and pelvic-floor-protective lifting by the third author before the trial and received refreshers after every village (see S2 for physiotherapy training details). They practiced delivering the intervention with detailed scripts to ensure that all participants received the same information.

Participants in all conditions first received information on health consequences and pelvic-floor-protective carrying with leaflets validated in rural Nepal (see Figures S6 & S7 for validated leaflet and Figure S5 for a leaflet designed specifically for this study) (Caagbay et al., 2017, 2020). Subsequently, the intervention conditions received additional interventions according to their assigned condition.

Information on health consequences and behavior

Trained health practitioners informed the women about preventing pelvic organ disorders by coping with pelvic floor pressure while lifting (5.1 Information about health consequences). For the target behavior of reducing weight carried, all women received information on recommended weight limits but were also informed that any reduction of weight carried was beneficial (4.1 Instruction on how to perform a behavior). Then, as a prerequisite of protective lifting, all women including information-only controls learned the co-contraction of the pelvic floor in sitting position, supported by visual cues such as indicating a squeeze with a hand around one finger (Luginbuehl et al., 2015) (4.1 Instruction on how to perform a behavior). The practitioner then provided instructions on pelvic-floor-protective lifting (only instructions, no practice), which included the co-contraction of the PFM before and during lifting the load and exhaling breath (Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018) (4.1 Instruction on how to perform a behavior).

Self-efficacy promotion

Self-efficacy was promoted by activities targeting the four sources of self-efficacy (Bandura, 1977): performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal.

First, the practitioners invited the women to practice protective lifting and provided encouraging feedback (8.1 Behavioral practice/rehearsal, 15.1 Verbal persuasion about capability; 2.2 Feedback on behavior). Second, the practitioners videotaped the women while they practiced protective lifting. Afterwards, the women watched themselves on the video and identified which components of protective lifting they had applied successfully (15.3 Focus on past success; 2.3 Self-monitoring of behavior). Third, the women were shown a video of a rural Nepali woman (role model, see Figure S9 for a screenshot of the video) carrying a reduced-weight load and using pelvic-floor-protective lifting techniques and were encouraged to do the same (4.1 Instruction on how to perform the behavior; 6.1 Demonstration of behavior; 16.1 Vicarious reinforcement; 15.1 Verbal persuasion about capability). In the fourth activity, the women received a model of a woman, loads, and symbols of the pelvic floor and breath made of paper (see these symbols in Figure S8) and were encouraged to set up a scene of themselves carrying less weight and performing pelvic-floor-protective lifting (15.2 Mental rehearsal of successful performance). To enhance positive emotional arousal, the women were asked to draw a smiling face on the model (11.2 reduce negative emotions). Finally, the practitioners read out a mental journey to further increase a relaxing arousal (11.2 reduce negative emotions). In the mental journey, the

women imagined themselves standing in the field and then deciding to reduce the weight they carried and to practice protective lifting (15.2 Mental rehearsal of successful performance; 15.1 Verbal persuasion about capability; 4.1 Instruction on how to perform the behavior). They were encouraged to inwardly repeat to themselves: "I am sure I can carry less weight [use protective lifting techniques]" (15.4 Self-talk).

Self-efficacy and social support promotion

The social support intervention included dyadic behavior change techniques (DBCTs) comprising joint DBCTs such as cooperative learning of the behavior and cross-over DBCTs which are techniques directed more specifically to the women as a focal person, e.g. the social partner provides social support) (Scholz et al., 2020). The women and their social partners received all the information and practiced self-efficacy activities such as PFM contractions together, or were both filmed during protective lifting (joint DBCTs: Cooperative learning). The role model video included a mother-in-law and a husband who helped carry weight and reminded the woman of protective lifting. The social partners were instructed to provide feedback to the participants and to support them during the activities if difficulties arose (Cross-over DBCTs: 15.1, Feedback on behavior; 3.2, Social support, practical; 3.3, Social support, emotional).

Data analyses

Missing data at follow-up were treated using listwise deletion (participants whose data were missing were excluded from the analysis) (Graham, 2009). However, we performed sensitivity analyses using intention-to-treat (ITT) with the last observation carried forward method (Graham, 2009), replacing missing follow-up data by the baseline. Univariate outliers *M* +- 3 *SD* were adapted to the next highest or lowest value within 3 *SD* for all variables (Tabachnick & Fidell, 1983). Identified outliers are reported in the Table note of Table S14 in the supplementary materials. For the symptoms of pelvic organ prolapse, we performed an additional analysis without correcting outliers to account for women with strong symptoms.

To evaluate baseline group differences for all study variables, we used ANOVAs with condition as independent variable (1 = control, 2 = self-efficacy, and 3 = self-efficacy + social support) and the baseline measures each as dependent variable or Chi-square test of equal frequencies for nominal variables such as ethnicity.

Main effect models

To investigate the intervention effects on weight carried and protective lifting we conducted a repeated-measures ANOVA with the two measurement points and the conditions as

independent variables and each of the outcomes as dependent variables. Because our preparatory analyses indicated systematic group differences at baseline (see results section), we decided to analyze group-by-time effects using planned contrasts with change scores in univariate ANOVAs (van Breukelen, 2013). The change scores were computed by subtracting the follow-up score from the baseline score. Using change scores (e.g. instead of ANCOVA) to analyze group-by-time intervention effects is recommended when baseline differences occur in pre-existing or naturally occurring conditions such as the three different villages in our study (van Breukelen, 2013). We used Helmert contrasts to compare information -only controls against the two intervention conditions (H1) and then compared self-efficacy against self-efficacy and social support (H2) (Schad et al., 2020).

In order to investigate whether reduced weight carried related to increased carrying frequency, we examined correlations of change scores from the two measurement points for these two variables. To investigate time effects on psychosocial well-being and physical health symptoms as well as the preregistered secondary outcomes, we conducted a repeated-measures ANOVA with the two measurement points and the conditions as independent variables and each of the outcomes as dependent variables.

Mediation analyses

To analyze whether self-efficacy or social support mediated the intervention effects on protective carrying behaviors (H3 and H4), mediation analyses were conducted using PROCESS in SPSS (Hayes, 2017). Change in self-efficacy and social support at follow-up were used as mediators of the effect of conditions on change in both protective carrying behaviors.

Sensitivity analyses

To confirm the robustness of the findings, four sensitivity analyses were performed for the main effect models (H1 and H2): (1) Removing participants who did not receive the intervention from the data set, (2) removing multivariate outliers from the data set (residuals +- 2 *SD*), (3) ITT analysis, and (4) adding sociodemographic factors as covariates to the model. All analyses were performed in IBM SPSS Statistics for Windows, Version 28.0 (IMB Corp, 2021); visualizations of effects were created in RStudio v 2022.07.01(R Core Team, 2022) using the ggplot2 package (Wickham, 2016) for the boxplot and the cat_plot function in the interact_plot package (Long, 2021) for the line graphs. A panel was created using the ggpubr package (Kassambara, 2022).

Results

See Table S10 for detailed descriptive statistics on sociodemographic data and Table S14 for all other study variables in the supplementary materials. The average household income of all women was 9168 NPR per month (~ 72 USD, *SD* = 62 USD). On average, they were 36 years old (*SD* = 9) and had given birth to 2.6 children (*SD* = 1.3), 45% of the women were illiterate or had informal education and 8% of them were either pregnant or up to 3 months postpartum. At baseline, 15% of women reported symptoms of urinary incontinence, and 14% reported often feeling one or more symptoms of pelvic organ prolapse. Social partners were 32% husbands, 31% mothers-in-law, 10% female friends and neighbors, and 8% sisters-in-law or others.

At baseline, women carried 17 kg (*SD* = 8 kg) of water 13 times (*SD* = 9) per week and 27 kg (*SD* = 15 kg) of other loads 7 times (*SD* = 6) per week. At baseline, 28% tightened the PFM, and 36% exhaled when demonstrating lifting; however, only 7% reported using one or both techniques at least half of the times they lifted loads.

Randomization check

Several statistical baseline differences emerged between conditions (see Tables S10 and S14 in the supplementary materials). All conditions differed from one another in distribution of ethnicities. Women in the information-only control condition were older and had lower education and a higher proportion of Buddhists than Hindus than did the intervention conditions. Women in the self-efficacy-only condition had fewer children, carried on average 10 kg less weight per trip, and had higher self-efficacy in using protective carrying than the other two conditions. They further reported higher household income and received more social support in reducing weight carried than controls.

Intervention fidelity

Eight women did not receive the intervention. They differed from recipients at baseline secondary outcomes, having decreased ability in feeling their PFM [$t(291) = -5.77$; $p < .001$, $d = .3$], but higher injunctive norms (i.e., others' approval) [$t(8.40) = 3.28$; $p = .011$, $d = .25$] and lower perceived barriers to reducing weight carried [$t(8.06) = -2.60$; $p = .031$, $d = .3$].

In terms of participant's intervention comprehension and learning we found that women in all conditions increased their ability in feeling their PFM from baseline to follow-up (12%, medium effect: $\eta^2 = .06$) and were more likely to report a technique for tightening the PFM (24%, large effect: $\eta^2 = .25$). At follow-up, we asked the women which intervention activities they remembered (see descriptive statistics and group differences in Table S11). Overall, 39% remembered they had learned to tighten the PFM, 71% remembered

instructions on the reduction of carried loads and 61% remembered protective lifting techniques. Women in the social support condition mentioned more protective lifting techniques correctly than women in the other two conditions (p <.001, medium effect: η^2 = .25) and remembered all self-efficacy activities more than women in the self-efficacy-only condition (p < .001 - p = 0.030, small effects: d = .4).

Main intervention effects on pelvic-floor-protective carrying behavior

An overview of descriptive statistics and group differences for co-primary outcomes is given in Table 9 and a visualization in Figure 11. All conditions significantly increased use of protective lifting techniques by 23–33% and decreased mean weight carried by 3–6 kg after the interventions (large time effects η^2= .49/.20).

Table 9

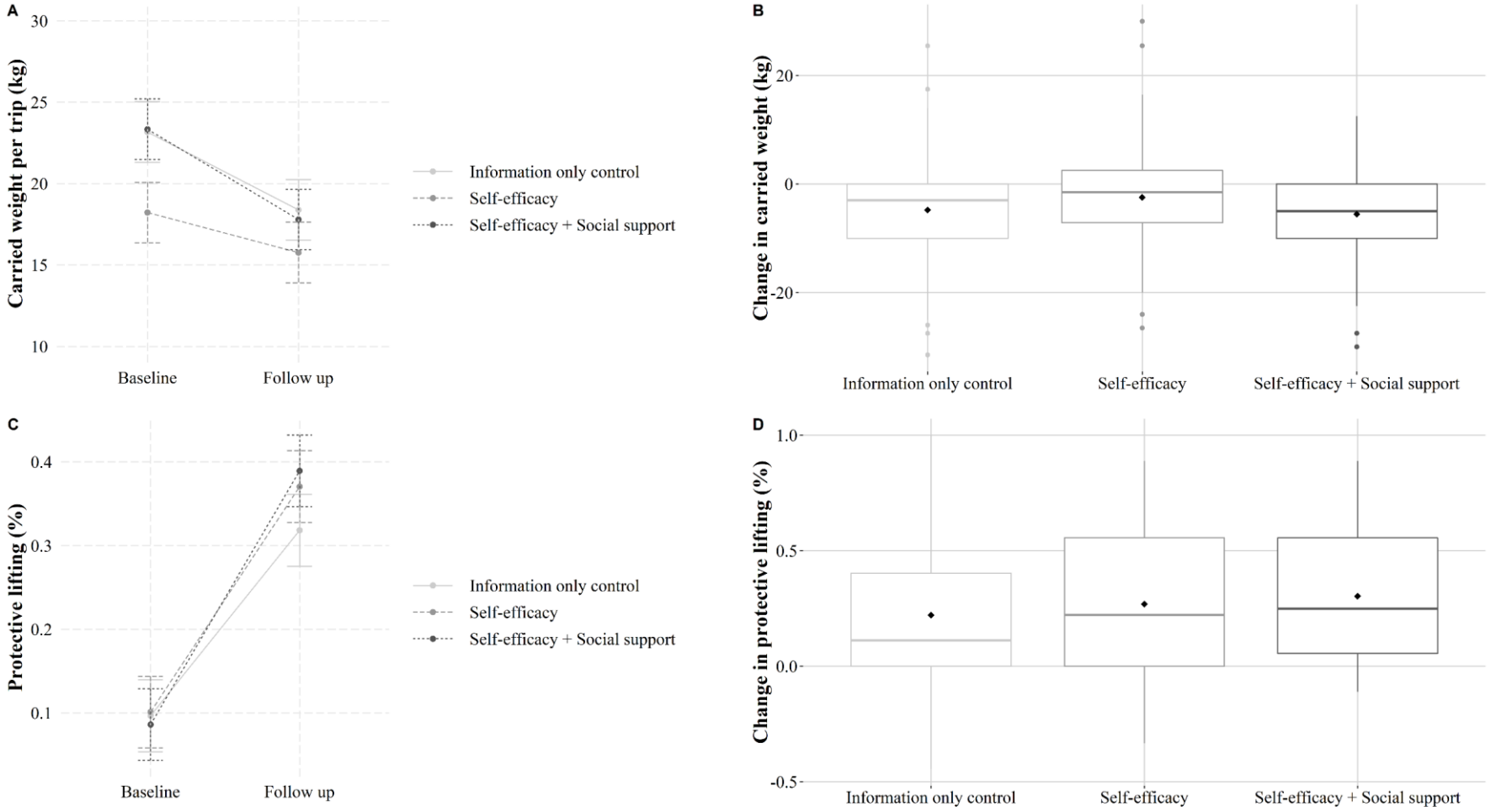
Intervention effects for changes in protective carrying behavior

	Baseline		Follow-up		Change		Group Effect[3]		Time effect[4]		Group × Time effect[5]	
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*	η^2	*p*	η^2	*p*	η^2
Protective lifting (%)[1]							.098	.02	<.001	.49	.021	.02
Info												
control	.10	.11	.33	.29	.23	.33						
SE only	.11	.12	.39	.29	.28	.39						
SE + SS	.10	.15	.43	.27	.33	.43						
Overall	.10	.11	.38	.29	.28	.38						
Weight carried (kg)[2]							<.001	.07	<.001	.20	.014	.03
Info												
control	23.5	9.9	18.5	9.4	-5.0	9.8						
SE only	17.7	9.5	15.1	8.5	-2.6	9.2						
SE + SS	24.4	8.1	18.2	9.3	-6.2	8.2						
Overall	21.9	9.7	17.3	9.1	-4.6	9.2						

Note. N = 280, M = Mean, SD = Standard deviation, η^2 = Eta-squared effect size with small (.01), medium (.06), and large (.14) effects (Cohen, 1988). Info = Information only, SE =self-efficacy, SE+SS = self-efficacy and social support. [1]Product of correctness and frequency of using protective lifting techniques (range: 0-1). [2]Mean of water and other loads carried in an average trip in kilograms.[3]Group effects in ANOVA represent baseline differences. [4]Time effects in ANOVA represent whether the variable changed from baseline to follow-up across conditions [5]Group×Time interaction effects indicate that there was a significant difference in the change from baseline to follow-up between the conditions.

Figure 11

Intervention effects on protective carrying behaviors (co-primary outcomes)



Note. Plots A and C visualize time effects in protective carrying behaviors from baseline to follow-up. Plots B and D visualize change scores in the three conditions.

Regarding the use of protective lifting techniques, effects of different conditions differed (small group by time effect: $\eta^2 = .02$). Planned contrasts revealed that the intervention conditions compared to controls showed 8.5% greater use, supporting H1a [$p = 0.013$, $d = 0.3$]. There was no added effect of self-efficacy and social support compared to self-efficacy, rejecting H2a [$t(277) = 1.20$; $p = 0.111$]. An exploratory analysis found that self-efficacy and social support increased lifting techniques by 10% more than controls [$t(277) = 2.53$; $p = 0.009$, medium effect: $d = 0.6$].

Effects of conditions on reducing weight carried also differed over time (small group by time effect: $\eta 2 = .03$). Planned contrasts indicated that, against H1b, the intervention conditions did not reduce weight more than information only [$t\ (277) = 0.52$; $p = 0.304$]. However, self-efficacy and social support reduced weight carried to a greater extent (3 kg more) than self-efficacy, supporting H2b [$t(277) = -2.65$; $p = 0.005$, $d = 0.4$]. Exploratory analyses indicated that self-efficacy and social support did not reduce weight carried over information only [$t(277) = -0.89$; $p = 0.374$].

Sensitivity analyses for main effects on pelvic-floor-protective carrying behavior

Overall, the results remained substantively unchanged after excluding data from participants who did not receive the intervention, removing multivariate outliers, or using ITT (See Table S12 in the supplementary materials for sensitivity analyses). The only except was a group-by-time interaction in the ANOVA, which did not remain robust for protective lifting when using ITT. Still, the planned contrast for protective lifting remained substantively unchanged (intervention conditions vs. information only: $p = 0.033$, $d = 0.3$). When adjusting for sociodemographic variables (see Table S13), the group-by-time effects for using protective lifting techniques remained substantially unchanged but were no longer significant for weight carried.

The role of self-efficacy and social support as mediators

We did not find group differences in changes to self-efficacy in reducing weight or using protective lifting. Thus, the condition for mediation was violated, and we rejected the mediation hypotheses for self-efficacy (H3). In an exploratory analysis, we detected time and group effects for self-efficacy measured immediately after administering the intervention. Self-efficacy for both protective carrying behaviors was significantly higher immediately after the interventions ($M = .84$ / $.85$) compared to baseline ($M = .55$ / $.59$, both $p < 0.001$), but returned to baseline level at follow-up ($M = -.54$ / $M = .61$, both $p < 0.001$). Self-efficacy for protective lifting increased more from baseline to intervention in the self-efficacy-only condition and decreased less from intervention to follow-up in the self-efficacy and social support

condition compared to controls. However, none of these changes in self-efficacy mediated the intervention effects.

Partly supporting H4, social support in using protective lifting techniques at follow-up was 24% higher in the self-efficacy intervention conditions than controls ($p < 0.001$, medium effect: $\eta^2 = .07$), and mediated the intervention effects on increased protective lifting techniques, with condition predicting social support ($B = .14$, $p < .001$) and social support predicting protective lifting ($B = .28$, $p < .001$), indirect effect $ab = .04$, 95%-CI [.02, .07]. Comparing the self-efficacy + social support condition to controls, greater social support also explained increased protective lifting, with a stronger indirect effect $ab = .07$, 95%-CI [.03, .14]. For weight carried, there was no evidence of mediation in the absence of group differences in changes in social support. It is noteworthy that social support in reducing weight significantly decreased by 8% from baseline to follow-up across all conditions ($p < 0.001$, $\eta^2 = .07$).

Interventions effects on secondary outcomes: pelvic floor health and well-being

We did not find any group-by-time effects in secondary outcomes except for pelvic and genital pain, which was reduced by 8% more in the self-efficacy and social support condition than in the self-efficacy-only condition (small effect: $\eta^2 = .02$). However, we found time effects for various secondary outcomes across all conditions (see Table S14 in the supplementary materials for all preregistered variables). All women reduced carrying frequency of water by around 2.5 trips and other loads by around 1.5 trips per week over time (medium/small effect: $\eta^2 = .08/.03$). Women who reduced carried weight to a greater extent showed greater reductions in their carrying frequency (r = .08/.22, $p = .003/ .001$).

Regarding our research question on time effects on physical health, women in all conditions reported less urinary incontinence (small effect: $\eta^2 = .04$). Those who reported incontinence reported a reduced frequency of leaking urine within one week (large effect: $\eta^2 = .52$), but their perceived burden of incontinence symptoms did not change. All women decreased in symptoms of pelvic organ prolapse (-0.92 points, medium effect: $\eta^2 = .10$) and rated the impact of symptoms, if they had any, as 8% lower (large effect: $\eta^2 = .14$). The decrease in symptoms remained unchanged when not controlling for statistical outliers in symptoms (i.e. not adjusting women with high symptoms of pelvic organ prolapse to sample mean), (-1.0 points decrease in symptoms over time, medium effect: $\eta^2 = .09$). Regarding psychosocial well-being, all women on average increased 4% in illness-related control over pelvic organ disorders (large effect: $\eta^2 = .36$) and reported that carrying loads was on average 5% less of a

burden for their daily functioning in other tasks at follow-up (small effect: $\eta^2 = .02$). No effect was found for quality of life.

Discussion

Based on the enabling hypothesis, this study aimed at testing whether the promotion of self-efficacy and social support can enable women's health behavior in a low-resource setting above giving information only. We investigated this for pelvic-floor-protective carrying behaviors in rural Nepal. Our study provides first promising, quasi-experimental evidence for the increased effectiveness of self-efficacy and social support on protective carrying behaviors over giving information only. Women in the self-efficacy and the self-efficacy and social support conditions indicated more frequent use of protective lifting techniques compared to women receiving information only (H1a). Comparing women from the two self-efficacy intervention conditions, weight carried was only reduced when social support was also promoted (H2b). An additional exploratory analysis showed group-by-time effects for pain, with those in the self-efficacy and social support condition reporting reduced pain at follow-up compared to self-efficacy only. Finally, there were improvements in all conditions in behavior, health, and well-being, such as reduced symptoms of pelvic organ prolapse and perceived control over pelvic floor disorders. Overall, these results emphasize the important role of behavior change in reducing the health risks of carrying heavy loads.

All time effects on protective carrying were large. Group-by-time effects on protective carrying were small, except for the effect of self-efficacy and social support on protective lifting, which was medium sized. All time effects on protective carrying behaviors remained highly robust in the sensitivity analyses. The group effects remained robust in several sensitivity analyses. However, intervention effects on protective lifting did not remain robust when using ITT or when controlling for sociodemographic variables in the analysis for weight carried. Overall, these findings provide strong first evidence for the effectiveness of this behavior change intervention in promoting protective carrying behaviors. Self-efficacy interventions may thus complement educational approaches to health behavior change and target the limited behavioral control in populations with socioeconomic disadvantages that is often discussed (Greene & Murdock, 2013; Schüz et al., 2020; Tomberge, Shrestha, et al., 2021).

Findings diverged on the benefits of the self-efficacy conditions for the two carrying behaviors. A possible explanation for this is that the behaviors may require different coping strategies (Carver et al., 1989). Increased self-efficacy can help individuals cope actively with a situation (Schwarzer & Knoll, 2007). Protective lifting techniques can be chosen and

applied by the women alone, but reducing weight carried may need the help of social partners if household needs for food and water supply are to be met (Earth & Sthapit, 2002; Meierhofer et al., 2022; Tomberge, Shrestha, et al., 2021). Our social support intervention made this social resource available directly. Also the finding that women did not increase carrying frequency when reducing carried weight can be an indicator for a social coping strategy rather than an individual one, e.g. walking more times with less weight.

Against our expectations, our intervention effects were not explained by changes is self-efficacy. This is in line with some health interventions for self-efficacy and social support which have similarly achieved desired behavioral outcomes without changing self-efficacy (Allison & Keller, 2004; Hohl et al., 2016). Interestingly, we found a large increase in self-efficacy immediately after the intervention, supporting the validity of our intervention in promoting self-efficacy. However, this one-time intervention might not have been successful in maintaining self-efficacy over time. Future interventions may need to sequentially target self-efficacy at different phases in the behavior change process to enable recipients to maintain and recover healthy behaviors even when facing barriers in daily life.

In contrast, our mediation analyses indicated that social support explained the intervention effect on increased use of protective lifting techniques. Social support as a mediator of the effects in the intervention conditions is in line with the cultivation hypothesis. The cultivation hypothesis, which is often discussed together with the enabling hypothesis, suggests that self-efficacy facilitates social support such that more self-efficacious individuals are more likely to reach out for help. This in turn explains behavioral health outcomes (Schwarzer & Knoll, 2007).

While the intervention effects on increased use of protective lifting was explained by social support, the mechanisms of the intervention of increased reduction of carried weight remain unexplained by the assumed mechanisms of self-efficacy and social support. An alternative explanation may be that women in the social support condition remembered significantly more self-efficacy activities than women in the self-efficacy condition without support. This may simply indicate that the intervention itself was more engaging due to the interaction with the social partner, but another possibility is that the social exchange about protective behaviors helped women to remember (Scholz et al., 2020). Another possible mechanism is that the social support intervention may have changed a partners' psychosocial cognitions such as partners' risk awareness about carrying loads and consequently influenced the women's cognitions and behavior (Rothman et al., 2020). This needs to be tested.

Strengths and limitations

This study is the first to quasi-experimentally test the enabling effect of self-efficacy and social support on women's health behavior in a low-resource setting. It is also the first to examine carrying loads from a health behavior change perspective and emphasize the importance of this neglected research field to promoting women's health in the Global South. Our intervention materials were developed in close discussion with local researchers and practitioners and provide a culturally adapted intervention to promote protective carrying behaviors tailored for women living in rural Nepal. These materials can now be used and adapted for further evidence-based health prevention campaigns and intervention studies in similar settings.

There are also some limitations and avenues for future research. The generalizability of our results needs to be further tested in similar populations that present behavioral risks for pelvic floor health, such as heavy working and lack of postpartum PFM exercise (Caagbay et al., 2020; Geere et al., 2010; Harvey, 2003). Our study included a heterogeneous population of nulliparous and multiparous healthy women as well as women with salient symptoms of pelvic organ disorders, which can be considered a strength. However, further subgroup analyses are needed to disentangle whether some groups of women profit more than others. A further limitation is the nonrandomized study design, which may have contributed to the systematic group differences in sociodemographic and behavioral factors. The systematic group differences may be a major reason why group effects did not remain robust when controlling for sociodemographic variables. Nevertheless, the results of our study are highly valuable and provide evidence that the interventions are promising and should be tested in a cluster-randomized controlled trial.

Conclusions

Our study provides promising evidence of the importance of self-efficacy and social support in a low-resource setting. Health behavior change interventions for protective carrying behaviors can enable women in the Global South to care for their pelvic health independently in demanding environments, and help prevent pelvic floor muscle disorders.

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Ethical statement

The study was approved by the Ethical Review Committee of the Nepal Health Research Council [514/2021] and the Ethical Board of the University of Bern, Switzerland

[2021-10-00005]. All procedures were in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki declaration and its later amendments. This article does not contain any studies with animals.

Informed consent statement

All participants provided written informed consent prior to their interviews and observations. Potential study participants who could not sign their names were permitted to indicate consent with a thumbprint.

Conflicts of interest

The authors declare that they have no conflict of interest.

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Chapter VI
General discussion

1. Summary

This thesis aimed at understanding and addressing women's health behavior in unequal gender power relations with the example of carrying heavy loads in Nepal. First, the influence of gender power relations on women's health behavior was explained. A need was identified to consider gender power relations in health behavior theory and methods when investigating women's health behavior in low-resource populations. Carrying heavy loads in Nepal was outlined as a suitable example with which to test and adapt common approaches to health behavior research in unequal gender power relations (Chapter I). Chapters II and III identified carrying loads as a highly prevalent everyday working task for women in rural Nepal, even during vulnerable periods of pregnancy. Chapter II described the physical burden of this behavior and its relation with women's impaired well-being. Chapters III and IV identified self-efficacy, injunctive norm, and social support as the most important determinants of women's -protective carrying behavior and emphasized the strong influence of family members' cognitions and behaviors and a shift in decision-making power towards them. In line with the determinants identified and the enabling hypothesis, interventions were developed to promote self-efficacy and social support by promoting women's pelvic-floor-protective carrying behaviors (Chapter V). A nonrandomized, controlled trial found that these promoted pelvic-floor-protective carrying behaviors more effectively than only giving information (Chapter V). The intervention effects were partly explained by received social support (Chapter V). Women in all study conditions reported improved pelvic floor health and well-being.

The preceding chapters discussed the empirical studies' findings in depth. This last chapter integrates the findings of these studies to discuss how health behavior research can investigate women's health behavior in unequal gender power relations. Table 10 provides a brief overview of the research questions, the main results, and the major conclusions drawn. The subsequent Sections 2.1–2.3 then discuss the insights into the behavior of carrying heavy loads in light of the three structures of unequal gender power relations (R. Connell, 1987) and propose recommendations for research on women's health behavior in unequal gender power relations directly in the relevant sections. Section 2.4 then discusses the role of social support and how it may enable women's self-efficacy and health behavior in gender power relations. Afterwards, Section 3 discusses the implications of gender and power inequalities for health behaviors in other populations. Specific recommendations for further research and practice supporting pelvic-floor-protective carrying in Nepal are then outlined (Section 4). After discussing the strengths and limitations of this research (Section 5), this Chapter will end with general conclusions (Section 6).

Table 10

Overview of this thesis's main findings

Aim	Research questions	Chapter	Results	Conclusions
Understanding women's health behavior in unequal gender power relations	(1) What are behavioral risk components of carrying loads in Nepal?	II & III	Women in the study area carried an average weight of 19 kg of water (SD = 10 kg) over a distance of 81 m (SD = 162 m) 3 times per day (SD = 2). Women also reported carrying other heavy loads such as firewood (M = 36 kg per trip, SD = 12 kg). At least half of the women carried loads during pregnancy and postpartum.	These results emphasize the behavioral risk of a typical women's everyday domestic work task such as carrying water in Nepal and indicate the potentially harmful combination of this behavior with women's reproductive role: the frequent carrying during pregnancy and postpartum. This highlights that women's working behaviors can be physically demanding and thus potentially health-impeding behaviors.
	(2) How is the behavior of carrying loads related to women's psychosocial well-being?	II	The physical burden of carrying water is related to more emotional distress and reduced functioning in other tasks. This relationship was exacerbated for women carrying in hilly terrain, and for those who already had pelvic organ prolapse. For women with pelvic organ prolapse, higher physical burden of water carrying was nevertheless related to higher quality of life.	Women's everyday working behaviors such as carrying loads can have detrimental effects on their well-being, especially when facing challenging environmental and personal conditions. However, maintaining working tasks even with impaired health may be an important factor of women's quality of life.
	(3) What are the psychosocial determinants of the intention and behavior of pelvic-floor-protective carrying behavior?	III	Outcome expectancies, self-efficacy, injunctive norms, and social support were associated with higher intention and behavior related to protective carrying. Qualitative interviews further identified that household decision-making power, structural barriers, and the necessity of goods were determinants that explained diminished self-efficacy. Norms supporting a traditional gender division and self-identity that aligned with these were further explanatory factors.	Psychosocial determinants can explain protective carrying behaviors in addition to structural barriers such as the lack of infrastructure. Self-efficacy and social influences that are shaped by traditional gender roles may explain women's health behavior in unequal gender power relations and undermine their individual health decision-making power.
	(4) How well does an established health psychology model predict women's pelvic-floor-protective carrying behavior, and which adaptations are useful?	III	The quantitative assessment of the HAPA model identified determinants that related to protective carrying behaviors. Qualitative findings cross-validated the psychosocial determinants identified in the quantitative HAPA assessment, explained them, and emphasized additional contextual determinants.	The HAPA model proved useful in investigating protective carrying, provided that items were carefully adapted to the local context. A qualitative perspective helped to understand and extend the quantitative results. The assumption of individual decision-making power in common health behavior models may be invalid for women in gender power relations as health decisions can be made by family members.

Aim	Research questions	Chapter	Results	Conclusions
Identify the role of an influential social partner on women's health behavior in gender power relations	(5) Do daughters-in-law and their mothers-in-law correlate in their cognitions and behavior related to protective carrying?	IV	Mothers-in-law and daughters-in-law were similar in their behavioral intentions risk perception, self-efficacy, and action planning skills but varied in other cognitions and in behavior.	Women's health cognitions and behaviors may align with but also contradict influential others in unequal gender power relations.
	(6) How do daughters- and mothers-in-law's cognitions relate to their own and their dyadic partner's behavioral intentions and behavior over and above their own cognitions?	IV	Daughters- and mothers-in-law's cognitions were related to each other's intentions about protective carrying. The mother-in-law's cognitions were related to the daughter-in-law's protective carrying behavior. The mother-in-law's self-efficacy, descripte and injunctive norm were both positively and negatively related to women's intentions and behavior over and above their own cognitions. Negative partner effects were predominant when the women's own self-efficacy was low.	Cognitions of an influential partner's seem to be linked to a woman's health behavior in unequal gender power relations. Partner's self-efficacy was found to be particularly important. These findings indicate the benefit and the importance of including a dyadic perspective when understanding and changing women's health behavior in gender power relations.
Change women's health behavior and health in gender power relations	(7) Can the promotion of self-efficacy or social support improve women's pelvic-floor-protective carrying behavior over only giving information?	V	Self-efficacy promotion in the two intervention groups combined increased the use of pelvic-floor-protective lifting techniques 9% more than only giving information. Carried weight was reduced by 3 kg more when promoting self-efficacy and social support than when only promoting self-efficacy.	Interventions in gender power relations based on the enabling hypothesis, such as those targeting self-efficacy and the social support of influential social partners may be more promising when promoting women's health behavior than informational interventions.
	(8) Are the intervention effects of pelvic-floor-protective carrying behavior explained by increased self-efficacy (8a) or increased received social support (8b)?	V	Intervention effects were not explained by increased self-efficacy. Stronger received social support explained higher use of protective lifting techniques in the self-efficacy groups than in controls.	The interventions examined were unable to sustainably increase self-efficacy. Interventions on women's health behavior in gender power relations may need other approaches to promote self-efficacy. However, receiving social support seems relevant to women changing health behaviors in unequal gender power relations.
	(9) Can the promotion of protective carrying improve women's symptoms of pelvic organ disorder and psychosocial well-being?	V	Women in all study conditions improved symptoms of pelvic organ disorders and indicated improved psychosocial well-being over time. These results need to be interpreted with caution because we had no control group that received no health behavior change promotion.	Promoting behavioral adaptations to enable women to independently diminish health risks in everyday working behavior proved promising in improving women's physical and psychological health.

2. Unequal gender power relations and women's health behavior

The results on and implications for women's carrying heavy loads in Nepal highlight the relevance of unequal gender power relations to women's health behavior in multiple aspects that are briefly summarized here. Describing and understanding the behavior of carrying heavy loads highlighted that this behavior was rooted in a gender division of labor and emphasized that this behavior was harmful for women's well-being. The results of this thesis further highlighted the relevance of the gender division of cathexis and social norms because the influence of close social relationships, injunctive norms, self-identity, and correlated affective attitudes were found to be relevant to women's pelvic-floor-protective carrying behaviors. Ultimately, the key role of self-efficacy highlighted by these results and its interrelatedness with limited decision-making power due to social influence and lack of structural resources support the identification of the gender division of power as an important behavioral risk factor. The gender division of power and cathexis became even more salient when identifying the role in women's pelvic floor protective carrying behavior of their mothers-in-law as influential partners of perceived higher status. Finally, the results of this thesis highlighted ways of changing women's behavior in unequal gender power relations because self-efficacy and social support promotion enabled women to use pelvic-floor-protective carrying behaviors.

The following section discusses the findings on women's protective carrying behaviors in more detail and in the light of three structures of unequal gender power relations: the gender divisions of labor, cathexis and social norms, and power. It elaborates how health behavior research can consider unequal gender power relations when describing, understanding, and changing women's health behavior.

2.1 Considering a gender division of labor in women's health behavior

This thesis identified the carrying of water and other loads in Nepal as typical women's everyday domestic work as prescribed by a traditional gender division of labor (Chapter III). Chapters II and III objectified the risks of this behavior by describing its physical burden in terms of weight in kilogram, distance, frequency, and elevation of carrying and indicated the potentially harmful combination of this behavior with women's reproductive role: frequent carrying during pregnancy and postpartum. The relationship of the physical burden of carrying with women's impaired physical health was supported by another work of our research group (Meierhofer et al., 2022), and Chapter II further emphasized its relationship with their lower psychological well-being. This section uses the implications of these

findings to discuss how health behavior research can consider the gender division of labor when understanding and addressing women's health behavior.

Women's working behaviors are health behaviors

The carrying of heavy loads is only one context-specific example of how women's work behavior can pose potential risks to their health and well-being in contexts of unequal gender power relations. However, women's working behaviors are somewhat overlooked as health behaviors. Health behavior research dedicated to women's health is predominantly focused on reproductive health behaviors (Garrison-Desany et al., 2021; Robinson et al., 2017; World Health Organization, 2012): behaviors necessary for understanding and managing their own fertility and preventing and treating sexually transmitted diseases (United Nations Population Fund, 2014). The findings of this thesis encourage a broader perspective on women's health behaviors instead of solely considering reproduction.

Chapters II and III described all aspects of carrying loads and thus helped to identify its behavioral risk factors and objectify its physical burden. Multiple other domestic work behaviors can pose a potential risk to physical health and would be worth examining from a health behavior perspective. For example, exposure to chemicals or dust during cleaning can irritate skin, eyes, and lungs and trigger allergies and asthma (Charles et al., 2009). Using solid fuels such as coal and biomass for cooking can pose a risk of respiratory diseases and affects approximately 50% of households globally (International Energy Agency, 2006; Torres-Duque et al., 2008). In rural areas, women's role in agriculture is also substantial and can pose severe health risks (e.g. Gurung et al., 2005; Halbrendt et al., 2014; Johnston et al., 2018). Working in fields that have been treated with pesticides for example can cause a broad range of acute and chronic diseases (Atinkut Asmare et al., 2022), and weeding, harvesting, and planting is predominantly undertaken by women and girls. Just like carrying loads, these working behaviors can pose particular risks during pregnancy and postpartum (MacDonald et al., 2013; Naidoo et al., 2011).

Future health behavior research that aims to promote women's health in unequal gender power relations can describe the risk factors of women's context-specific work behaviors such as exposure to chemicals and pesticides, body posture, and the relevance of these behaviors during vulnerable periods such as pregnancy. In this way, health behavior research will be able to identify other neglected yet relevant women's health behaviors, identify potential behavioral adaptations to cope with the risks involved, and start developing theory-based interventions to promote these.

The importance of well-being when addressing women's health behavior

Health behavior research in the field of women's health should aim for behavior change to promote not only physical health but also psychological health. This is particularly important because the workload of unpaid and paid work has often been described as impeding women's psychological health (Cramer & Hunter, 2019; Gu et al., 2019; Väänänen et al., 2005). This is in line with the findings of the present research that carrying loads in Nepal increased women's emotional distress and reduced their functioning (Chapter II). Research from other contexts has found that women's work-related stress can arise from feeling overwhelmed by the demands of their jobs, lacking time for themselves, and not having control over their work (Avotri & Walters, 1999; Cramer & Hunter, 2019). The findings of this thesis indicate that the promotion of behaviors to cope with the risk factors of working behavior can promote women's psychosocial well-being, such as perceived control of the symptoms of pelvic organ prolapse and increased functioning (Chapter IV). However, it is important to mention at this point that the study design did not include a control group without behavior change promotion, and the increased in well-being can therefore also be attributed to fluctuations in well-being over time. Other approaches to promoting women's psychological health in health behavior research might include promoting resilient working practices such as setting workload priorities and stress management training as health behaviors (K. Rao et al., 2011; Verburgh et al., 2020).

In any case, it is important to address at this point that the qualitative findings in Chapter III describes how some women also report positive feelings associated with carrying tasks and perceive it as part of their self-identity. This finding is discussed below in the section on social norms.

The indirect risk of women's working behaviors on health behaviors

Chapter II also indicated the relation between the physical burden of carrying loads and low functioning in other daily activities. This indicates that women's work tasks may pose not only a direct but also an indirect risk to women's health by preventing them from engaging in other, potentially health-promoting, behaviors. This encourages health behavior research, in addition to discovering new research fields of women's health behaviors, to consider women's working behaviors in established research fields. Health behavior research about sleep hygiene, physical activity, and healthy eating, for example, has described competing working tasks and responsibilities that prevent women from engaging in healthy behaviors (Devine et al., 2003; King et al., 2000; Tikotzky et al., 2015; Verburgh et al., 2020). Likewise, future health behavior research needs to assess working tasks and domestic and

care responsibilities as potential barriers to women's health behaviors. Thus, health behavior change interventions can develop and integrate tailored elements that support women's engagement in healthy behaviors despite competing demands (Campbell & Quintiliani, 2006; Noar et al., 2007). This entails recruiting samples that are representative of women in gender power relations: women with low access to resources, high workload, caring responsibilities, and those facing structural power imbalances, such as women who have migrated from low- and middle-income countries (UNICEF et al., 2018; World Health Organization, 2010). These groups are less likely to be represented in health psychology research (Cheon et al., 2020; Szinay et al., 2023).

2.2 Considering a gender division of cathexis in women's health behavior

The findings of this thesis further corroborate the influential role of a gender division of cathexis, particularly women's internalization of and conformity with social norms about their role as a woman in pleasing social partners in power-driven relationships (Wingood & DiClemente, 2000). Chapters III and IV confirm the salient role of social norms as a determinant of women's protective carrying behavior. Although women's descriptive norms did not quantitatively explain protective carrying behavior in Chapter III, Chapter IV indicates that their mother-in-law's descriptive norm were related to the woman's protective carrying. The women's own and their mothers-in-law's injunctive norms were related to women's carrying behavior. The qualitative results in Chapter III further elaborated that women would conform to their family members' injunctive norms by fulfilling working responsibilities foreseen by the family division of labor, even if this resulted in risky behaviors. This section uses the implications of these findings to discuss how health behavior research can consider the gender division of cathexis and social norms when understanding and addressing women's health behavior.

The role of self-identity and positive affect

The reasons for women's internalization of and conformity with social norms in gender power relations about their role as a woman can be twofold. Willingness to conform to norms and cultural ideals includes a desire to coordinate, signaling membership in a group, following the lead of others, and avoiding feelings of guilt, shame, disappointment, and rejection by their social group or their intimate partner (Bute & Jensen, 2010; H. P. Young, 2015). However, conforming to norms can also make people feel good about their behavior and about themselves (Berkowitz, 1972). Similarly, the results of this thesis found that conforming to social norms and maintaining the physical load of water carrying even when

difficulties such as pelvic organ prolapse arise can be associated with positive affect and higher quality of life and may be an important component of women's self-identity (Chapters II & III). Other studies have also reported that women can be satisfied with their larger share of domestic work when they consider it fair and in alignment with the gender division of labor (Qian & Sayer, 2016; Zuo & Bian, 2001). These results show that women can certainly experience joyful elements in their work and feel positively reinforced in their self-image when engaging in working behaviors.

However, these results emphasize that despite the impairments arising from working behaviors such as carrying loads, women may need to maintain these behaviors to fulfill their roles in the community, function in families, and maintain their self-image. In addition to gendered work behaviors, this can potentially translate to other health behaviors that are closely associated with traditional gender role ideologies about women, such as avoiding bearing many children or eating modestly (Kumar et al., 2016; Messer, 1997). Health behavior interventions need to ensure they are designed in a way that enables women to conform to norms about their role in the community and family but prevent them from negative feelings about these behaviors, such as guilt for taking care of their own health. Such interventions need to minimize the risk factors of women's working and other gender-role specific behaviors without necessarily requiring that women fully avoid these behaviors and promote non-harmful role models. In the pilot intervention for example (Chapter V), elements of a community peer were used as a positive role model were used and may also help create new behavioral norms (Paluck et al., 2016).

A gendered perspective on social norms in health behavior models

Health behavior models such as the SCT and HAPA include injunctive norms among social outcome expectancies. In line with the outlined findings of this thesis, such models should further explicitly assess descriptive norm and women's willingness and feelings about conforming to social norms when studying determinants of women's health behaviors. However, simply adding social norms to health psychology models might not be sufficient if the models do not consider the gendered aspects of norms. Cislaghi and Heise (2020) proposed that many social norms are actually gender norms; beliefs about others' expectations actually refer to what is expected from them because of the socially constructed rules of behavior assigned to their sex. They state that "gender norms are social norms defining acceptable and appropriate actions for women and men in a given group or society. They are embedded in formal and informal institutions, nested in the mind, and produced and reproduced through social interaction." (Cislaghi & Heise, 2020, p. 415-416). To highlight the gender aspect of

social norms, health behavior research should distinguish between norms that are relevant to women or to men to avoid overlooking gendered norms for health behaviors, particularly when using quantitative measures (Cislaghi & Heise, 2020).

2.3 Considering a gender division of power in women's health behavior

The findings of this thesis further emphasize the gender division of power at several levels. Impairments and enablers of power imbalances arising from women's structural and social environment represent the actual availability of opportunities and resources and affect the extent to which women have a choice about their behaviors (Ajzen, 1991; Wallston et al., 1987). In addition, this thesis located the aspect of power at women's cognitive level (Bandura, 1977): Their self-efficacy to engage and maintain pelvic-floor-protective carrying behaviors was highlighted in Chapters III–V in various respects.

This section outlines a gender division of power at the levels of women's self-efficacy for protective carrying behaviors, structural barriers, and social relationships. The implications of these findings are used to discuss how health behavior research can consider these three levels of women's unequal power when understanding and addressing women's health behavior.

Self-efficacy as the most important determinant in gender power relations

Self-efficacy was found to be the lowest of all the behavioral determinants studied and explained the greatest part of variance in protective carrying behaviors in Chapters III and IV. Convergent evidence was found in our qualitative results, which showed that self-efficacy in reducing weight carried was impaired by limited decision-making power within families and structural barriers, such as lacking reliable water access and motorized transport. Chapter IV also demonstrated a moderating effect of women's self-efficacy that buffered any potentially harmful influences of her mother-in-law's cognitions on her health-protective intentions. Chapter V then provided quasi-experimental evidence that an intervention to promote self-efficacy can enable women's protective carrying behaviors, although social support promotion was also needed to reduce the weight of loads carried compared to giving only information.

Consequently, this thesis identified self-efficacy as the most salient psychological determinant of women's health behavior and emphasized its interrelatedness with structural and social factors in contexts of unequal gender power relations. These findings are in line with the SCT and HAPA, which both hypothesize the importance of self-efficacy and its causal relationship with sociostructural determinants of health behaviors and emphasize its key role

in women's health behavior in unequal gender power relations (Bandura, 1977; Schwarzer, 1992). Even so, common health behavior models currently seem not to fully reflect the implications that may be associated with sociostructural barriers in gender power relations, such as when women cannot decide autonomously over their behavior or have only limited choices (Acharya et al., 2010; Osamor & Grady, 2016; Wingood & DiClemente, 2000).

In the following, structural and social factors that were identified in line with a gender division of power are outlined, and how they can potentially both hinder and enable women's self-efficacy and health behavior in unequal gender power relations is discussed. Another topic discussed is how these factors can be more explicitly understood and addressed by health behavior research.

Structural dimensions of power and the role of health behavior research

The findings of this thesis provide an example of how the lack of power over structural resources and challenging environment can affect women's behavioral self-efficacy, health behavior, and well-being. Chapters II and III indicated that the lack of household water infrastructure rendered water-carrying a task that women could not refuse even though it was related to increased physical burden and their well-being. Chapter II found that additional structural challenges such as living in a hilly environment can exacerbate this relationship. Chapter III then highlighted women's limited power over behavioral decisions arising from a lack of structural options; women named these in relation to low self-efficacy in avoiding risky carrying behavior.

These findings support that women in low- and middle-income countries are highly dependent on infrastructure such as basic transport, energy, and water access to play their economic and social roles (DFID, 2000; Kohler et al., 2019; UNICEF et al., 2018). They are disproportionately affected by structural impairment and can potentially profit most from advances such as improved water but infrastructure (DFID, 2000; Fisher et al., 2010; Kohler et al., 2019). Certainly, improvements in infrastructure are indispensable for women's health as well as for social, economic and environmental development, particularly at the intersection with gender (SDG 6: Industries, Innovation and Infrastructure, United Nations, 2015). However, these improvements take time, are not always technically and financially feasible and can be unreliable due, for instance, to seasonal interruptions (e.g. Starkl et al., 2013). Behavioral adaptations can prevent women's health risks complementarily to as well as in the absence of structural interventions (Ambuehl et al., 2022; Harter et al., 2020).

Promoting self-efficacy for behaviors that can cope with the health risks of structural challenges was presented in this thesis as one approach rooted in health psychology to

addressing gender power relations at the structural level. This approach has also been found successful in other low-resource contexts (Poussin et al., 2014). Complimentary to infrastructural improvements, psychological interventions can also foster women's self-efficacy to use and maintain new infrastructure and to find behavioral coping strategies in case of interruptions such as overcoming seasonal interruptions of water infrastructure by rainwater harvesting. (Bisung & Elliott, 2016; Hamlet et al., 2020; Schlef et al., 2018). Women's empowerment, a frequently discussed term in sustainable development, may be a key factor in promoting behavioral adaptations to impaired infrastructure because women can gain control over their situation by using their personal resources to achieve their goals (Jennings et al., 2014; Perkins & Zimmerman, 1995; Robinson et al., 2017).

A health behavior perspective can further address the implications of infrastructure for women's working and health behaviors by designing them in a gender-sensitive way (UNICEF et al., 2018). In terms of the division of labor, infrastructure design needs to ensure it facilitates women's workload tasks instead of increasing it (Greenwood et al., 2005), for instance by building water systems that are safe but require women to walk longer to fetch water (Sultana, 2006). Infrastructural improvements also need to address women's cultural-specific behavioral norms, such as ensuring women's privacy by designing sanitary infrastructure that reduces or eliminates the visibility of menstrual hygiene waste (Kohler et al., 2019; UNICEF et al., 2018). Finally, infrastructure designers need to consider gender power relations by paying attention to security and putting infrastructure in safe locations with good lighting (Bisung & Elliott, 2017; UNICEF et al., 2018). Infrastructure that does not address women's needs and behaviors can fail to address or even exacerbate unequal gender power relations (UNICEF et al., 2018).

Addressing power imbalances in social relationships

The findings of this thesis strongly emphasize social relationships and its power dynamics as a key source of both support and distress for women's protective carrying behaviors in unequal gender power relations. This supports previous studies on women's health behavior in low-resource populations (Hirani, 2015; Kumar et al., 2016; Mumtaz & Salway, 2007; Raman et al., 2014; Yount, 2002). One finding was that not only were women's protective carrying behaviors influenced by family members, but that decision making over women's health behavior was sometimes even transferred to them at the expense of women's behavioral self-efficacy. Chapter IV specifically examined the role of women's mothers-in-law in avoiding carrying loads during pregnancy and postpartum, a behavior that may require social collaboration, such as coordinating water carrying for women or providing resources

such as hiring someone to carry (see Chapter III for coping strategies). Thus, the significant role of social influence may be applicable to other women's health behaviors that require social collaboration or resources from others, such as maternal health care utilization, intake of nutritious foods and vitamin supplements (World Health Organization, 2016) or using contraception (Plourde et al., 2017; Sieverding, 2001). All of these behaviors require access to resources, such as transportation, financial resources, medications, or food that are likely to be managed by other family members in unequal gender power relations (Allendorf, 2017; Simkhada et al., 2010; D. K. Thapa & Niehof, 2013).

Health behavior models such as the SCT and HAPA provide important determinants for understanding the influence of social relationships on health behavior. However, integrating certain theoretical and methodological adaptations towards social influences may improve their validity and comprehensiveness when understanding and addressing women's health behavior in unequal gender power relations. A main limitation is that health behavior models such as the SCT and HAPA necessarily presuppose that engagement in healthy behavior is subject to one's own decision-making control (Schwarzer & Fuchs, 2007). The findings of this thesis suggest that women in unequal gender power relations do not hold full decision-making power over their health behavior, which is in line with other research in contexts of unequal gender power relations (Moss, 2002; Osamor & Grady, 2016; Robinson et al., 2017; World Bank, 2022). The following explains how women's limitations in individual decision-making power and the interference or coercion of others can be better considered and addressed in health behavior research.

Dyadic perspectives to account for the influence of powerful others. With the example of carrying heavy loads, this thesis identified the influential role of women's mothers-in-law, which encouraged us to include their dyadic perspective to understand women's protective carrying (Chapter IV). Common health behavior models focus on individuals and their perspective instead of including others' perspectives. They therefore largely overlook the full range of social determinants of behavior change (Berli et al., 2018; Emmons, 2000). Chapter IV found that considering a social partner's perspective in a common health behavior model such as the HAPA was useful in accounting for both the interrelatedness and the bidirectional influences of women's social networks. These findings indicate the benefit of including a dyadic perspective to understand the influence of significant others on women's health behaviors and the underlying power relations (Berli et al., 2018; Howland et al., 2016).

The following paragraph will discuss one dyadic finding in particular, because it provides potential insights into how women's health behavior may emerge in dyads that indicate

various patterns of power dynamics. Our moderation analyses in Chapter IV revealed that a mother-in-law's self-efficacy could have incremental effects on the other woman's protective carrying behavior if her own self-efficacy was low, particularly in low-quality relationships. In contrast, when both women felt self-efficacious, they had the healthiest cognitions. However, the divergence in self-efficacy between partners, with one partner having reporting self-efficacy and low-quality relationship while the other has high self-efficacy, may represent power imbalances within that dyad. Other studies in the field of relationship research have found that relationships characterized by power imbalances or mismatch in health cognitions can lead a partner with lower power to engage in health-harming behavior (Williams & Merten, 2013). In contrast, people in egalitarian, and collaborative relationships are more likely to match in their motivation to behave healthily, feel more self-efficacious, and prefer working together to improve their health (Williams & Merten, 2013; Zimmer-Gembeck, 2013). This finding is important because it shows that power dynamics within a family may determine how social relationships affect women's health behaviors in challenging environments. Women in cooperative relationships may overcome obstacles in patriarchal systems through the influence of their social partners, whereas women in power-unequal relationships are more likely to behave according to the patriarchal system.

Considering relational power imbalances in health behavior interventions. Women who face harmful social interactions may benefit from other interventions than women who have supportive social relationships. This implies that health behavior change approaches may need to develop tailored interventions to consider different family dynamics (Campbell & Quintiliani, 2006). One way found to respect power imbalances and more successfully promote change with interventions that involve social partners is to integrate active promotion of gender equal relationships such as exploring and reshaping gender roles and decision making within relationships (Barker et al., 2010; Jennings et al., 2014; Robinson et al., 2017).

However, if social partners are not supportive, it may be beneficial to identify and promote behavior change for behaviors that are less prone to interference and coercion from these social partners and can more feasibly be performed autonomously. With carrying loads, this would include women integrating protective lifting techniques in their working routines. Tightening the pelvic floor and breathing out while lifting are techniques that are likely to go fully unnoticed by others. However, such independent health behaviors may not always be available, particularly if they require the cooperation of others (Ajzen, 1985) for instance condom use. Interventions may increase women's decision making autonomy by equipping

women with resources that increase control or communication and negotiation skills to increase their influence over decisions (McDonald, 1980; Wingood & DiClemente, 2000). With carrying loads, this may be financial resources to hire help or investing in supportive equipment such as water storage. With contraceptive behaviors for example, increasing access to mobile phone and mobile banking has been found to increase women's autonomy and improve health outcomes (MacPhail et al., 2018; Wamoyi et al., 2020).

However, many social partners such as other female family members and supportive husbands have good intentions, and their goal is to collectively protect the health of all family members even in gender and power inequalities (Edmonds et al., 2011; Sapkota et al., 2014; Simkhada et al., 2010; M. F. Young et al., 2019). In these cases, involving influential social partners as supporters in health behavior change interventions can be a beneficial approach to enabling women's health behavior in unequal gender power relations.

To summarize, a gender division of power was observed at the level of structural and social barriers and therefore also at women's cognitive level in terms of their self-efficacy, and this strongly influenced women's protective carrying behavior. The following section discusses how social support may enable women's power over health behavior despite the barriers outlined here and reflects on the consequences and mechanisms of social support in unequal gender power relations.

2.4 Social support to enable women's health behavior in unequal gender power relations

Research aiming to promote women's empowerment has proposed that social support may influence women's personal sense of power (Barringer et al., 2017), which is in line with social support promoting self-efficacy according to the enabling hypothesis (Benight & Bandura, 2004; Schwarzer & Knoll, 2007). In line with these theoretical assumptions, Chapter III emphasized that one common way to cope with the health risks of carrying heavy loads despite limited structural power was through social support, such as family members supporting the women by carrying loads in times of need. Based on the enabling hypothesis, the present research promoted social support in addition to promoting self-efficacy to better enable women's protective carrying behaviors. Chapter V found that social support promotion had the highest increase in both protective carrying behaviors, although this increase over the self-efficacy-only condition was only significant for a greater reduction of weight carried. These findings are in line with other studies that reported beneficial effects of social support promotion on health behavior change (Keyserling et al., 2002; Rackow et al., 2015), the importance of social support for women in low-resource populations (Keyserling et al., 2002;

McCarter-Spaulding & Gore, 2012; Raman et al., 2014; M. F. Young et al., 2019), and social support as a resource to enable women's health behavior in gender power relations.

Self-efficacy and social support

Against our expectations, we did not find that social support promotion increased women's self-efficacy and thus did not quasi-experimentally support the enabling hypothesis in Chapter V, even though we had identified the interconnectedness of social influences and self-efficacy in Chapters III and IV. These results invite reflection on the mechanisms of social exchange processes to promote women's health behaviors in unequal gender power relations and their interrelatedness with self-efficacy.

Social support and dependencies in social relationships. One potential reason why social support promotion did not strengthen women's behavioral self-efficacy is that social support promotion facilitated women's dependencies on their social partners (Berkhuysen et al., 1999; Bolger et al., 2000; Joekes et al., 2007). Whenever the performance of a behavior depends on the cooperation of other people, control over health behaviors is incomplete (Ajzen, 1985). More explicitly, when women managed to reduce the health risks of carrying heavy loads only because another person carried weight for them, they may have continued to depend on their social network, resulting in lower self-efficacy. Other studies have also found that social support may signal to recipients that they are dependent on providers' help and incapable of coping independently with a stressful situation, consequently decreasing self-efficacy and well-being (Berkhuysen et al., 1999; Berli et al., 2018; Bolger et al., 2000; Joekes et al., 2007).

Support that is provided beyond the recipient's awareness or attempts to maintain reciprocal support relationships such as equal support have been found beneficial to avoiding feelings of dependency and negative affect (Antonucci et al., 1990; Gleason et al., 2008; Howland & Simpson, 2010). Particularly in unequal gender power relations, social support interventions should consider a long-term goal to promote health behavior independently of a social partner (Garrison-Desany et al., 2021; Robinson et al., 2017; United Nations, 2015; World Health Organization, 2010). Although no research has investigated different types of social support interventions in unequal gender power relations, jointly making an action plan for the recipient (Scholz et al., 2020) instead of simply shifting working tasks to the support provider are one example of a social support intervention that may increase independence. In any case, social support interventions for women's health behaviors need to monitor potential side effects on self-efficacy, dependence, and well-being to avoid unintentionally exacerbating power relations.

Enabling or cultivating. Instead of social support enabling increased self-efficacy, our findings pointed towards a cultivating effect of self-efficacy, so that self-efficacy promotion was related to more social support (Benight & Bandura, 2004). Across studies comparing the temporal dynamics of self-efficacy and social support in health behavior, some provide evidence for the cultivating hypothesis (Hohl et al., 2016; Schwaninger et al., 2021), whereas others support the enabling hypothesis (Banik et al., 2017). These results may indicate that both causal relationships co-exist. In some situations, enabling self-efficacy may be more important, whereas in others promoting social support is more beneficial. However, the intervention that was conducted in this thesis was not ideally suited to systematically detecting whether health behavior in gender power relations can be promoted via self-efficacy enabling social support or vice versa. Longitudinal mediation modeling is needed to disentangle this reciprocity, ideally with various conditions testing the effect of one promotion on another, of unfolding temporal dynamics, and of processes of self-efficacy and social support (Scholz, 2019; Schwaninger et al., 2021).

Mechanisms of social support interventions in unequal gender power relations

Although social support promotion successfully enabled behavior change towards protective carrying behaviors, the results of this thesis suggest that certain types of social influences and social exchange processes may be beneficial to promoting women's health behaviors without necessarily promoting self-efficacy. One possible social exchange mechanism to change behavior is social control: urging social partners to modify their health behaviors regardless of their own intentions (M. A. Lewis & Butterfield, 2005). Social control has been reported as an outcome of social support interventions and can promote behavior change, but mostly it does not enable self-efficacy and sometimes even reduces it (Hohl et al., 2018; Okun et al., 2007). Indeed, intergenerational or hierarchical family systems can be characterized by social control of younger women's behavior (Kumar et al., 2016; Raman et al., 2014). In light of the dynamics of decision making and coercion, such that family members may have expected women to carry loads even during pregnancies (Chapters III & IV), social partners likely exercised social control in addition to or instead of providing social support to enable protective carrying after the interventions (Chapter V). Future studies observing women's health behavior in unequal gender power relations need to assess social control as potentially both a predictor in health behavior models and an outcome of social support interventions.

However, social control is only one potential mechanism of social support interventions in unequal gender power relations. Recent conceptualizations in social support research

have highlighted the heterogeneity of behavior change interventions involving social partners and the various mechanisms by which these can affect recipients' behavior (Scholz et al., 2020). In general, there seem to be no evidence-based recommendations on how social support interventions need to be designed to optimally promote self-efficacy. Future intervention studies involving a social partner should assess the content, adequacy, and quality of support and consider various dyadic processes of behavior change (M. A. Lewis & Butterfield, 2005; Rothman et al., 2020; Scholz et al., 2020). Following a systematic approach to reporting and evaluating social support interventions can enable researchers to identify and promote forms of support that best increase autonomy and self-efficacy and thus help enable women to independently maintain health behaviors despite unequal power relations (Garrison-Desany et al., 2021; Robinson et al., 2017). More qualitative research is needed to understand how, when, and by whom women wish to be supported to feel capable of taking care of their health.

2.5 Contextualizing gender power relations through qualitative methods

This thesis developed its recommendations towards the addressing of unequal gender power relations in relation to women's health behaviors from findings about women's pelvic-floor-protective carrying in Nepal and from theoretical assumptions derived from combining health behavior models with the theory of gender and power. However, it is important to recognize that gender power relations may have context-specific origins and that the consequences of gender inequity are generally complex in nature (Garrison-Desany et al., 2021). Specifically, the gender divisions of labor, power and cathexis can be expressed and perceived in many different ways and also their consequences on women's behavior are likely to vary contextually and need to be explored.

Qualitative approaches can identify context-specific structures of gender power relations and their implications for health psychology theory in other populations (Amacker et al., 2017; Garrison-Desany et al., 2021). Adding qualitative measures to existing quantitative ones that assess the HAPA determinants, for example, presents a robust approach to a context-sensitive adaptation of measurement instruments (Ambuehl & Inauen, 2022).

Qualitative measures also enable the opportunity to address power imbalances between researchers and study participants (Cornwall, 2003). By avoiding a top-down process in which the priorities about a topic are based on researchers' perceptions or a theory chosen by them, the women decide which aspects they value as important (Amacker et al., 2017). Choosing qualitative, participatory measures such as the storytelling picture task described in Chapter III can empower women to explain behaviors and processes and other topics of their

choice freely from their own perspective and express connected thoughts and feelings without the researcher superimposing any theory (Amacker et al., 2017; Feldman et al., 2004).

3. Gender and power inequalities in other populations

The aim of this thesis was to discuss the implications of unequal gender power relations for women's health behavior with the example of carrying heavy loads in rural Nepal. Unequal relations of power can also have implications for the health behavior of other populations, which encourages a general consideration of power dynamics in health behavior research.

3.1 Implications for other genders

Gender norms and power dynamics have also been investigated in relation to men's health-impairing behaviors, and to a greater extent than for women (Fleming & Agnew-Brune, 2015; Sabo & Gordon, 1995). Whereas gender norms in women typically constrain women's decision-making power over their health and health behavior, they can be harmful for men by presenting risky health behaviors as expressions of masculinity such as being dominant, courageous, and invulnerable (R. Connell, 1987; Odimegwu et al., 2013; Sabo & Gordon, 1995).

A review by Fleming and Agnew-Brune (2015) discussed the various ways in which norms about masculinity and their internalization can lead to health-harming behavior in men. These include higher alcohol and tobacco consumption, avoiding healthy food options, and risky sexual behaviors such as having numerous sexual partners without using condoms. Men have been found to be at risk of avoiding help-seeking behaviors, including screening for and treating physical and psychological health conditions, particularly when they internalize norms about masculinity (Addis & Mahalik, 2003; Odimegwu et al., 2013). Norms about masculinity can also lead to aggressive or dangerous behavior to gain authority or recognition from others, leading to violence, including violence against other men which increases the risk of injury (Fleming & Agnew-Brune, 2015).

In the same way as for women, when ethnicity, socioeconomic status, strong patriarchal values, and gender intersect, men are at higher risk from psychosocial factors that can lead to violence, sexually risky behavior, suicide, as well as drug and alcohol abuse (Odimegwu et al., 2013; Staples, 1995).

Research into the impact of gender norms on health and health behavior mainly examines the binarity of male and female genders. Studies on trans and queer identities are rare in this field (Fleming & Agnew-Brune, 2015). However, forms of heteronormativity and gender

normativity, defined as beliefs and practices in which sex and gender and sexual orientations are unquestionable binaries, have been found to have detrimental effects on the health of people who deviate from that norm (Cicero et al., 2019; Zeeman et al., 2019).

For example, lesbian, gay, bisexual, trans- and intersex individuals have frequently been reported to face greater barriers to seeking health care than heterosexual and cis individuals (Cicero et al., 2019; Zeeman et al., 2019). Transgender-related discrimination in particular can increase a person's risk of psychological health impairments, substance abuse, and self-harming behaviors (Cicero et al., 2019). Among other health behaviors, harmful gender norms can cause men and trans women who have sex with men to engage in risky sexual behaviors (Cicero et al., 2019). One study has also reported that transgender and gender-nonconforming youth face greater barriers to engaging in physical activity and healthy eating (Bishop et al., 2020).

Overall, these investigations encourage health behavior research to assess gender related norms and barriers in general, not only when researching women's health in unequal gender power relations. This may enable researchers to understand health behavior with a more gendered lens and to overcome inequalities in health behavior research (Alcántara et al., 2020; Barker et al., 2010; Fleming & Agnew-Brune, 2015).

3.2 Implications for other populations with impaired power

Beyond the dimensions of gender and gender expression, certain other populations also face barriers to healthy behavior arising from limited power. This thesis has frequently mentioned that both men and women in low-resource populations, especially those who are underserved in financial resources, education, or literacy or have undocumented or asylum status have limited power over health-related decisions and working conditions (de Jonge et al., 2000; Scorgie et al., 2012; World Health Organization, 2010). These barriers can impair health and healthy behavior directly and diminish people's self-efficacy in finding ways to behave healthily (Greene & Murdock, 2013; Grembowski et al., 1993; Murray et al., 2012; Schüz et al., 2020; World Health Organization, 2010). The findings and recommendations on unequal power relations in this thesis may thus generalize to people in low-resource contexts.

Another group that may face barriers to power over health decisions without the influence or cooperation of others can be people with cognitive or physical barriers (Barnard et al., 2020; Ravesloot et al., 2011). This can include people with disabilities or chronic diseases and or people of older age if their ability to participate in health behavior is constrained by personal, social, or environmental circumstances (Barnard et al., 2020; Ravesloot et al.,

2011). Cognitive barriers can include difficulty with memory and decision making in organizing behaviors, and physical barriers can include limited mobility and strength to execute behaviors (Barnard et al., 2020; Ravesloot et al., 2011; Wehmeyer & Bolding, 2001). These barriers can lead to fewer opportunities to execute independent health decisions because making and realizing health decisions can then be highly influenced by social networks including family members, caregivers, and health professionals (Barnard et al., 2020; Ravesloot et al., 2011; Stuifbergen et al., 2000; Wehmeyer & Bolding, 2001). However, increased self-efficacy and social support have also been reported as enablers of health behaviors such as physical activity and healthy diet despite personal and environmental barriers (Barnard et al., 2020; Grembowski et al., 1993).

One group of researchers has reflected how health behavior research can consider disabilities and come to similar conclusions as this thesis: Health behavior models are applicable to people with disabilities but concepts need to take a contextualized lens, such as the norms in the general population that present people with disabilities as living in nursing homes or institutions, lower expectations of independently engaging in health-promoting behaviors, and a strong emphasis on environmental facilitators and barriers (Ravesloot et al., 2011).

To conclude, not only researchers who aim to understand and promote health behavior in populations with cognitive and physical disabilities and with lower socioeconomic resources but also researchers who aim to diversify their samples in regular practice may consider this thesis's implications for theory and methods intended to assess and overcome constraints in power. Although this research might bear implications for other populations, the populations addressed above and individuals within one population can of course not be considered to all share the same barriers to and resources for health behavior. However, the discussions in this thesis can provide general recommendations on how to address and overcome inequalities in work contexts, limited decision-making power and group-specific norms in health behavior research. The discussions also provide research insights into how to promote self-efficacy and social support. Integrating and testing these recommendations promises to further contextualize health behavior theory and methods to other non- White, Educated, Industrialized, Rich, and Democratic (WEIRD) samples.

4. Recommendations for research and practice on pelvic-floor-protective carrying

This thesis was the first to look at women's carrying of heavy loads from a health behavior perspective. It outlined the importance of carrying loads in women's everyday lives in Nepal and highlighted behavioral strategies for using pelvic-floor-protective carrying

behaviors to cope with health risks. Approaches to diminishing the health risks of carrying heavy loads need to be discussed by policy makers, nongovernmental organizations, community stakeholders, health practitioners, and interdisciplinary research teams. Future studies and development programs with a behavioral perspective can contribute to the numerous studies that indicate the need for improvement in infrastructure, such as access to water, electricity, and paved roads to diminish women's workload and health risks in Nepal and other low-income countries. (Adams et al., 2020; K. Das et al., 2019; Gage, 2007; Geere & Cortobius, 2017; Thakur et al., 2018; UNICEF et al., 2018). Shifting the focus from a structural perspective to a behavioral one allows researchers to assess and understand individual behavioral risk, identify specific risk groups within populations, and find individual, behavioral coping strategies to improve health and well-being with women's own resources.

This research also showed that women in rural Nepal are likely to be aware of the risks of pelvic organ disorders before interventions, that risk awareness did not predict whether they used protective carrying behaviors, and that interventions derived from health psychology theory were superior to simply giving information in enabling women to engage in protective carrying behaviors. Community health promotion programs in Nepal and other low- and middle-income countries often focus on health education and risk awareness when promoting pelvic floor health and other reproductive health behaviors (Chandra-Mouli et al., 2015; B. Shrestha, Devkota, et al., 2014). Being aware of health risks is a starting point for behavior change, but according to the present findings, mere awareness may not be sufficient to enable women to reduce behavioral risks (Arlinghaus & Johnston, 2018; Chandra-Mouli et al., 2015). Future health behavior interventions to promote women's pelvic-floor-protective carrying and correlated pelvic floor health behaviors should therefore focus on increasing self-efficacy and social support as well as social approval as outlined in the preceding sections of this thesis.

Despite the recommendations that can be drawn, avenues for further research are also open to understand and address these pelvic-floor-protective carrying behaviors. In Chapter II, we identified women who live in hilly terrain as especially vulnerable groups because they were particularly affected in their well-being when carrying loads. Unfortunately, we did not conduct any moderation analyses to see whether the interventions that were developed later were able to reach behavioral adaptations and positive health effects in these risk groups. In general, we did not investigate whether groups with particular sociodemographic or environmental characteristics benefitted from the interventions to a greater extent than others. Further research needs to include moderation analyses to identify for whom the interventions

work and who is excluded and whether identified risk groups such as women living in hilly terrain are addressed by interventions (Alcántara et al., 2020; Armitage et al., 2021).

Although we did not find a greater effect of self-efficacy interventions on women's pelvic floor health and well-being than only giving information, all conditions presented improvements in health and well-being over time, and many of them were medium to large (Cohen, 1988). Women in all conditions received instructions and information on pelvic-floor-protective carrying behavior, and we had no control group that received no information; challenges thus arise in confirming whether these changes were achieved by promoting protective carrying. Sometimes increases in healthy behavior can also simply arise through participants' contact with the study (L. Waters et al., 2012). However, former studies on pelvic floor health behaviors have also found that symptoms of pelvic organ disorders can be reduced simply by giving information because patients immediately find and use the relevant muscles (Bø et al., 2015; Caagbay et al., 2020; Dumoulin et al., 2018).

However, it remains to be tested whether the sole promotion of pelvic-floor-protective carrying can improve women's health and well-being. One study on pelvic-floor-protective lifestyle behaviors found that giving information on protective carrying besides multiple other behaviors including pelvic floor exercises promoted health and well-being over a control group without information (Caagbay et al., 2017, 2020). However, interventions that target multiple behaviors such as pelvic-floor-protective lifestyles are often time demanding or require extensive supervision to be impactful (Bø, 2012; Dumoulin et al., 2018) and are thus difficult to implement in low-resource settings (Radl et al., 2012). They can overwhelm participants with their multiple components and ultimately fail to address any single behavior effectively (Prochaska et al., 2008). If a health behavior change promotion focusing exclusively on protective carrying behavior is indeed suitable to contributing significantly to women's health and well-being, these interventions will be groundbreaking for the prevention of pelvic organ disorders in Nepal and other countries. Promoting pelvic-floor-protective carrying seem to be less complex and time demanding than comprehensive lifestyle interventions and can be taught by trained health practitioners in the rural communities, which is likely to be more feasible and sustainable for promoting behavior change.

5. Strengths and limitations

One of the main strengths of this research is that it is the first to describe, understand, and change the behavior of carrying heavy loads from a health psychology perspective and thus adapt and test established theory and methods. Carrying heavy loads is one of the most

prevalent behaviors relevant to women's pelvic floor health in the Global South and was previously neglected in health behavior research.

This thesis was also the first to combine health psychology models with the sociological theory of gender and power. The perspective developed here considers power structures that go beyond individual decision-making power and thus embeds the process of women's individual health behavior change in its broader social context.

Another strength of this research is the stepwise, adaptive methodological approach. The quantitative analyses in Chapter II and III used large, randomized samples that allowed a description of carrying behaviors, behavioral risk factors, and determinants of protective carrying behavior in a robust test of theory-based assumptions and delivered more generalizable conclusions. The qualitative analyses used a systematic, iterative approach of inductive reasoning that converged and extended the quantitative findings and enabled a strong emphasis on the perspective of women and their family members by using semistructured interviews and storytelling methods. The findings of Chapter III encouraged the addition of a dyadic perspective to understanding the determinants of behavior. The findings of the first study (Chapters II–IV) were then used to develop interventions based on established self-efficacy theory and tested in a quasi-experimental design in Chapter IV. These study designs demonstrate not only the rigor and variety of the methods used but also its natural, adaptive nature which allowed interventions to be tailored to the resources and needs of the women in the study area.

Another strength is the contextualization of all measures and intervention materials, which were derived closely from health psychology theory. We used existing quantitative measures whenever available and systematically adapted and translated these to the local context in discussions and pretests with Nepali researchers and practitioners. The intervention materials were also derived from behavior change theory and were developed in close discussion with local researchers and practitioners to provide a culturally adapted intervention that promoted protective carrying behaviors.

Lastly, this thesis consciously aimed for a balanced range of citations of research studying all genders, from multiple disciplines and specifically considering scientific studies by researchers, institutions, and journals from the Global South. This also means that some of the cited references were published in media that are considered less impactful, but diversifying citation sources is a strength because it can help tackle power imbalances in dissemination of research. Besides these strengths, this research also presents some limitations and avenues for future research, which are discussed in the following.

5.1 Study designs

Chapters II–IV all used cross-sectional designs, and therefore no assumptions can be drawn on the causality of the associations outlined there. However, corroboration by qualitative interviews and including the perspectives of women's family members both qualitatively and quantitively provided greater fidelity to the individual cross-sectional data and a more ecologically valid context to the health cognitions and behavior studied (Chapters III & IV). Our quasi-experimental design (Chapter IV) further confirmed some of the associations of self-efficacy and social support with increased protective carrying behavior that were indicated by the two prior chapters.

Conducting longitudinal studies requires more financial and time resources, which are only reasonably invested if fundamental cross-sectional research has been conducted. No other studies that could have warranted longitudinal studies had investigated pelvic-floor-protective carrying or dyadic health psychology models in this context. The broader association of water-carrying with well-being (Chapter II) would have had a sufficient research base to be investigated in a longitudinal design. In general, conducting a smaller, longitudinal mixed-methods pilot study may be preferable to a large-scale cross-sectional study for in-depth and causal understanding of new behaviors and their correlated cognitions and emotions.

Another limitation concerns the nonrandomized design we used to test the effect of self-efficacy and social support promotion on protective carrying behaviors. We selected three geographically separated villages that randomly received one of the intervention conditions, but individual women within one village all received the same intervention. Randomization at the individual level would have risked contamination of information between villagers, who often shared water sources and forests where loads were collected. A cluster-randomized design would have avoided this risk, but such a design requires large samples and corresponding financial and human resources, which we did not have, and in any case would not have been warranted at this stage of research. This is why, in the light of the given study setting, the available research base and resources, the nonrandomized parallel trial was the most suitable study design to pilot-test the interventions.

However, this design led to further limitations in the data, such as the systematic differences between conditions at baseline (Chapter V). Although we had matched the villages according to the similarity in their data from the first study, selection bias of households and different development rates in the villages from 2019 to 2022 might have caused differences. This said, future intervention studies should favor randomized designs whenever justified and feasible.

An additional limitation of the pilot intervention trial was that we did not apply a factorial design and were therefore unable to fully investigate all effects and mechanisms of all combinations of providing information, self-efficacy, and social support. A social-support-only group was missing. In addition, insights might have been gained by including a control group with no health behavior change promotion, not even information. This group may be important to control for changes over time that are not attributable to promoting pelvic-floor-protective carrying behavior. This would be particularly important for investigating whether the improvements in women's health and well-being are caused by promoting pelvic-floor-protective carrying, as this behavior has not been investigated in isolation from other pelvic-floor lifestyle behaviors. For ethical reasons, the no-intervention control group would be able to receive information on another health or pelvic-floor health behavior as a placebo and then receive the most effective intervention after finalizing the trial, as was reported in Chapter V with a waiting list control group.

5.2 Samples

This thesis used the behavior of carrying heavy loads in Nepal as one example of women's health behavior in unequal gender power relations and used the findings from this example to discuss gender power relations in women's health behavior more generally. The generalization from this example to other low-resource populations and to other women's health behaviors remains to be tested. Nevertheless, the insights of this example provide important recommendations on theoretical and methodological approaches to be contextualized and investigated in other examples of women's health behavior in unequal gender power relations.

One further limitation was that Chapters II and III included very large sample sizes, which may have increased the probability of a Type I error (e.g. Pollard & Richardson, 1987), detecting significance for negligible effects. This was because the initial study design we had aimed and powered for had been a case study design with five villages representing different types of water access. This had to be abandoned subsequently due to a heterogeneity of water access options within the individual case villages. The dyadic study (Chapter IV) used convenience sampling: we interviewed women's mothers-in-law whenever they were available, in sufficient health and willing to participate in the study, which may limit its representativeness, because quite plausibly, mothers-in-law who were less supportive may have been included less often. A replication with a predefined sample that is powered to detect partner effects as well as actor effects may be used in further studies (Kenny et al., 2006).

5.3 Measures

One limitation in the measures was that several of them were self-reported, which can lead to socially desirable answers and other types of subjective answering bias. We counteracted potential bias with observational data wherever possible. These included the objective assessments of water-carrying distance and weight reported in Chapter II and cross-validation of self-reported breathing techniques during lifting with observations by the research assistants in Chapter V. We were not able to objectively assess weight of loads carried other than water at the individual level (Chapter V), because asking women to walk to the forest to collect firewood to measure its weight would have extended the feasible and acceptable time of household visits. However, cluster-randomized studies might conduct structured observations in designated areas at cluster level to assess water and other loads carried by passers-by. We found this procedure feasible during our pilot intervention study but did not report those data because they were village-based and collected only at follow-up. Furthermore, the self-reported, retrospective data of carrying behavior during pregnancy and postpartum might be particularly prone to subjective reporting biases, such as memorizing only selective information (Chapters III & IV, Bradburn et al., 1987). Further studies may sample women that are currently pregnant or in the postpartum stage to diminish the risks of bias in retrospective reporting. In the present study, this would have required larger study areas to meet the sample size required, because only approximately 8–10% of women in the study area met these criteria.

Finally, one of the caveats of the adaptive and needs-based research design was that we adapted the operationalization of pelvic-floor-protective carrying behavior throughout the evolution of this research. For example, the first analyses focused specifically on the carrying of water or on the carrying of loads during vulnerable periods. This may limit the comparability of the behavioral measures used. Further, in the absence of an established measure for pelvic-floor-protective lifting, we needed to develop a new measure, and the new measure had not been tested in the first studies either. However, the measure was strongly informed by physiotherapy literature and practice and cross-validated with the self-reported measures and behavioral observations described above.

At a more general level, another limitation of this research was that it neither achieved nor aimed to draw on the broader political levels of gender and power relations, such as laws and policy regulations, and it only marginally touches on environmental risk factors and enablers. Future transdisciplinary research teams may include broader political and

environmental perspectives when aiming to understand and promote women's health at all sociostructural levels of unequal gender power relations.

5.4 Personal reflections on privilege as a Western researcher and power in this research

Ethical dilemmas may arise from researching a sensitive topic such as gender and power dynamics within a Global South context as a White Western researcher. I believe that being non-Nepali and European has a strong impact on the research as a whole. In fieldwork-based research, Western researchers may actively participate in the structural power dynamics with which they aim to critically engage. The relationship between the study's Global-North-based budget and Global-South-based implementation can be perceived as reflecting elements of neocolonialism that are to be viewed critically (Flint et al., 2022). However, not conducting or discussing this research would only contribute to the neglect of unequal gender power relations by theory-based health behavior research to this day.

I do not claim that this thesis can speak for all women in gender power relations and particularly women in the Global South, because they can only speak for themselves. Still, from my position of privilege, my highest priority was to protect the best interests of every woman over any other consideration, including my clear commitment towards advocacy for and promotion of women's rights.

At the comprehensive levels of power structures that may also be reflected in this research, our research group did their best to maintain a high level of critical reflection throughout the design and implementation of the studies, at the level of collaboration as a binational, transdisciplinary project team, with research assistants in the field, and by emphasizing participants' perspectives and needs to address potential power imbalances between participants and researchers.

The natural and participatory evolution of this research project developed needs-oriented interventions based on evidence that was mostly provided by the local women and their family members in qualitative and storytelling methods. We framed these findings in established, if Western, self-efficacy theory and then discussed them with local practitioners and researchers to develop the most useful perspective in research and intervention and collaboratively design intervention materials. In addition, although not remarked in the published manuscripts, our perspective during this research was also influenced by numerous informal conversations in the field.

All interviews and observations were conducted by female Nepali researchers, not only due to the sensitive nature of the research topic but also to ensure women's confidence

during the assessments (Axinn, 1991; B. Shrestha, Onta, et al., 2014). In addition, debriefing sessions were held every night during the field research and included reflections on power between research assistants and local village residents, such as financial compensation. At the level of collaboration and capacity building, trainings and discussions in rigorous, critical research methods to support students from both Nepal and Switzerland and the evolution of career support networks between female early career researchers were given high priority in this research project.

I do not claim that these measures to address power in this research project were exhaustive, nor that they were able to overcome all potential entailments of power. I consider this to be an ongoing process of reflection and seek to continue learning about ways to address and overcome structures of power in research.

6. General conclusions

Carrying heavy loads in Nepal is one example of how women's everyday working behaviors in low-resource populations are actually health behaviors. Taking a health behavioral perspective on women's carrying of heavy loads allowed pelvic-floor-protective carrying behaviors to be investigated and identified that these are shaped by decision-making power, social norms, and identity, as suggested by the theory of gender and power. Well-established health behavior models such as the SCT and the HAPA proved useful to understanding and changing women's health behavior in unequal gender power relations with the example of protective carrying behaviors. Even so, certain methodological and theoretical adaptations may be needed to better account for women's decision-making power as well as a more gendered lens on social factors and structural barriers.

Future research should focus on developing and testing ways to strengthen self-efficacy and on enabling social exchange processes by social partners to support women in taking care of their own health complementarily to improving infrastructure, policy regulations, and law to reduce gender-based barriers to health behavior. Raising awareness of unequal gender and power relations when describing and understanding health behavior and developing behavior change interventions may be a comprehensive approach to supporting women's health behavior in low-resource populations and other people who are impaired by power inequalities. Addressing power relations is a milestone to develop socially inclusive perspectives in health behavior research and ultimately, overcome gender and social inequalities to health.

References

Acharya, D. R., Bell, J. S., Simkhada, P., van Teijlingen, E. R., & Regmi, P. R. (2010). Women's autonomy in household decision-making: A demographic study in Nepal. *Reproductive Health*, *7*(1), 15. https://doi.org/10.1186/1742-4755-7-15

Ackermann, R. A., Ledermann, T., & Kenny, D. A. (2010). Using dyadic analysis in health psychology. *The European Health Psychologist*, *12*(2), 18–20.

Acock, A. C. (2005). Working with missing values. *Journal of Marriage and Family*, *67*(4), 1012–1028. https://doi.org/10.1111/j.1741-3737.2005.00191.x

Adams, E. A., Stoler, J., & Adams, Y. (2020). Water insecurity and urban poverty in the Global South: Implications for health and human biology. *American Journal of Human Biology*, *32*(1), e23368. https://doi.org/10.1002/ajhb.23368

Adanu, R. M. K., & Johnson, T. R. B. (2009). Migration and women's health. *International Journal of Gynecology & Obstetrics*, *106*(2), 179–181. https://doi.org/10.1016/j.ijgo.2009.03.036

Addis, M. E., & Mahalik, J. R. (2003). Men, masculinity, and the contexts of help seeking. *American Psychologist*, *58*(1), 5–14. https://doi.org/10.1037/0003-066X.58.1.5

Ademas, A., Adane, M., Sisay, T., Kloos, H., Eneyew, B., Keleb, A., Lingerew, M., Derso, A., & Alemu, K. (2020). Does menstrual hygiene management and water, sanitation, and hygiene predict reproductive tract infections among reproductive women in urban areas in Ethiopia? *PLOS ONE*, *15*(8), e0237696. https://doi.org/10.1371/journal.pone.0237696

Ajzen, I. (1985). From intentions to actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control* (pp. 11–39). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-69746-3_2

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Akhter, S., Rutherford, S., Akhter Kumkum, F., Bromwich, D., Anwar, I., Rahman, A., & Chu, C. (2017). Work, gender roles, and health: Neglected mental health issues among female workers in the ready-made garment industry in Bangladesh. *International Journal of Women's Health*, *9*, 571–579. https://doi.org/10.2147/IJWH.S137250

Alarcon, G. M. (2011). A meta-analysis of burnout with job demands, resources, and attitudes. *Journal of Vocational Behavior*, *79*(2), 549–562. https://doi.org/10.1016/j.jvb.2011.03.007

Alcántara, C., Diaz, S. V., Cosenzo, L. G., Loucks, E. B., Penedo, F. J., & Williams, N. J. (2020). Social determinants as moderators of the effectiveness of health behavior

change interventions: Scientific gaps and opportunities. *Health Psychology Review*, *14*(1), 132–144. https://doi.org/10.1080/17437199.2020.1718527

Allendorf, K. (2007). Couples' reports of women's autonomy and health-care use in Nepal. *Studies in Family Planning*, *38*(1), 35–46. https://doi.org/10.1111/j.1728-4465.2007.00114.x

Allendorf, K. (2017). Like her own: Ideals and experiences of the mother-in-law/daughter-in-law relationship. *Journal of Family Issues*, *38*(15), 2102–2127. https://doi.org/10.1177/0192513X15590685

Allison, M. J., & Keller, C. (2004). Self-efficacy intervention effect on physical activity in older adults. *Western Journal of Nursing Research*, *26*(1), 31–46. https://doi.org/10.1177/0193945903259350

Amacker, M., Schlaepfer, I., Bigler, C., & Graf, A. (2017). The development of gender-responsive indicators: Towards a participatory approach. *Kvinder, Køn & Forskning*, *17*(1), 97–106. https://doi.org/10.7146/kkf.v26i1.109790

Ambuehl, B., & Inauen, J. (2022). Contextualized measurement scale adaptation: A 4-step tutorial for health psychology research. *International Journal of Environmental Research and Public Health*, *19*(19), 12775. https://doi.org/10.3390/ijerph191912775

Ambuehl, B., Kunwar, B. M., Schertenleib, A., Marks, S. J., & Inauen, J. (2022). Can participation promote psychological ownership of a shared resource? An intervention study of community-based safe water infrastructure. *Journal of Environmental Psychology*, *81*, 101818. https://doi.org/10.1016/j.jenvp.2022.101818

Ambuehl, B., Tomberge, V. M. J., Kunwar, B. M., Schertenleib, A., Marks, S. J., & Inauen, J. (2021). The role of psychological ownership in safe water management: A mixed-methods study in Nepal. *Water*, *13*(5), 589. https://doi.org/10.3390/w13050589

American Academy of Pediatrics, & American College of Obstetricians and Gynecologists (Eds.). (2017). *Guidelines for perinatal care* (8th ed.). American Academy of Pediatrics; The American College of Obstetricians and Gynecologists. https://www.acog.org/store/products/clinical-resources/guidelines-for-perinatal-care

Anderson, C. (2010). Presenting and evaluating qualitative research. *American Journal of Pharmaceutical Education*, *74*(8). https://doi.org/10.5688/aj7408141

Anderson, E. S., Wojcik, J. R., Winett, R. A., & Williams, D. M. (2006). Social-cognitive determinants of physical activity: The influence of social support, self-efficacy, outcome expectations, and self-regulation among participants in a church-based health promotion study. *Health Psychology*, *25*(4), 510–520. https://doi.org/10.1037/0278-6133.25.4.510

References

Ansari, S., Abedi, P., Hasanpoor, S., & Bani, S. (2014). The effect of interventional program on breastfeeding self-efficacy and duration of exclusive breastfeeding in pregnant women in Ahvaz, Iran. *International Scholarly Research Notices*, *2014*, 1–6. https://doi.org/10.1155/2014/510793

Antonucci, T. C., Fuhrer, R., & Jackson, J. S. (1990). Social support and reciprocity: A cross-ethnic and cross-national perspective. *Journal of Social and Personal Relationships*, *7*(4), 519–530. https://doi.org/10.1177/0265407590074008

Arlinghaus, K. R., & Johnston, C. A. (2018). Advocating for behavior change with education. *American Journal of Lifestyle Medicine*, *12*(2), 113–116. https://doi.org/10.1177/1559827617745479

Armitage, C. J., Conner, M., Prestwich, A., Bruin, M., Johnston, M., Sniehotta, F., & Epton, T. (2021). Investigating which behaviour change techniques work for whom in which contexts delivered by what means: Proposal for an international collaboratory of Centres for Understanding Behaviour Change (CUBiC). *British Journal of Health Psychology*, *26*(1), 1–14. https://doi.org/10.1111/bjhp.12479

Atinkut Asmare, B., Freyer, B., & Bingen, J. (2022). Women in agriculture: Pathways of pesticide exposure, potential health risks and vulnerability in sub-Saharan Africa. *Environmental Sciences Europe*, *34*(1), 89. https://doi.org/10.1186/s12302-022-00638-8

Avotri, J. Y., & Walters, V. (1999). ``You just look at our work and see if you have any freedom on earth'': Ghanaian women's accounts of their work and their health. *Social Science & Medicine*, *48*(9), 1123–1133. https://doi.org/10.1016/S0277-9536(98)00422-5

Axinn, W. G. (1991). The influence of interviewer sex on responses to sensitive questions in Nepal. *Social Science Research*, *20*(3), 303–318. https://doi.org/10.1016/0049-089X(91)90009-R

Bailis, D. S., Segall, A., Mahon, M. J., Chipperfield, J. G., & Dunn, E. M. (2001). Perceived control in relation to socioeconomic and behavioral resources for health. *Social Science & Medicine*, *52*(11), 1661–1676. https://doi.org/10.1016/S0277-9536(00)00280-X

Bakker, A. B., & Costa, P. L. (2014). Chronic job burnout and daily functioning: A theoretical analysis. *Burnout Research*, *1*(3), 112–119. https://doi.org/10.1016/j.burn.2014.04.003

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

References

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, *44*(9), 1175–1184. https://doi.org/10.1037/0003-066X.44.9.1175

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology & Health*, *13*(4), 623–649. https://doi.org/10.1080/08870449808407422

Bandura, A., Freeman, W. H., & Lightsey, R. (1999). Self-efficacy: The exercise of control. *Journal of Cognitive Psychotherapy*, *13*(2), 158–166. https://doi.org/10.1891/0889-8391.13.2.158

Banik, A., Luszczynska, A., Pawlowska, I., Cieslak, R., Knoll, N., & Scholz, U. (2017). Enabling, not cultivating: Received social support and self-efficacy explain quality of life after lung cancer surgery. *Annals of Behavioral Medicine*, *51*(1), 1–12. https://doi.org/10.1007/s12160-016-9821-9

Barber, M. D., Kuchibhatla, M. N., Pieper, C. F., & Bump, R. C. (2001). Psychometric evaluation of 2 comprehensive condition-specific quality of life instruments for women with pelvic floor disorders. *American Journal of Obstetrics and Gynecology*, *185*(6), 1388–1395. https://doi.org/10.1067/mob.2001.118659

Barker, G., Ricardo, C., Nascimento, M., Olukoya, A., & Santos, C. (2010). Questioning gender norms with men to improve health outcomes: Evidence of impact. *Global Public Health*, *5*(5), 539–553. https://doi.org/10.1080/17441690902942464

Barnard, E., Brown, C. R., Weiland, T. J., Jelinek, G. A., & Marck, C. H. (2020). Understanding barriers, enablers, and long-term adherence to a health behavior intervention in people with multiple sclerosis. *Disability and Rehabilitation*, *42*(6), 822–832. https://doi.org/10.1080/09638288.2018.1510550

Barringer, A., Hunter, B. A., Salina, D. D., & Jason, L. A. (2017). Empowerment and social support: Implications for practice and programming among minority women with substance abuse and criminal justice histories. *The Journal of Behavioral Health Services & Research*, *44*(1), 75–88. https://doi.org/10.1007/s11414-016-9499-6

Bartholomew, L. K., & Mullen, P. D. (2011). Five roles for using theory and evidence in the design and testing of behavior change interventions: Theory in behavior change intervention. *Journal of Public Health Dentistry*, *71*, 20–33. https://doi.org/10.1111/j.1752-7325.2011.00223.x

Becker, S., Fonseca-Becker, F., & Schenck-Yglesias, C. (2006). Husbands' and wives' reports of women's decision-making power in Western Guatemala and their effects on preventive health behaviors. *Social Science & Medicine*, *62*(9), 2313–2326. https://doi.org/10.1016/j.socscimed.2005.10.006

References

Benight, C. C., & Bandura, A. (2004). Social cognitive theory of posttraumatic recovery: The role of perceived self-efficacy. *Behaviour Research and Therapy*, *42*(10), 1129–1148. https://doi.org/10.1016/j.brat.2003.08.008

Benjamin-Chung, J., Arnold, B. F., Berger, D., Luby, S. P., Miguel, E., Colford Jr, J. M., & Hubbard, A. E. (2018). Spillover effects in epidemiology: Parameters, study designs and methodological considerations. *International Journal of Epidemiology*, *47*(1), 332–347. https://doi.org/10.1093/ije/dyx201

Bentley, M. E., Dee, D. L., & Jensen, J. L. (2003). Breastfeeding among low income, African-American women: Power, beliefs and decision making. *The Journal of Nutrition*, *133*(1), 305–309. https://doi.org/10.1093/jn/133.1.305S

Benyamini, Y., Gozlan, M., & Kokia, E. (2009). Women's and men's perceptions of infertility and their associations with psychological adjustment: A dyadic approach. *British Journal of Health Psychology*, *14*(1), 1–16. https://doi.org/10.1348/135910708X279288

Berkhuysen, M. A., Nieuwland, W., Buunk, B. P., Sanderman, R., & Rispens, P. (1999). Change in self-efficacy during cardiac rehabilitation and the role of perceived overprotectiveness. *Patient Education and Counseling*, *38*(1), 21–32. https://doi.org/10.1016/S0738-3991(98)00115-3

Berkowitz, L. (1972). Social norms, feelings, and other factors affecting helping and altruism. In *Advances in experimental social psychology* (Vol. 6, pp. 63–108). Elsevier. https://doi.org/10.1016/S0065-2601(08)60025-8

Berli, C., Lüscher, J., Luszczynska, A., Schwarzer, R., & Scholz, U. (2018). Couples' daily self-regulation: The Health Action Process Approach at the dyadic level. *PLOS ONE*, *13*(10), e0205887. https://doi.org/10.1371/journal.pone.0205887

Bietsch, K. E., LaNasa, K. H., & Sonneveldt, E. (2021). Women living with their mothers-in-law. *Gates Open Research*, *5*. https://doi.org/10.12688/gatesopenres.13433.1

Bird, C. E. (1999). Gender, household labor, and psychological distress: The impact of the amount and division of housework. *Journal of Health and Social Behavior*, 32–45.

Bishop, A., Overcash, F., McGuire, J., & Reicks, M. (2020). Diet and physical activity behaviors among adolescent transgender students: School survey results. *Journal of Adolescent Health*, *66*(4), 484–490. https://doi.org/10.1016/j.jadohealth.2019.10.026

Bisung, E., & Elliott, S. J. (2016). 'Everyone is exhausted and frustrated': Exploring psychosocial impacts of the lack of access to safe water and adequate sanitation in Usoma, Kenya. *Journal of Water, Sanitation and Hygiene for Development*, *6*(2), 205–214. https://doi.org/10.2166/washdev.2016.122

References

Bisung, E., & Elliott, S. J. (2017). Psychosocial impacts of the lack of access to water and sanitation in low- and middle-income countries: A scoping review. *Journal of Water and Health*, *15*(1), 17–30. https://doi.org/10.2166/wh.2016.158

Biswokarma, Y. (2016). *Effect of heavy lifting with a head strap on the pelvic floor across the menstrual cycle* (Publication No. 10253058) [Doctoral dissertation, Loma Linda University]. ProQuest Dissertations Publishing. https://www.proquest.com/docview/1938283861?pq-origsite=gscholar&fromopenview=true

Blackden, M., & Wodon, Q. (2006). Gender, time use, and poverty: Introduction. In M. Blackden & Q. Wodon (Eds.), *Gender, time use, and poverty in sub-Saharan Africa*. The World Bank.

Bø, K. (2004). Urinary incontinence, pelvic floor dysfunction, exercise and sport. *Sports Medicine*, *34*(7), 451–464. https://doi.org/10.2165/00007256-200434070-00004

Bø, K. (2006). Can pelvic floor muscle training prevent and treat pelvic organ prolapse? *Acta Obstetricia et Gynecologica Scandinavica*, *85*(3), 263–268. https://doi.org/10.1080/00016340500486800

Bø, K. (2012). Pelvic floor muscle training in treatment of female stress urinary incontinence, pelvic organ prolapse and sexual dysfunction. *World Journal of Urology*, *30*(4), 437–443. https://doi.org/10.1007/s00345-011-0779-8

Bø, K., Berghmans, B., Mørkved, S., & Van Kampen, M. (Eds.). (2015). *Evidence-based physical therapy for the pelvic floor: Bridging science and clinical practice* (2nd ed.). Churchill Livingstone.

Bolger, N., Zuckerman, A., & Kessler, R. C. (2000). Invisible support and adjustment to stress. *Journal of Personality and Social Psychology*, *79*(6), 953–961. https://doi.org/10.1037/0022-3514.79.6.953

Bonzini, M., Coggon, D., Godfrey, K., Inskip, H., Crozier, S., & Palmer, K. T. (2009). Occupational physical activities, working hours and outcome of pregnancy: Findings from the Southampton Women's Survey. *Occupational and Environmental Medicine*, *66*(10), 685–690. https://doi.org/10.1136/oem.2008.043935

Borah, S. (2015). Physiological workload of hill farm women of Meghalaya, India involved in firewood collection. *Procedia Manufacturing*, *3*, 4984–4990. https://doi.org/10.1016/j.promfg.2015.07.648

Bowling, N. A., Alarcon, G. M., Bragg, C. B., & Hartman, M. J. (2015). A meta-analytic examination of the potential correlates and consequences of workload. *Work & Stress*, *29*(2), 95–113. https://doi.org/10.1080/02678373.2015.1033037

References

Bradburn, N. M., Rips, L. J., & Shevell, S. K. (1987). Answering autobiographical questions: The impact of memory and inference on surveys. *Science*, *236*(4798), 157–161. https://doi.org/10.1126/science.3563494

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bute, J. J., & Jensen, R. E. (2010). Low-income women describe fertility-related expectations: Descriptive norms, injunctive norms, and behavior. *Health Communication*, *25*(8), 681–691. https://doi.org/10.1080/10410236.2010.521909

Caagbay, D.-M., Black, K., Dangal, G., & Rayes-Greenow, C. (2017). Can a leaflet with brief verbal instruction teach Nepali women how to correctly contract their pelvic floor muscles? *Journal of Nepal Health Research Council*, *15*(2), 105–109. https://doi.org/10.3126/jnhrc.v15i2.18160

Caagbay, D.-M., Raynes-Greenow, C., Dangal, G., Mc Geechan, K., & Black, K. I. (2020). Impact of an informational flipchart on lifestyle advice for Nepali women with a pelvic organ prolapse: A randomized controlled trial. *International Urogynecology Journal*, *31*(6), 1223–1230. https://doi.org/10.1007/s00192-020-04228-1

Campbell, M. K., & Quintiliani, L. M. (2006). Tailored interventions in public health: Where does tailoring fit in interventions to reduce health disparities? *American Behavioral Scientist*, *49*(6), 775–793. https://doi.org/10.1177/0002764205283807

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*(2), 267–283. https://doi.org/10.1037/0022-3514.56.2.267

Chandra-Mouli, V., Lane, C., & Wong, S. (2015). What does not work in adolescent sexual and reproductive health: A review of evidence on interventions commonly accepted as best practices. *Global Health: Science and Practice*, *3*(3), 333–340. https://doi.org/10.9745/GHSP-D-15-00126

Chant, S. (2014). Exploring the "feminisation of poverty" in relation to women's work and home-based enterprise in slums of the Global South. *International Journal of Gender and Entrepreneurship*, *6*(3), 296–316. https://doi.org/10.1108/IJGE-09-2012-0035

Charles, L. E., Loomis, D., & Demissie, Z. (2009). Occupational hazards experienced by cleaning workers and janitors: A review of the epidemiologic literature. *Work*, *34*(1), 105–116. https://doi.org/10.3233/WOR-2009-0907

Charmaz, K., & Henwood, K. (2017). Grounded theory methods for qualitative psychology. In C. Willig & W. S. Rogers (Eds.), *The SAGE handbook of qualitative research in*

psychology (pp. 238–256). SAGE Publications Ltd. https://doi.org/10.4135/9781526405555.n14

Chehreh, R., Zahrani, S. T., Karamelahi, Z., & Baghban, A. A. (2021). Effect of peer support on breastfeeding self-efficacy in Ilamian primiparous women: A single-blind randomized clinical trial. *Journal of Family Medicine and Primary Care*, *10*(9), 3417–3423. https://doi.org/10.4103/jfmpc.jfmpc_172_21

Cheon, B. K., Melani, I., & Hong, Y. (2020). How USA-centric is psychology? An archival study of implicit assumptions of generalizability of findings to human nature based on origins of study samples. *Social Psychological and Personality Science*, *11*(7), 928–937. https://doi.org/10.1177/1948550620927269

Chibuike, C., & Innocent, O. (2016). An analysis of the culture of patriarchy and the participation of women in politics in enugu north senatorial zone. *Specialty Journal of Politics and Law*, *1*(1), 85–98.

Chipojola, R., Chiu, H.-Y., Huda, M. H., Lin, Y.-M., & Kuo, S.-Y. (2020). Effectiveness of theory-based educational interventions on breastfeeding self-efficacy and exclusive breastfeeding: A systematic review and meta-analysis. *International Journal of Nursing Studies*, *109*, 103675. https://doi.org/10.1016/j.ijnurstu.2020.103675

Cho, Y.-M., Lee, S., Islam, S. M. S., & Kim, S.-Y. (2018). Theories applied to m-health interventions for behavior change in low- and middle-income countries: A systematic review. *Telemedicine and E-Health*, *24*(10), 727–741. https://doi.org/10.1089/tmj.2017.0249

Chow, D., & Rodríguez, L. V. (2013). Epidemiology and prevalence of pelvic organ prolapse. *Current Opinion in Urology*, *23*(4), 293–298. https://doi.org/10.1097/MOU.0b013e3283619ed0

Chow, S., & Mullan, B. (2010). Predicting food hygiene. An investigation of social factors and past behaviour in an extended model of the Health Action Process Approach. *Appetite*, *54*(1), 126–133. https://doi.org/10.1016/j.appet.2009.09.018

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. In *Advances in experimental social psychology* (Vol. 24, pp. 201–234). Elsevier. https://doi.org/10.1016/S0065-2601(08)60330-5

Cicero, E. C., Reisner, S. L., Silva, S. G., Merwin, E. I., & Humphreys, J. C. (2019). Health care experiences of transgender adults: An integrated mixed research literature review. *Advances in Nursing Science*, *42*(2), 123–138. https://doi.org/10.1097/ANS.0000000000000256

References

Cislaghi, B., & Heise, L. (2020). Gender norms and social norms: Differences, similarities and why they matter in prevention science. *Sociology of Health & Illness*, *42*(2), 407–422. https://doi.org/10.1111/1467-9566.13008

Closson, K., Dietrich, J. J., Lachowsky, N. J., Nkala, B., Palmer, A., Cui, Z., Beksinska, M., Smit, J. A., Hogg, R. S., Gray, G., Miller, C. L., & Kaida, A. (2018). Sexual self-efficacy and gender: A review of condom use and sexual negotiation among young men and women in sub-Saharan Africa. *The Journal of Sex Research*, *55*(4–5), 522–539. https://doi.org/10.1080/00224499.2017.1421607

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge.

Colditz, G. A. (Ed.). (2015). *The SAGE encyclopedia of cancer and society* (2nd ed.). SAGE Publications, Inc.

Connell, L. E., Carey, R. N., de Bruin, M., Rothman, A. J., Johnston, M., Kelly, M. P., & Michie, S. (2019). Links between behavior change techniques and mechanisms of action: An expert consensus study. *Annals of Behavioral Medicine*, *53*(8), 708–720. https://doi.org/10.1093/abm/kay082

Connell, R. (1987). *Gender and power: Society, the person and sexual politics*. Polity Press.

Cornwall, A. (2003). Whose voices? Whose choices? Reflections on gender and participatory development. *World Development*, *31*(8), 1325–1342. https://doi.org/10.1016/S0305-750X(03)00086-X

Cox, R., Rodnyansky, S., Henwood, B., & Wenzel, S. (2017). Measuring population estimates of housing insecurity in the united states: A comprehensive approach. *CESR - Schaeffer Working Paper No. 2017-012*. https://doi.org/10.2139/ssrn.3086243

Cramer, E., & Hunter, B. (2019). Relationships between working conditions and emotional wellbeing in midwives. *Women and Birth*, *32*(6), 521–532. https://doi.org/10.1016/j.wombi.2018.11.010

Creswell, J. W. (2015). *A concise introduction to mixed methods research*. SAGE.

Curtis, V. (1986). *Women and the transport of water*. Intermediate Technology Publications. https://practicalactionpublishing.com/book/2423/women-and-the-transport-of-water

Darj, E., Chalise, P., & Shakya, S. (2019). Barriers and facilitators to cervical cancer screening in Nepal: A qualitative study. *Sexual & Reproductive Healthcare*, *20*, 20–26. https://doi.org/10.1016/j.srhc.2019.02.001

Darshan, A. (2009). Prevalence of uterine prolapse amongst gynecology OPD patients

in Tribhuvan University teaching hospital in Nepal and its sociocultural determinants. In *Safe Motherhood Network Federation (SMNF), Beyond Beijing Committee (BBC).* Tribhnuvan University Teaching Hospital (TUTH).

Das, K., Pradhan, G., & Nonhebel, S. (2019). Human energy and time spent by women using cooking energy systems: A case study of Nepal. *Energy*, *182*, 493–501. https://doi.org/10.1016/j.energy.2019.06.074

Das, P., Baker, K. K., Dutta, A., Swain, T., Sahoo, S., Das, B. S., Panda, B., Nayak, A., Bara, M., Bilung, B., Mishra, P. R., Panigrahi, P., Cairncross, S., & Torondel, B. (2015). Menstrual hygiene practices, WASH access and the risk of urogenital infection in women from Odisha, India. *PLOS ONE*, *10*(6), e0130777. https://doi.org/10.1371/journal.pone.0130777

Davis, R., Campbell, R., Hildon, Z., Hobbs, L., & Michie, S. (2015). Theories of behaviour and behaviour change across the social and behavioural sciences: A scoping review. *Health Psychology Review*, *9*(3), 323–344. https://doi.org/10.1080/17437199.2014.941722

de Jong, K., Ariti, C., van der Kam, S., Mooren, T., Shanks, L., Pintaldi, G., & Kleber, R. (2016). Monitoring and evaluating psychosocial intervention outcomes in humanitarian aid. *PLOS ONE*, *11*(6), e0157474. https://doi.org/10.1371/journal.pone.0157474

de Jonge, J., Bosma, H., Peter, R., & Siegrist, J. (2000). Job strain, effort-reward imbalance and employee well-being: A large-scale cross-sectional study. *Social Science & Medicine*, *50*(9), 1317–1327. https://doi.org/10.1016/S0277-9536(99)00388-3

DePadilla, L., Windle, M., Wingood, G., Cooper, H., & DiClemente, R. (2011). Condom use among young women: Modeling the theory of gender and power. *Health Psychology*, *30*(3), 310–319. https://doi.org/10.1037/a0022871

Department of Health Services, Ministry of Health and Population Nepal. (2019). *Nepal Department of Health Services annual report 2017-2018*. https://ghdx.healthdata.org/record/nepal-department-health-services-annual-report-2017-2018

Dethier, J.-J., & Effenberger, A. (2012). Agriculture and development: A brief review of the literature. *Economic Systems*, *36*(2), 175–205. https://doi.org/10.1016/j.ecosys.2011.09.003

Devine, C. M., Connors, M. M., Sobal, J., & Bisogni, C. A. (2003). Sandwiching it in: Spillover of work onto food choices and family roles in low- and moderate-income urban households. *Social Science & Medicine*, *56*(3), 617–630. https://doi.org/10.1016/S0277-9536(02)00058-8

Devkota, H. R., Sijali, T. R., Harris, C., Ghimire, D. J., Prata, N., & Bates, M. N.

(2020). Bio-mechanical risk factors for uterine prolapse among women living in the hills of west Nepal: A case-control study. *Women's Health*, *16*, 174550651989517. https://doi.org/10.1177/1745506519895175

DFID (Ed.). (2000). *Poverty elimination and the empowerment of women: Strategies for achieving the international development targets*. DFID.

Doku, D. T., & Asante, K. O. (2015). Women's approval of domestic physical violence against wives: Analysis of the Ghana demographic and health survey. *BMC Women's Health*, *15*(1), 120. https://doi.org/10.1186/s12905-015-0276-0

Drever, F. (2004). Exploring the relation between class, gender, and self rated general health using the new socioeconomic classification. A study using data from the 2001 census. *Journal of Epidemiology & Community Health*, *58*(7), 590–596. https://doi.org/10.1136/jech.2003.013383

Due, U., Brostrøm, S., & Lose, G. (2016). Lifestyle advice with or without pelvic floor muscle training for pelvic organ prolapse: A randomized controlled trial. *International Urogynecology Journal*, *27*(4), 555–563. https://doi.org/10.1007/s00192-015-2852-0

Dumoulin, C., Cacciari, L. P., & Hay-Smith, E. J. C. (2018). Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. *Cochrane Database of Systematic Reviews*, *10*. https://doi.org/10.1002/14651858.CD005654.pub4

Earth, B., & Sthapit, S. (2002). Uterine prolapse in rural Nepal: Gender and human rights implications. A mandate for development. *Culture, Health & Sexuality*, *4*(3), 281–296. https://doi.org/10.1080/13691050110090248

Edmonds, J. K., Paul, M., & Sibley, L. M. (2011). Type, content, and source of social support perceived by women during pregnancy: Evidence from Matlab, Bangladesh. *Journal of Health, Population and Nutrition*, *29*(2), 163–173. https://doi.org/10.3329/jhpn.v29i2.7859

Eiroa-Orosa, F. J. (2020). Understanding psychosocial wellbeing in the context of complex and multidimensional problems. *International Journal of Environmental Research and Public Health*, *17*(16), 5937. https://doi.org/10.3390/ijerph17165937

Emmons, K. (2000). Health behaviors in a social context. In L. F. Berkman, I. Kawachi, & M. M. Glymour (Eds.), *Social epidemiology* (pp. 242–265). https://doi.org/10.1093/med/9780195377903.001.0001

Ernsting, A., Knoll, N., Schneider, M., & Schwarzer, R. (2015). The enabling effect of social support on vaccination uptake via self-efficacy and planning. *Psychology, Health & Medicine*, *20*(2), 239–246. https://doi.org/10.1080/13548506.2014.920957

References

European Parliament, Directorate-General for External Policies of the Union, Dalton, P., Devrim, D., Blomeyer, R., & Mut-Tracy, S. (2020). Discriminatory laws undermining women's rights: In depth analysis. *European Parliament*. https://doi.org/10.2861/906027

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Feldman, M. S., Sköldberg, K., Brown, R. N., & Horner, D. (2004). Making sense of stories: A rhetorical approach to narrative analysis. *Journal of Public Administration Research and Theory*, *14*(2), 147–170. https://doi.org/10.1093/jopart/muh010

Fisher, J., Tran, T., La, B. thi, Kriitmaa, K., Rosenthal, D., & Tran, T. (2010). Common perinatal mental disorders in northern Viet Nam: Community prevalence and health care use. *Bulletin of the World Health Organization*, *88*(10), 737–745. https://doi.org/10.2471/BLT.09.067066

Flanagan, S. V., Johnston, R., & Zheng, Y. (2012). Arsenic in tube well water in Bangladesh: Health and economic impacts and implications for arsenic mitigation. *Bulletin of the World Health Organization*, *90*(11), 839–846. https://doi.org/10.2471/BLT.11.101253

Flanagan, S. V., Marvinney, R. G., & Zheng, Y. (2015). Influences on domestic well water testing behavior in a Central Maine area with frequent groundwater arsenic occurrence. *Science of The Total Environment*, *505*, 1274–1281. https://doi.org/10.1016/j.scitotenv.2014.05.017

Fleming, P. J., & Agnew-Brune, C. (2015). Current trends in the study of gender norms and health behaviors. *Current Opinion in Psychology*, *5*, 72–77. https://doi.org/10.1016/j.copsyc.2015.05.001

Fletcher, G. J. O., Simpson, J. A., & Thomas, G. (2000). The measurement of perceived relationship quality components: A confirmatory factor analytic approach. *Personality and Social Psychology Bulletin*, *26*(3), 340–354. https://doi.org/10.1177/0146167200265007

Flint, A., Howard, G., Baidya, M., Wondim, T., Poudel, M., Nijhawan, A., Mulugeta, Y., & Sharma, S. (2022). Equity in Global North–South research partnerships: Interrogating UK funding models. *Global Social Challenges Journal*, *1*(1), 76–93. https://doi.org/10.1332/VQIL8302

Freivogel, C., & Visschers, V. H. M. (2020). Understanding the underlying psychosocial determinants of safe food handling among consumers to mitigate the transmission risk of antimicrobial-resistant bacteria. *International Journal of Environmental Research and Public Health*, *17*(7), 2546. https://doi.org/10.3390/ijerph17072546

Gage, A. J. (2007). Barriers to the utilization of maternal health care in rural Mali. *Social Science & Medicine*, *65*(8), 1666–1682. https://doi.org/10.1016/j.socscimed.2007.06.001

Galupo, M. P., Pulice-Farrow, L., & Ramirez, J. L. (2017). "Like a constantly flowing river": Gender identity flexibility among nonbinary transgender individuals. In J. D. Sinnott (Ed.), *Identity flexibility during adulthood: Perspectives in adult development* (pp. 163–177). Springer International Publishing. https://doi.org/10.1007/978-3-319-55658-1_10

Gamper, M., Seidel, J., Kupfer, A., Keim-Klärner, S., & Klärner, A. (2022). Gender and health inequalities: Social networks in the context of health and health behavior. In A. Klärner, M. Gamper, S. Keim-Klärner, I. Moor, H. von der Lippe, & N. Vonneilich (Eds.), *Social networks and health inequalities: A new perspective for research* (pp. 245–272). Springer International Publishing. https://doi.org/10.1007/978-3-030-97722-1_14

Garrison-Desany, H. M., Wilson, E., Munos, M., Sawadogo-Lewis, T., Maïga, A., Ako, O., Mkuwa, S., Hobbs, A. J., & Morgan, R. (2021). The role of gender power relations on women's health outcomes: Evidence from a maternal health coverage survey in Simiyu region, Tanzania. *BMC Public Health*, *21*(1), 909. https://doi.org/10.1186/s12889-021-10972-w

Geere, J.-A., Bartram, J., Bates, L., Danquah, L., Evans, B., Fisher, M. B., Groce, N., Majuru, B., Mokoena, M. M., Mukhola, M. S., Nguyen-Viet, H., Duc, P. P., Williams, A. R., Schmidt, W.-P., & Hunter, P. R. (2018). Carrying water may be a major contributor to disability from musculoskeletal disorders in low income countries: A cross-sectional survey in South Africa, Ghana and Vietnam. *Journal of Global Health*, *8*(1). https://doi.org/10.7189/jogh.08.010406

Geere, J.-A., & Cortobius, M. (2017). Who carries the weight of water? Fetching water in rural and urban areas and the implications for water security. *Water Alternatives*, *10*(2), 28.

Geere, J.-A., Cortobius, M., Geere, J. H., Hammer, C. C., & Hunter, P. R. (2018). Is water carriage associated with the water carrier's health? A systematic review of quantitative and qualitative evidence. *BMJ Global Health*, *3*(3), e000764. https://doi.org/10.1136/bmjgh-2018-000764

Geere, J.-A., Hunter, P. R., & Jagals, P. (2010). Domestic water carrying and its implications for health: A review and mixed methods pilot study in Limpopo province, South Africa. *Environmental Health*, *9*(1). https://doi.org/10.1186/1476-069X-9-52

George, C. M., Sima, L., Arias, M. H. J., Mihalic, J., Cabrera, L. Z., Danz, D., Checkley, W., & Gilman, R. H. (2014). Arsenic exposure in drinking water: An unrecognized

health threat in Peru. *Bulletin of the World Health Organization*, *92*(8), 565–572. https://doi.org/10.2471/BLT.13.128496

Ghetti, C., Lowder, J. L., Ellison, R., Krohn, M. A., & Moalli, P. (2010). Depressive symptoms in women seeking surgery for pelvic organ prolapse. *International Urogynecology Journal*, *21*(7), 855–860. https://doi.org/10.1007/s00192-010-1106-4

Glaser, B. G. (1999). The future of grounded theory. *Qualitative Health Research*, *9*(6), 836–845. https://doi.org/10.1177/104973299129122199

Gleason, M. E. J., Iida, M., Shrout, P. E., & Bolger, N. (2008). Receiving support as a mixed blessing: Evidence for dual effects of support on psychological outcomes. *Journal of Personality and Social Psychology*, *94*(5), 824–838. https://doi.org/10.1037/0022-3514.94.5.824

Goodwin, N. J., O'Farrell, S. E., Jagoe, K., Rouse, J., Roma, E., Biran, A., & Finkelstein, E. A. (2015). Use of behavior change techniques in clean cooking interventions: A review of the evidence and scorecard of effectiveness. *Journal of Health Communication*, *20*, 43–54. https://doi.org/10.1080/10810730.2014.1002958

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology*, *60*(1), 549–576. https://doi.org/10.1146/annurev.psych.58.110405.085530

Greene, C. A., & Murdock, K. K. (2013). Multidimensional control beliefs, socioeconomic status, and health. *American Journal of Health Behavior*, *37*(2), 227–237. https://doi.org/10.5993/AJHB.37.2.10

Greenwood, J., Seshadri, A., & Yorukoglu, M. (2005). Engines of liberation. *The Review of Economic Studies*, *72*(1), 109–133. https://doi.org/10.1111/0034-6527.00326

Grembowski, D., Patrick, D., Diehr, P., Durham, M., Beresford, S., Kay, E., & Hecht, J. (1993). Self-efficacy and health behavior among older adults. *Journal of Health and Social Behavior*, *34*(2), 89. https://doi.org/10.2307/2137237

Grøn Jensen, L. C., Boie, S., & Axelsen, S. (2022). International consultation on incontinence questionnaire – Urinary incontinence short form ICIQ-UI SF: Validation of its use in a Danish speaking population of municipal employees. *PLOS ONE*, *17*(4), e0266479. https://doi.org/10.1371/journal.pone.0266479

Gu, B., Tan, Q., & Zhao, S. (2019). The association between occupational stress and psychosomatic wellbeing among Chinese nurses. *Medicine*, *98*(22), e15836. https://doi.org/10.1097/MD.0000000000015836

Gubhaju, B. (2009). The influence of wives' and husbands' education levels on

contraceptive method choice in Nepal, 1996-2006. *International Perspectives on Sexual and Reproductive Health*, *35*(04), 176–185. https://doi.org/10.1363/3517609

Gunasekera, P., Sazaki, J., & Walker, G. (2007). Pelvic organ prolapse: Don't forget developing countries. *The Lancet*, *369*(9575), 1789–1790. https://doi.org/10.1016/S0140-6736(07)60814-9

Gupta, S., Ksoll, C., & Maertens, A. (2021). Intra-household efficiency in extended family households: Evidence from rural India. *The Journal of Development Studies*, *57*(7), 1172–1197. https://doi.org/10.1080/00220388.2020.1850696

Gurung, K., Tulachan, P. M., & Gauchan, D. (2005). *Gender and social dynamics in livestock management: A case study from three ecological zones in Nepal*. Center for Mountain Research Development (CEMORD), Kathmandu/National Agricultural Research Centre, Kathmandu.

Hagen, S., Glazener, C., Sinclair, L., Stark, D., & Bugge, C. (2009). Psychometric properties of the pelvic organ prolapse symptom score. *BJOG: An International Journal of Obstetrics & Gynaecology*, *116*(1), 25–31. https://doi.org/10.1111/j.1471-0528.2008.01903.x

Hagenaars, A., Vos, K. de, & Zaidi, M. A. (1994). *Poverty statistics in the late 1980s: Research based on micro-data*. Office for Official Publications of the European Communities.

Hagins, M., Pietrek, M., Sheikhzadeh, A., Nordin, M., & Axen, K. (2004). The effects of breath control on intra-abdominal pressure during lifting tasks. *Spine*, *29*(4), 464–469. https://doi.org/10.1097/01.BRS.0000092368.90019.D8

Halbrendt, J., Kimura, A. H., Gray, S. A., Radovich, T., Reed, B., & Tamang, B. B. (2014). Implications of conservation agriculture for men's and women's workloads among marginalized farmers in the central middle hills of Nepal. *Mountain Research and Development*, *34*(3), 214–222. https://doi.org/10.1659/MRD-JOURNAL-D-13-00083.1

Hameed, S. (2019). Universal access to sexual and reproductive health and rights: Gaps in policies in the Maldives. *Asia-Pacific Social Science Review*, *19*(3), 217–229.

Hamlet, L. C., Mwiti Kamui, M., & Kaminsky, J. (2020). Infrastructure for water security: Coping with risks in rural Kenya. *Journal of Water, Sanitation and Hygiene for Development*, *10*(3), 481–489. https://doi.org/10.2166/washdev.2020.038

Harpham, T. (2003). Measuring mental health in a cost-effective manner. *Health Policy and Planning*, *18*(3), 344–349. https://doi.org/10.1093/heapol/czg041

Harter, M., Inauen, J., & Mosler, H.-J. (2020). How does Community-Led Total Sanitation (CLTS) promote latrine construction, and can it be improved? A cluster-randomized

controlled trial in Ghana. *Social Science & Medicine*, *245*, 112705. https://doi.org/10.1016/j.socscimed.2019.112705

Harvey, M.-A. (2003). Pelvic floor exercises during and after pregnancy: A systematic review of their role in preventing pelvic floor dysfunction. *Journal of Obstetrics and Gynaecology Canada*, *25*(6), 487–498. https://doi.org/10.1016/S1701-2163(16)30310-3

Hatamleh, W. (2012). Prenatal breastfeeding intervention program to increase breastfeeding duration among low income women. *Health*, *4*(3), 143–149. https://doi.org/10.4236/health.2012.43022

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis, second edition: A regression-based approach*. Guilford Publications. http://ebookcentral.proquest.com/lib/unibern/detail.action?docID=5109647

Heath, W. (2017). *Psychology research methods: Connecting research to students' lives*. Cambridge University Press.

Hirani, S. A. A. (2015). Continuing breastfeeding with paid employment: Breastfeeding and support from women's informal social network. *Clinical Lactation*, *6*(4), 137–143. https://doi.org/10.1891/2158-0782.6.4.137

Hoff Brækken, I., Majida, M., Engh, M. E., & Bø, K. (2010). Morphological changes after pelvic floor muscle training measured by 3-dimensional ultrasonography: A randomized controlled trial. *Obstetrics & Gynecology*, *115*(2, Part 1), 317–324. https://doi.org/10.1097/AOG.0b013e3181cbd35f

Hoffmeyer-Zlotnik, J. H. P. (2003). New sampling designs and the quality of data. *Developments in Applied Statistics*, *19*, 205–217.

Hohl, D. H., Knoll, N., Wiedemann, A., Keller, J., Scholz, U., Schrader, M., & Burkert, S. (2016). Enabling or cultivating? The role of prostate cancer patients' received partner support and self-efficacy in the maintenance of pelvic floor exercise following tumor surgery. *Annals of Behavioral Medicine*, *50*(2), 247–258. https://doi.org/10.1007/s12160-015-9748-6

Hohl, D. H., Lüscher, J., Keller, J., Heuse, S., Scholz, U., Luszczynska, A., & Knoll, N. (2018). Inter-relations among negative social control, self-efficacy, and physical activity in healthy couples. *British Journal of Health Psychology*, *23*(3), 580–596. https://doi.org/10.1111/bjhp.12305

Hohl, D. H., Schultze, M., Keller, J., Heuse, S., Luszczynska, A., & Knoll, N. (2019). Inter-relations between partner-provided support and self-efficacy: A dyadic longitudinal analysis. *Applied Psychology: Health and Well-Being*, *11*(3), 522–542.

https://doi.org/10.1111/aphw.12166

Howard County General Hospital, & John Hopkins Medicine. (n.d.). *Taking Baby Home*. John Hopkins Medicine.

Howland, M., Farrell, A. K., Simpson, J. A., Rothman, A. J., Burns, R. J., Fillo, J., & Wlaschin, J. (2016). Relational effects on physical activity: A dyadic approach to the theory of planned behavior. *Health Psychology*, *35*(7), 733–741. https://doi.org/10.1037/hea0000334

Howland, M., & Simpson, J. A. (2010). Getting in under the radar: A dyadic view of invisible support. *Psychological Science*, *21*(12), 1878–1885. https://doi.org/10.1177/0956797610388817

Hsu, Y., Hitchcock, R., Niederauer, S., Nygaard, I. E., Shaw, J. M., & Sheng, X. (2018). Variables affecting intra-abdominal pressure during lifting in the early postpartum period. *Female Pelvic Medicine & Reconstructive Surgery*, *24*(4), 287–291. https://doi.org/10.1097/SPV.0000000000000462

Huber, S., Zahourek, P., & Fieder, M. (2017). Living with own or husband's mother in the household is associated with lower number of children: A cross-cultural analysis. *Royal Society Open Science*, *4*(10), 170544. https://doi.org/10.1098/rsos.170544

Humpel, N., Magee, C., & Jones, S. C. (2007). The impact of a cancer diagnosis on the health behaviors of cancer survivors and their family and friends. *Supportive Care in Cancer*, *15*(6), 621–630. https://doi.org/10.1007/s00520-006-0207-6

IMB Corp. (2021). *IBM SPSS Statistics for Windows, Version 28.0*. IMB Corp.

Inauen, J., Lilje, J., & Mosler, H.-J. (2020). Refining hand washing interventions by identifying active ingredients: A cluster-randomized controlled trial in rural Zimbabwe. *Social Science & Medicine*, *245*, 112712. https://doi.org/10.1016/j.socscimed.2019.112712

International Energy Agency. (2006). Energy for cooking in developing countries. In *World energy outlook 2006* (pp. 419–445). OECD. https://doi.org/10.1787/weo-2006-16-en

International Health Conference. (2002). Constitution of the World Health Organization. 1946. *Bulletin of the World Health Organization*, *80*(12), 983–984.

International Labour Organization. (2018). *World employment and social outlook: Trends 2018* [Report]. http://www.ilo.org/global/research/global-reports/weso/2018/WCMS_615594/lang--en/index.htm

Ip, W.-Y., Tang, C. S., & Goggins, W. B. (2009). An educational intervention to improve women's ability to cope with childbirth. *Journal of Clinical Nursing*, *18*(15), 2125–2135. https://doi.org/10.1111/j.1365-2702.2008.02720.x

Ivers, L. C., & Cullen, K. A. (2011). Food insecurity: Special considerations for

women. *The American Journal of Clinical Nutrition*, *94*(6), 1740–1744. https://doi.org/10.3945/ajcn.111.012617

Iyer, A., Sen, G., & Östlin, P. (2008). The intersections of gender and class in health status and health care. *Global Public Health*, *3*(sup1), 13–24. https://doi.org/10.1080/17441690801892174

Jelovsek, J. E., Maher, C., & Barber, M. D. (2007). Pelvic organ prolapse. *The Lancet*, *369*(9566), 1027–1038. https://doi.org/10.1016/S0140-6736(07)60462-0

Jennings, L., Na, M., Cherewick, M., Hindin, M., Mullany, B., & Ahmed, S. (2014). Women's empowerment and male involvement in antenatal care: Analyses of Demographic and Health Surveys (DHS) in selected African countries. *BMC Pregnancy and Childbirth*, *14*(1), 297. https://doi.org/10.1186/1471-2393-14-297

Joekes, K., Van Elderen, T., & Schreurs, K. (2007). Self-efficacy and overprotection are related to quality of life, psychological well-being and self-management in cardiac patients. *Journal of Health Psychology*, *12*(1), 4–16. https://doi.org/10.1177/1359105306069096

Johnston, D., Stevano, S., Malapit, H. J., Hull, E., & Kadiyala, S. (2018). Review: Time use as an explanation for the agri-nutrition disconnect: evidence from rural areas in low and middle-income countries. *Food Policy*, *76*, 8–18. https://doi.org/10.1016/j.foodpol.2017.12.011

Joyal-Desmarais, K., Lenne, R. L., Panos, M. E., Huelsnitz, C. O., Jones, R. E., Auster-Gussman, L. A., Johnson, W. F., Simpson, J. A., & Rothman, A. J. (2019). Interpersonal effects of parents and adolescents on each other's health behaviours: A dyadic extension of the theory of planned behaviour. *Psychology & Health*, *34*(5), 569–589. https://doi.org/10.1080/08870446.2018.1549733

Juhl, M., Strandberg-Larsen, K., Larsen, P. S., Andersen, P. K., Svendsen, S. W., Bonde, J. P., & Nybo Andersen, A.-M. (2013). Occupational lifting during pregnancy and risk of fetal death in a large national cohort study. *Scandinavian Journal of Work, Environment & Health*, *39*(4), 335–342. https://doi.org/10.5271/sjweh.3335

Kashy, D. A., & Kenny, D. A. (2000). The analysis of data from dyads and groups. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 452–477). Cambridge University Press.

Kassambara, A. (2022). *'Ggplot2' based publication ready plots*.

Katabaro, B. D. (2016). Patriarchy ideology dimensions of gender inequalities in stereotypes and social scripts. *International Journal of Research in Social Sciences*, *6*(3), 483–

499.

Kawabata, M., Shima, N., Hamada, H., Nakamura, I., & Nishizono, H. (2010). Changes in intra-abdominal pressure and spontaneous breath volume by magnitude of lifting effort: Highly trained athletes versus healthy men. *European Journal of Applied Physiology*, *109*(2), 279–286. https://doi.org/10.1007/s00421-009-1344-7

Kaz de Jong, Ariti, C., van der Kam, S., Mooren, T., Shanks, L., Pintaldi, G., & Kleber, R. (2016). Monitoring and evaluating psychosocial intervention outcomes in humanitarian aid. *PLOS ONE*, *11*(6), e0157474. https://doi.org/10.1371/journal.pone.0157474

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis* (Paperback edition). The Guilford Press.

Kenny, D. A., & Ledermann, T. (2010). Detecting, measuring, and testing dyadic patterns in the actor–partner interdependence model. *Journal of Family Psychology*, *24*(3), 359–366. https://doi.org/10.1037/a0019651

Keyserling, T. C., Samuel-Hodge, C. D., Ammerman, A. S., Ainsworth, B. E., Henríquez-Roldán, C. F., Elasy, T. A., Skelly, A. H., Johnston, L. F., & Bangdiwala, S. I. (2002). A randomized trial of an intervention to improve self-care behaviors of African-American women with type 2 diabetes. *Diabetes Care*, *25*(9), 1576–1583. https://doi.org/10.2337/diacare.25.9.1576

Khadgi, B., Shrestha, A., & Acharaya, R. (2015). A step towards a maternal health: Retrospective study. *International Journal of Scientific and Research Publications*, *5*(9), 761–764.

Khadgi, B., Shrestha, L., & Shrestha, S. (2015). Effectiveness of the antenatal pelvic floor exercise for stress urinary incontinence among the postpartum women. *International Journal of Scientific and Research Publications*, *5*(9), 412–414.

Khodadadi, A. B., Hansen, B., Kim, Y., & Scarinci, I. C. (2022). Latinx immigrant mothers' perceived self-efficacy and intentions regarding human papillomavirus vaccination of their daughters. *Women's Health Issues*, *32*(3), 293–300. https://doi.org/10.1016/j.whi.2021.10.009

King, A. C., Castro, C., Wilcox, S., Eyler, A. A., Sallis, J. F., & Brownson, R. C. (2000). Personal and environmental factors associated with physical inactivity among different racial–ethnic groups of U.S. middle-aged and older-aged women. *Health Psychology*, *19*(4), 354–364. https://doi.org/10.1037/0278-6133.19.4.354

Koester, D. (2015). *DLP concept brief 04: Gender & power*. Developmental Leadership Program. https://prevention-collaborative.org/wp-

content/uploads/2021/08/DLP_2015_Gender-and-Power.pdf

Kohler, P., Renggli, S., & Lüthi, C. (2019). WASH and gender in health care facilities: The uncharted territory. *Health Care for Women International*, *40*(1), 3–12. https://doi.org/10.1080/07399332.2017.1395440

Kojima, M. (2021). *Primary household energy for cooking and heating in 52 developing economies*. World Bank. https://openknowledge.worldbank.org/handle/10986/35947

Komatsu, S., Yamamoto, Y., Ito, Y., Kaneko, S., & Dhital, R. P. (2019). Water for life: Ceaseless routine efforts for collecting drinking water in remote mountainous villages of Nepal. *Environment, Development and Sustainability*, *22*(8), 7909–7925. https://doi.org/10.1007/s10668-019-00552-9

Koyuncu, A., Kadota, J. L., Mnyippembe, A., Njau, P. F., Sijali, T. R., McCoy, S. I., Bates, M. N., Harris-Adamson, C., & Prata, N. (2021). Heavy load carrying and symptoms of pelvic organ prolapse among women in Tanzania and Nepal: An exploratory study. *International Journal of Environmental Research and Public Health*, *18*(3), 1279. https://doi.org/10.3390/ijerph18031279

Krishnan, V. (2010). *Constructing an area-based socioeconomic index: A principal components analysis approach*. Early Child Development Mapping Project.

Kumar, A., Bordone, V., & Muttarak, R. (2016). Like mother(-in-law) like daughter? Influence of the older generation's fertility behaviours on women's desired family size in Bihar, India. *European Journal of Population*, *32*(5), 629–660. https://doi.org/10.1007/s10680-016-9379-z

Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. *Health Psychology*, *28*(1), 56–65. https://doi.org/10.1037/a0013424

Ledermann, T., Rudaz, M., & Grob, A. (2017). Analysis of group composition in multimember multigroup data: Multimember multigroup data. *Personal Relationships*, *24*(2), 242–264. https://doi.org/10.1111/pere.12176

Lee, L.-L., Arthur, A., & Avis, M. (2007). Evaluating a community-based walking intervention for hypertensive older people in Taiwan: A randomized controlled trial. *Preventive Medicine*, *44*(2), 160–166. https://doi.org/10.1016/j.ypmed.2006.09.001

Lee, L.-L., Kuo, Y.-C., Fanaw, D., Perng, S.-J., & Juang, I.-F. (2012). The effect of an intervention combining self-efficacy theory and pedometers on promoting physical activity among adolescents: Intervention for promoting physical activity. *Journal of Clinical Nursing*, *21*(7–8), 914–922. https://doi.org/10.1111/j.1365-2702.2011.03881.x

Lee, R., Lee, K. S., Oh, E.-G., & Kim, S. H. (2013). A randomized trial of dyadic peer support intervention for newly diagnosed breast cancer patients in Korea. *Cancer Nursing*, *36*(3), E15–E22. https://doi.org/10.1097/NCC.0b013e3182642d7c

Leech, K. A., Roemmich, R. T., Gordon, J., Reisman, D. S., & Cherry-Allen, K. M. (2022). Updates in motor learning: Implications for physical therapist practice and education. *Physical Therapy*, *102*(1), pzab250. https://doi.org/10.1093/ptj/pzab250

Lewis, M. A., & Butterfield, R. M. (2005). Antecedents and reactions to health-related social control. *Personality and Social Psychology Bulletin*, *31*(3), 416–427. https://doi.org/10.1177/0146167204271600

Lewis, M. A., & Rook, K. S. (1999). Social control in personal relationships: Impact on health behaviors and psychological distress. *Health Psychology*, *18*(1), 63–71. https://doi.org/10.1037/0278-6133.18.1.63

Lewis, S., Lee, A., & Simkhada, P. (2015). The role of husbands in maternal health and safe childbirth in rural Nepal: A qualitative study. *BMC Pregnancy and Childbirth*, *15*(1), 162. https://doi.org/10.1186/s12884-015-0599-8

Li, J. (2004). Gender inequality, family planning, and maternal and child care in a rural Chinese county. *Social Science & Medicine*, *59*(4), 695–708. https://doi.org/10.1016/j.socscimed.2003.11.041

Liang, K.-Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized linear models. *Biometrika*, *73*(1), 13–22. https://doi.org/10.1093/biomet/73.1.13

Lippke, S., & Ziegelmann, J. P. (2008). Theory-based health behavior change: Developing, testing, and applying theories for evidence-based interventions. *Applied Psychology*, *57*(4), 698–716. https://doi.org/10.1111/j.1464-0597.2008.00339.x

Long, J. A. (2021). *Comprehensive, user-friendly toolkit for probing interactions. R package version 1.1.5*.

Lowe, M., Chen, D.-R., & Huang, S.-L. (2016). Social and cultural factors affecting maternal health in rural Gambia: An exploratory qualitative study. *PLOS ONE*, *11*(9), e0163653. https://doi.org/10.1371/journal.pone.0163653

Luginbuehl, H., Lehmann, C., Baeyens, J.-P., Kuhn, A., & Radlinger, L. (2015). Involuntary reflexive pelvic floor muscle training in addition to standard training versus standard training alone for women with stress urinary incontinence: Study protocol for a randomized controlled trial. *Trials*, *16*(1), 524. https://doi.org/10.1186/s13063-015-1051-0

Luginbuehl, H., Lehmann, C., Koenig, I., Kuhn, A., Buergin, R., & Radlinger, L. (2022). Involuntary reflexive pelvic floor muscle training in addition to standard training

versus standard training alone for women with stress urinary incontinence: A randomized controlled trial. *International Urogynecology Journal*, *33*(3), 531–540. https://doi.org/10.1007/s00192-021-04701-5

Luszczynska, A. (2004). Change in breast self-examination behavior: Effects of intervention on enhancing self-efficacy. *International Journal of Behavioral Medicine, 11*(2), 95–103. https://doi.org/10.1207/s15327558ijbm1102_5

Luszczynska, A., Gutiérrez-Doña, B., & Schwarzer, R. (2005). General self-efficacy in various domains of human functioning: Evidence from five countries. *International Journal of Psychology*, *40*(2), 80–89. https://doi.org/10.1080/00207590444000041

Luszczynska, A., Hagger, M. S., Banik, A., Horodyska, K., Knoll, N., & Scholz, U. (2016). Self-efficacy, planning, or a combination of both? A longitudinal experimental study comparing effects of three interventions on adolescents' body fat. *PLOS ONE*, *11*(7), e0159125. https://doi.org/10.1371/journal.pone.0159125

Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2006). Improving fruit and vegetable consumption: A self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Education Research*, *22*(5), 630–638. https://doi.org/10.1093/her/cyl133

MacDonald, L. A., Waters, T. R., Napolitano, P. G., Goddard, D. E., Ryan, M. A., Nielsen, P., & Hudock, S. D. (2013). Clinical guidelines for occupational lifting in pregnancy: Evidence summary and provisional recommendations. *American Journal of Obstetrics and Gynecology*, *209*(2), 80–88. https://doi.org/10.1016/j.ajog.2013.02.047

MacPhail, C., Khoza, N., Selin, A., Julien, A., Twine, R., Wagner, R. G., Gomez-Olivé, X., Kahn, K., Wang, J., & Pettifor, A. (2018). Cash transfers for HIV prevention: What do young women spend it on? Mixed methods findings from HPTN 068. *BMC Public Health*, *18*(1), 10. https://doi.org/10.1186/s12889-017-4513-3

Mailey, E. L., & McAuley, E. (2014). Impact of a brief intervention on physical activity and social cognitive determinants among working mothers: A randomized trial. *Journal of Behavioral Medicine*, *37*(2), 343–355. https://doi.org/10.1007/s10865-013-9492-y

Mannell, J., Willan, S., Shahmanesh, M., Seeley, J., Sherr, L., & Gibbs, A. (2019). Why interventions to prevent intimate partner violence and HIV have failed young women in southern Africa. *Journal of the International AIDS Society*, *22*(8), e25380. https://doi.org/10.1002/jia2.25380

Marahatta, R. K., & Shah, A. (2003). Genital prolapse in women of Bhaktapur, Nepal. *Nepal Medical College Journal: NMCJ*, *5*(1), 31–33.

Matthews, S., & Power, C. (2002). Socio-economic gradients in psychological distress: A focus on women, social roles and work–home characteristics. *Social Science & Medicine*, *54*(5), 799–810. https://doi.org/10.1016/S0277-9536(01)00110-1

Maume, D. J., Sebastian, R. A., & Bardo, A. R. (2009). Gender differences in sleep disruption among retail food workers. *American Sociological Review*, *74*(6), 989–1007. https://doi.org/10.1177/000312240907400607

McCarter-Spaulding, D., & Gore, R. (2012). Social support improves breastfeeding self-efficacy in a sample of Black women. *Clinical Lactation*, *3*(3), 112–115. https://doi.org/10.1891/215805312807022923

McDonald, G. W. (1980). Family power: The assessment of a decade of theory and research, 1970-1979. *Journal of Marriage and the Family*, *42*(4), 841. https://doi.org/10.2307/351828

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, *15*(4), 351–377. https://doi.org/10.1177/109019818801500401

Megersa, B. S., Bussmann, H., Bärnighausen, T., Muche, A. A., Alemu, K., & Deckert, A. (2020). Community cervical cancer screening: Barriers to successful home-based HPV self-sampling in Dabat district, North Gondar, Ethiopia. A qualitative study. *PLOS ONE*, *15*(12), e0243036. https://doi.org/10.1371/journal.pone.0243036

Meierhofer, R., Tomberge, V. M. J., Inauen, J., & Shrestha, A. (2022). Water carrying in hills of Nepal–associations with women's musculoskeletal disorders, uterine prolapse, and spontaneous abortions. *PLOS ONE*, *17*(6), e0269926. https://doi.org/10.1371/journal.pone.0269926

Messer, E. (1997). Intra-household allocation of food and health care: Current findings and understandings—Introduction. *Social Science & Medicine*, *44*(11), 1675–1684. https://doi.org/10.1016/S0277-9536(96)00370-X

Michie, S., Jochelson, K., Markham, W. A., & Bridle, C. (2009). Low-income groups and behaviour change interventions: A review of intervention content, effectiveness and theoretical frameworks. *Journal of Epidemiology & Community Health*, *63*(8), 610–622. https://doi.org/10.1136/jech.2008.078725

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The Behavior Change Technique Taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine*, *46*(1), 81–95.

https://doi.org/10.1007/s12160-013-9486-6

Miller, J. (2001). Pelvic floor muscle contraction during a cough and decreased vesical neck mobility. *Obstetrics & Gynecology*, *97*(2), 255–260. https://doi.org/10.1016/S0029-7844(00)01132-7

Mookerjee, S. (2019). Gender-neutral inheritance laws, family structure, and women's status in India. *The World Bank Economic Review*, *33*(2), 498–515. https://doi.org/10.1093/wber/lhx004

Moran, M. B., & Sussman, S. (2014). Translating the link between social identity and health behavior into effective health communication strategies: An experimental application using antismoking advertisements. *Health Communication*, *29*(10), 1057–1066. https://doi.org/10.1080/10410236.2013.832830

Morgenroth, T., & Ryan, M. K. (2021). The effects of gender trouble: An integrative theoretical framework of the perpetuation and disruption of the gender/sex binary. *Perspectives on Psychological Science*, *16*(6), 1113–1142. https://doi.org/10.1177/1745691620902442

Moss, N. E. (2002). Gender equity and socioeconomic inequality: A framework for the patterning of women's health. *Social Science & Medicine*, *54*(5), 649–661. https://doi.org/10.1016/S0277-9536(01)00115-0

Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L., & Buick, D. (2002). The Revised Illness Perception Questionnaire (IPQ-R). *Psychology & Health*, *17*(1), 1–16. https://doi.org/10.1080/08870440290001494

Mullany, B. C. (2006). Barriers to and attitudes towards promoting husbands' involvement in maternal health in Katmandu, Nepal. *Social Science & Medicine*, *62*(11), 2798–2809. https://doi.org/10.1016/j.socscimed.2005.11.013

Mumtaz, Z., & Salway, S. M. (2007). Gender, pregnancy and the uptake of antenatal care services in Pakistan. *Sociology of Health & Illness*, *29*(1), 1–26. https://doi.org/10.1111/j.1467-9566.2007.00519.x

Murray, T. C., Rodgers, W. M., & Fraser, S. N. (2012). Exploring the relationship between socioeconomic status, control beliefs and exercise behavior: A multiple mediator model. *Journal of Behavioral Medicine*, *35*(1), 63–73. https://doi.org/10.1007/s10865-011-9327-7

Mustafa, A., Mustafa, U., & Khalid, M. (2011). Rooftop rain water harvesting technology and women time allocation in district Bagh and Battagram Pakistan. *The Pakistan Development Review*, *50*(4), 459–470. https://doi.org/10.30541/v50i4IIpp.459-470

Naidoo, S., London, L., Burdorf, A., Naidoo, R., & Kromhout, H. (2011). Spontaneous miscarriages and infant deaths among female farmers in rural South Africa. *Scandinavian Journal of Work, Environment & Health*, *37*(3), 227–236.

Nelder, J. A., & Wedderburn, R. W. M. (1972). Generalized linear models. *Journal of the Royal Statistical Society. Series A (General)*, *135*(3), 370–384. https://doi.org/10.2307/2344614

Noar, S. M., Benac, C. N., & Harris, M. S. (2007). Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychological Bulletin*, *133*(4), 673–693. https://doi.org/10.1037/0033-2909.133.4.673

O'Connell, S. B. L., Gelgoot, E. N., Grunberg, P. H., Schinazi, J., Da Costa, D., Dennis, C.-L., Rosberger, Z., & Zelkowitz, P. (2021). 'I felt less alone knowing I could contribute to the forum': Psychological distress and use of an online infertility peer support forum. *Health Psychology and Behavioral Medicine*, *9*(1), 128–148. https://doi.org/10.1080/21642850.2021.1884556

Odimegwu, C., Pallikadavath, S., & Adedini, S. (2013). The cost of being a man: Social and health consequences of Igbo masculinity. *Culture, Health & Sexuality*, *15*(2), 219–234. https://doi.org/10.1080/13691058.2012.747700

Ohkura, Y., Ichikura, K., Shindoh, J., Ueno, M., Udagawa, H., & Matsushima, E. (2020). Relationship between psychological distress and health-related quality of life at each point of the treatment of esophageal cancer. *Esophagus*, *17*(3), 312–322. https://doi.org/10.1007/s10388-019-00710-y

Okun, M. A., Huff, B. P., August, K. J., & Rook, K. S. (2007). Testing hypotheses distilled from four models of the effects of health-related social control. *Basic and Applied Social Psychology*, *29*(2), 185–193. https://doi.org/10.1080/01973530701332245

Osamor, P., & Grady, C. (2016). Women's autonomy in health care decision-making in developing countries: A synthesis of the literature. *International Journal of Women's Health*, *8*, 191–202. https://doi.org/10.2147/IJWH.S105483

Osamor, P., & Grady, C. (2018). Factors associated with women's health care decision-making autonomy: Empirical evidence from Nigeria. *Journal of Biosocial Science*, *50*(1), 70–85. https://doi.org/10.1017/S0021932017000037

Owoo, N. S., & Lambon-Quayefio, M. P. (2021). Mixed methods exploration of Ghanaian women's domestic work, childcare and effects on their mental health. *PLOS ONE*, *16*(2), e0245059. https://doi.org/10.1371/journal.pone.0245059

Oxford University Hospitals. (2016). *Your recovery after childbirth. Physiotherapy,*

exercises and advice. NHS Trust.

Paluck, E. L., Shepherd, H., & Aronow, P. M. (2016). Changing climates of conflict: A social network experiment in 56 schools. *Proceedings of the National Academy of Sciences*, *113*(3), 566–571. https://doi.org/10.1073/pnas.1514483113

Panter-Brick, C. (1989). Motherhood and subsistence work: The Tamang of rural Nepal. *Human Ecology*, *17*(2), 205–228. https://doi.org/10.1007/BF00889713

Pathak, A., Sharma, S., & Jensen, M. P. (2018). The utility and validity of pain intensity rating scales for use in developing countries. *PAIN Reports*, *3*(5), e672. https://doi.org/10.1097/PR9.0000000000000672

Pennington, A., Orton, L., Nayak, S., Ring, A., Petticrew, M., Sowden, A., White, M., & Whitehead, M. (2018). The health impacts of women's low control in their living environment: A theory-based systematic review of observational studies in societies with profound gender discrimination. *Health & Place*, *51*, 1–10. https://doi.org/10.1016/j.healthplace.2018.02.001

Perkins, D. D., & Zimmerman, M. A. (1995). Empowerment theory, research, and application. *American Journal of Community Psychology*, *23*(5), 569–579. https://doi.org/10.1007/BF02506982

Plourde, K. F., Ippoliti, N. B., Nanda, G., & McCarraher, D. R. (2017). Mentoring interventions and the impact of protective assets on the reproductive health of adolescent girls and young women. *Journal of Adolescent Health*, *61*(2), 131–139. https://doi.org/10.1016/j.jadohealth.2017.03.002

Pollard, P., & Richardson, J. T. (1987). On the probability of making Type I errors. *Psychological Bulletin*, *102*(1), 159–163. https://doi.org/10.1037/0033-2909.102.1.159

Poussin, J. K., Botzen, W. J. W., & Aerts, J. C. J. H. (2014). Factors of influence on flood damage mitigation behaviour by households. *Environmental Science & Policy*, *40*, 69–77. https://doi.org/10.1016/j.envsci.2014.01.013

Prentice, D. A., & Miller, D. T. (1993). Pluralistic ignorance and alcohol use on campus: Some consequences of misperceiving the social norm. *Journal of Personality and Social Psychology*, *64*(2), 243–256. https://doi.org/10.1037/0022-3514.64.2.243

Prochaska, J. J., Spring, B., & Nigg, C. R. (2008). Multiple health behavior change research: An introduction and overview. *Preventive Medicine*, *46*(3), 181–188. https://doi.org/10.1016/j.ypmed.2008.02.001

Pun, K. D., Infanti, J. J., Koju, R., Schei, B., Darj, E., & on behalf of the ADVANCE Study Group. (2016). Community perceptions on domestic violence against pregnant women

in Nepal: A qualitative study. *Global Health Action*, *9*(1), 31964. https://doi.org/10.3402/gha.v9.31964

Qian, Y., & Sayer, L. C. (2016). Division of labor, gender ideology, and marital satisfaction in east asia: Division of labor and marital satisfaction in asia. *Journal of Marriage and Family*, *78*(2), 383–400. https://doi.org/10.1111/jomf.12274

R Core Team. (2022). *R: a language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org

Rackow, P., Scholz, U., & Hornung, R. (2015). Received social support and exercising: An intervention study to test the enabling hypothesis. *British Journal of Health Psychology*, *20*(4), 763–776. https://doi.org/10.1111/bjhp.12139

Radl, C. M., Rajwar, R., & Aro, A. R. (2012). Uterine prolapse prevention in Eastern Nepal: The perspectives of women and health care professionals. *International Journal of Women's Health*, 373–382. https://doi.org/10.2147/IJWH.S33564

Raj, V. K., & Plichta, S. B. (1998). The role of social support in breastfeeding promotion: A literature review. *Journal of Human Lactation*, *14*(1), 41–45. https://doi.org/10.1177/089033449801400114

Raman, S., Srinivasan, K., Kurpad, A., Dwarkanath, P., Ritchie, J., & Worth, H. (2014). 'My Mother…my sisters… and my friends': Sources of maternal support in the perinatal period in urban India. *Midwifery*, *30*(1), 130–137. https://doi.org/10.1016/j.midw.2013.03.003

Rao, K., Vanguri, P., & Premchander, S. (2011). Community-based mental health intervention for underprivileged women in rural India: An experiential report. *International Journal of Family Medicine*, *2011*, 1–7. https://doi.org/10.1155/2011/621426

Rao, N. (2012). Male 'providers' and female 'housewives': A gendered co-performance in rural north India. *Development and Change*, *43*(5), 1025–1048. https://doi.org/10.1111/j.1467-7660.2012.01789.x

Ravesloot, C., Ruggiero, C., Ipsen, C., Traci, M., Seekins, T., Boehm, T., Ware-Backs, D., & Rigles, B. (2011). Disability and health behavior change. *Disability and Health Journal*, *4*(1), 19–23. https://doi.org/10.1016/j.dhjo.2010.05.006

Reeves, B. C., & Gaus, W. (2004). Guidelines for reporting non-randomised studies. *Complementary Medicine Research*, *11*(1), 46–52. https://doi.org/10.1159/000080576

Regmi, S. (2007). Nepali women and their struggles over water during pregnancy. *International Feminist Journal of Politics*, *9*(4), 522–523. https://doi.org/10.1080/14616740701608083

Reid, A. E., Cialdini, R. B., & Aiken, L. S. (2010). Social norms and health behavior. In A. Steptoe (Ed.), *Handbook of behavioral medicine* (pp. 263–274). Springer New York. https://doi.org/10.1007/978-0-387-09488-5_19

Renner, B., Spivak, Y., Kwon, S., & Schwarzer, R. (2007). Does age make a difference? Predicting physical activity of South Koreans. *Psychology and Aging*, *22*(3), 482–493. https://doi.org/10.1037/0882-7974.22.3.482

Richardson, A. S., Arsenault, J. E., Cates, S. C., & Muth, M. K. (2015). Perceived stress, unhealthy eating behaviors, and severe obesity in low-income women. *Nutrition Journal*, *14*(1), 122. https://doi.org/10.1186/s12937-015-0110-4

Risal, A., Manandhar, K., Linde, M., Steiner, T. J., & Holen, A. (2016). Anxiety and depression in Nepal: Prevalence, comorbidity and associations. *BMC Psychiatry*, *16*(1), 102. https://doi.org/10.1186/s12888-016-0810-0

Robinson, J. L., Narasimhan, M., Amin, A., Morse, S., Beres, L. K., Yeh, P. T., & Kennedy, C. E. (2017). Interventions to address unequal gender and power relations and improve self-efficacy and empowerment for sexual and reproductive health decision-making for women living with HIV: A systematic review. *PLOS ONE*, *12*(8), e0180699. https://doi.org/10.1371/journal.pone.0180699

Rocha, N. S. da, Power, M. J., Bushnell, D. M., & Fleck, M. P. (2012). The EUROHIS-QOL 8-Item Index: Comparative psychometric properties to its parent WHOQOL-BREF. *Value in Health*, *15*(3), 449–457. https://doi.org/10.1016/j.jval.2011.11.035

Romano, M., Cacciatore, A., Giordano, R., & La Rosa, B. (2010). Postpartum period: Three distinct but continuous phases. *Journal of Prenatal Medicine*, *4*, 22–25.

Rosenstock, I. M. (1974). The Health Belief Model and preventive health behavior. *Health Education Monographs*, *2*(4), 354–386. JSTOR.

Rosinger, A. Y., & Young, S. L. (2020). The toll of household water insecurity on health and human biology: Current understandings and future directions. *WIREs Water*, *7*(6), e1468. https://doi.org/10.1002/wat2.1468

Rothman, A. J., Simpson, J. A., Huelsnitz, C. O., Jones, R. E., & Scholz, U. (2020). Integrating intrapersonal and interpersonal processes: A key step in advancing the science of behavior change. *Health Psychology Review*, *14*(1), 182–187. https://doi.org/10.1080/17437199.2020.1719183

Sabo, D., & Gordon, D. (Eds.). (1995). *Men's health and illness: Gender, power, and the body*. SAGE Publications, Inc. https://doi.org/10.4135/9781452243757

Sacomori, C., Berghmans, B., Mesters, I., de Bie, R., & Cardoso, F. L. (2015).

Strategies to enhance self-efficacy and adherence to home-based pelvic floor muscle exercises did not improve adherence in women with urinary incontinence: A randomised trial. *Journal of Physiotherapy*, *61*(4), 190–198. https://doi.org/10.1016/j.jphys.2015.08.005

Sadler, P., Ethier, N., & Woody, E. (2011). Tracing the interpersonal web of psychopathology: Dyadic data analysis methods for clinical researchers. *Journal of Experimental Psychopathology*, *2*(2), 95–138. https://doi.org/10.5127/jep.010310

Sadler, P., & Woody, E. (2003). Is who you are who you're talking to? Interpersonal style and complementarily in mixed-sex interactions. *Journal of Personality and Social Psychology*, *84*(1), 80–96. https://doi.org/10.1037/0022-3514.84.1.80

Sapkota, S., Sayami, J. T., Manadhar, M. D., & Erlandsson, K. (2014). Nepalese mothers' experiences of care in labour. *Evidence Based Midwifery, 12*(4), 127–132.

Sarno, D., & Hameed, F. (2018). Pelvic pain and floor dysfunction. In M. J. Desai & J. O'Brien (Eds.), *The spine handbook* (Vol. 1). Oxford University Press. https://doi.org/10.1093/med/9780199350940.003.0024

Satyal, I., Shrestha, O., Jha, M., Chammaya, P., & Shrestha, B. (2003). *Report on utero-vaginal prolapse: Risk factors and associated problems in women's health maternity hospital, Thapathali*. Research Committee Maternity Hospital, Thapathali, Kathmandu.

Schaaf, J. M., Dongol, A., & van der Leeuw-Harmsen, L. (2008). Follow-up of prolapse surgery in rural Nepal. *International Urogynecology Journal*, *19*(6), 851–855. https://doi.org/10.1007/s00192-007-0542-2

Schad, D. J., Vasishth, S., Hohenstein, S., & Kliegl, R. (2020). How to capitalize on a priori contrasts in linear (mixed) models: A tutorial. *Journal of Memory and Language*, *110*, 104038. https://doi.org/10.1016/j.jml.2019.104038

Schlef, K. E., Kaboré, L., Karambiri, H., Yang, Y. C. E., & Brown, C. M. (2018). Relating perceptions of flood risk and coping ability to mitigation behavior in West Africa: Case study of Burkina Faso. *Environmental Science & Policy*, *89*, 254–265. https://doi.org/10.1016/j.envsci.2018.07.013

Scholz, U. (2019). It's time to think about time in health psychology. *Applied Psychology: Health and Well-Being*, *11*(2), 173–186. https://doi.org/10.1111/aphw.12156

Scholz, U., Berli, C., Lüscher, J., & Knoll, N. (2020). Dyadic behavior change interventions. In M. S. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (1st ed., pp. 632–648). Cambridge University Press. https://doi.org/10.1017/9781108677318.043

Schüz, B., Brick, C., Wilding, S., & Conner, M. (2020). Socioeconomic status

moderates the effects of health cognitions on health behaviors within participants: Two multi-behavior studies. *Annals of Behavioral Medicine*, *54*(1), 36–48. https://doi.org/10.1093/abm/kaz023

Schüz, B., Conner, M., Wilding, S., Alhawtan, R., Prestwich, A., & Norman, P. (2021). Do socio-structural factors moderate the effects of health cognitions on COVID-19 protection behaviours? *Social Science & Medicine*, *285*, 114261. https://doi.org/10.1016/j.socscimed.2021.114261

Schwaninger, P., Berli, C., Lüscher, J., & Scholz, U. (2021). Cultivation or enabling? Day-to-day associations between self-efficacy and received support in couples. *Social Science & Medicine*, *287*, 114330. https://doi.org/10.1016/j.socscimed.2021.114330

Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In R. Schwarzer (Ed.), *Self-efficacy: Through control of action* (pp. 217–243). Hemisphere.

Schwarzer, R. (2004). *Psychologie des Gesundheitsverhaltens: Einführung in die Gesundheitspsychologie [Psychology of health behavior: Introduction to health psychology]* (3rd ed.). Hogrefe.

Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*, *57*(1), 1–29. https://doi.org/10.1111/j.1464-0597.2007.00325.x

Schwarzer, R. (2016). Health Action Process Approach (HAPA) as a theoretical framework to understand behavior change. *Actualidades En Psicología*, *30*(121), 119. https://doi.org/10.15517/ap.v30i121.23458

Schwarzer, R., & Fuchs, R. (2007). Self-efficacy and health behaviors. In M. Conner & P. Norman (Eds.), *Predicting health behaviour: Research and practice with social cognition models* (2. ed., repr). Open Univ. Press.

Schwarzer, R., & Knoll, N. (2007). Functional roles of social support within the stress and coping process: A theoretical and empirical overview. *International Journal of Psychology*, *42*(4), 243–252. https://doi.org/10.1080/00207590701396641

Schwarzer, R., & Leppin, A. (1991). Social support and health: A theoretical and empirical overview. *Journal of Social and Personal Relationships*, *8*(1), 99–127. https://doi.org/10.1177/0265407591081005

Schwarzer, R., Lippke, S., & Luszczynska, A. (2011). Mechanisms of health behavior change in persons with chronic illness or disability: The Health Action Process Approach (HAPA). *Rehabilitation Psychology*, *56*(3), 161–170. https://doi.org/10.1037/a0024509

Schwarzer, R., & Schulz. (2013). *Berlin Social Support Scales (BSSS)* [Data set]. Whitaker Instiutute. https://doi.org/10.13072/midss.490

Schwarzer, R., Sniehotta, F., Lippke, S., Luszczynska, A., Scholz, U., Schüz, B., Wegner, M., & Ziegelmann, J. P. (2003). *On the assessment and analysis of variables in the health action process approach conducting an investigation.* Berlin: Freie Universität. https://doi.org/10.5167/uzh-102499

Scorgie, F., Chersich, M. F., Ntaganira, I., Gerbase, A., Lule, F., & Lo, Y.-R. (2012). Socio-demographic characteristics and behavioral risk factors of female sex workers in sub-Saharan Africa: A systematic review. *AIDS and Behavior*, *16*(4), 920–933. https://doi.org/10.1007/s10461-011-9985-z

Sharma, R., & Singh, R. (2012). Determination of safe carrying load limit for women carrying water. *Journal of Ergonomics*, *2*(2). https://doi.org/10.4172/2165-7556.1000103

Sharma, S., Palanchoke, J., Reed, D., & Haxby Abbott, J. (2017). Translation, cross-cultural adaptation and psychometric properties of the Nepali versions of numerical pain rating scale and global rating of change. *Health and Quality of Life Outcomes*, *15*(1), 236. https://doi.org/10.1186/s12955-017-0812-8

Sheng, Y., Carpenter, J. S., Ashton-Miller, J. A., & Miller, J. M. (2022). Mechanisms of pelvic floor muscle training for managing urinary incontinence in women: A scoping review. *BMC Women's Health*, *22*(1), 161. https://doi.org/10.1186/s12905-022-01742-w

Shijagurumayum Acharya, R., Tveter, A. T., Grotle, M., Khadgi, B., Braekken, I. H., & Stuge, B. (2020). Pelvic floor muscle training programme in pregnant Nepalese women—A feasibility study. *International Urogynecology Journal*, *31*(8), 1609–1619. https://doi.org/10.1007/s00192-019-04053-1

Shrestha, B., Devkota, B., Khadka, B. B., Choulagai, B., Pahari, D. P., Onta, S., Petzold, M., & Krettek, A. (2014). Knowledge on uterine prolapse among married women of reproductive age in Nepal. *International Journal of Women's Health*, 771—779. https://doi.org/10.2147/IJWH.S65508

Shrestha, B., Onta, S., Choulagai, B., Paudel, R., Petzold, M., & Krettek, A. (2015). Uterine prolapse and its impact on quality of life in the Jhaukhel–Duwakot Health Demographic Surveillance Site, Bhaktapur, Nepal. *Global Health Action*, *8*(1), 28771. https://doi.org/10.3402/gha.v8.28771

Shrestha, B., Onta, S., Choulagai, B., Poudyal, A., Pahari, D. P., Uprety, A., Petzold, M., & Krettek, A. (2014). Women's experiences and health care-seeking practices in relation to uterine prolapse in a hill district of Nepal. *BMC Women's Health*, *14*(1).

https://doi.org/10.1186/1472-6874-14-20

Shrestha, S., Aihara, Y., Bhattarai, A. P., Bista, N., Kondo, N., Futaba, K., Nishida, K., & Shindo, J. (2018). Development of an objective water security index and assessment of its association with quality of life in urban areas of developing countries. *SSM - Population Health*, *6*, 276–285. https://doi.org/10.1016/j.ssmph.2018.10.007

Shrestha, S., Chapagain, P. S., & Ghimire, M. (2019). Gender perspective on water use and management in the context of climate change: A case study of Melamchi Watershed area, Nepal. *SAGE Open*, *9*(1), 215824401882307. https://doi.org/10.1177/2158244018823078

Sieverding, M. (2001). Gender and reproductive health. In *International encyclopedia of the social & behavioral sciences* (pp. 5969–5972). Elsevier. https://doi.org/10.1016/B0-08-043076-7/03861-4

Silver, R. C., Wortman, C. B., & Crofton, C. (1990). The role of coping in support provision: The self-presentational dilemma of victims of life crises. In B. R. Sarason, I. G. Sarason, & G. R. Pierce (Eds.), *Social support: An interactional view* (pp. 397–426). J. Wiley & Sons.

Simkhada, B., Porter, M. A., & van Teijlingen, E. R. (2010). The role of mothers-in-law in antenatal care decision-making in Nepal: A qualitative study. *BMC Pregnancy and Childbirth*, *10*(1). https://doi.org/10.1186/1471-2393-10-34

Smith-Estelle, A., & Gruskin, S. (2003). Vulnerability to HIV/STIs among rural women from migrant communities in Nepal: A health and human rights framework. *Reproductive Health Matters*, *11*(22), 142–151. https://doi.org/10.1016/S0968-8080(03)02292-4

Sorensen, G., Emmons, K., Hunt, M. K., Barbeau, E., Goldman, R., Peterson, K., Kuntz, K., Stoddard, A., & Berkman, L. (2003). Model for incorporating social context in health behavior interventions: Applications for cancer prevention for working-class, multiethnic populations. *Preventive Medicine*, *37*(3), 188–197. https://doi.org/10.1016/S0091-7435(03)00111-7

Sørensen, K., Pelikan, J. M., Röthlin, F., Ganahl, K., Slonska, Z., Doyle, G., Fullam, J., Kondilis, B., Agrafiotis, D., Uiters, E., Falcon, M., Mensing, M., Tchamov, K., Broucke, S. van den, & Brand, H. (2015). Health literacy in Europe: Comparative results of the European Health Literacy Survey (HLS-EU). *The European Journal of Public Health*, *25*(6), 1053–1058. https://doi.org/10.1093/eurpub/ckv043

Sorenson, S. B., Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. *Social Science & Medicine*, *72*(9),

1522–1526. https://doi.org/10.1016/j.socscimed.2011.03.010

Staples, R. (1995). Health among Afro-American males. In D. Sabo & D. F. Gordon (Eds.), *Men's health and illness: Gender, power, and the body* (pp. 122–138). SAGE Publications, Inc. https://doi.org/10.4135/9781452243757

Starkl, M., Brunner, N., & Stenström, T.-A. (2013). Why do water and sanitation systems for the poor still fail? Policy analysis in economically advanced developing countries. *Environmental Science & Technology*, *47*(12), 6102–6110. https://doi.org/10.1021/es3048416

Stockard, J. (2006). Gender socialization. In J. S. Chafetz (Ed.), *Handbook of the sociology of gender* (pp. 215–227). Springer US. https://doi.org/10.1007/0-387-36218-5_11

Stuifbergen, A. K., Seraphine, A., & Roberts, G. (2000). An explanatory model of health promotion and quality of life in chronic disabling conditions. *Nursing Research*, *49*(3), 122–129.

Sultana, F. (2006). *Gender concerns in arsenic mitigation in Bangladesh: Trends and challenges.* (Report). University of Minnesota.

Sultana, F. (2011). Suffering for water, suffering from water: Emotional geographies of resource access, control and conflict. *Geoforum*, *42*(2), 163–172. https://doi.org/10.1016/j.geoforum.2010.12.002

SUVA, the Swiss National Accident Insurance Fund (Ed.). (2019). *Gefährdungsermittlung: Heben und Tragen*. https://www.suva.ch/de-CH/material/Dokumentationen/beurteilung-der-koerperlichen-belastung-heben-und-tragen-von-lasten-88190d1812918129

Szinay, D., Forbes, C. C., Busse, H., DeSmet, A., Smit, E. S., & König, L. M. (2023). Is the uptake, engagement, and effectiveness of exclusively mobile interventions for the promotion of weight-related behaviors equal for all? A systematic review. *Obesity Reviews*, *24*(3), e13542. https://doi.org/10.1111/obr.13542

Tabachnick, B. G., & Fidell, L. S. (1983). *Using multivariate statistics*. Harper & Row.

Tay, L., Tan, K., Diener, E., & Gonzalez, E. (2013). Social relations, health behaviors, and health outcomes: A survey and synthesis: social relations and health. *Applied Psychology: Health and Well-Being*, *5*(1), 28–78. https://doi.org/10.1111/aphw.12000

Thakur, M., Nuyts, P. A. W., Boudewijns, E. A., Flores Kim, J., Faber, T., Babu, G. R., van Schayck, O. C. P., & Been, J. V. (2018). Impact of improved cookstoves on women's and child health in low and middle income countries: A systematic review and meta-analysis. *Thorax, 73*(11), 1026–1040. https://doi.org/10.1136/thoraxjnl-2017-210952

Thapa, D. K., & Niehof, A. (2013). Women's autonomy and husbands' involvement in maternal health care in Nepal. *Social Science & Medicine*, *93*, 1–10. https://doi.org/10.1016/j.socscimed.2013.06.003

Thapa, S., Bhattarai, S., & Aro, A. R. (2019). 'Menstrual blood is bad and should be cleaned': A qualitative case study on traditional menstrual practices and contextual factors in the rural communities of far-western Nepal. *SAGE Open Medicine, 7*, 205031211985040. https://doi.org/10.1177/2050312119850400

Tikotzky, L., Sadeh, A., Volkovich, E., Manber, R., Meiri, G., & Shahar, G. (2015). Infant sleep development from 3 to 6 months postpartum: Links with maternal sleep and paternal involvement. *Monographs of the Society for Research in Child Development*, *80*(1), 107–124. https://doi.org/10.1111/mono.12147

Tomberge, V. M. J., Bischof, J. S., Meierhofer, R., Shrestha, A., & Inauen, J. (2021). The physical burden of water carrying and women's psychosocial well-being: Evidence from rural Nepal. *International Journal of Environmental Research and Public Health*, *18*(15), 7908. https://doi.org/10.3390/ijerph18157908

Tomberge, V. M. J., Harter, M., & Inauen, J. (2022). The importance of collective and individual psychological ownership for safe sanitation: A multilevel analysis in rural Ghana. *Global Public Health*, *17*(7), 1314–1329. https://doi.org/10.1080/17441692.2021.1928260

Tomberge, V. M. J., Shrestha, A., Meierhofer, R., & Inauen, J. (2021). Understanding safe water-carrying practices during pregnancy and postpartum: A mixed-methods study in Nepal. *Applied Psychology: Health and Well-Being*, aphw.12325. https://doi.org/10.1111/aphw.12325

Torres-Duque, C., Maldonado, D., Perez-Padilla, R., Ezzati, M., Viegi, G., & on behalf of the Forum of International Respiratory Societies (FIRS) Task Force on Health Effects of Biomass Exposure. (2008). Biomass fuels and respiratory diseases: A review of the evidence. *Proceedings of the American Thoracic Society*, *5*(5), 577–590. https://doi.org/10.1513/pats.200707-100RP

Tumwebaze, I. K., & Mosler, H.-J. (2014). Shared toilet users' collective cleaning and determinant factors in Kampala slums, Uganda. *BMC Public Health*, *14*(1), 1260. https://doi.org/10.1186/1471-2458-14-1260

Turner, J. C. (2005). Explaining the nature of power: A three-process theory. *European Journal of Social Psychology*, *35*(1), 1–22. https://doi.org/10.1002/ejsp.244

UN Population Fund (UNFPA). (1994). *Report of the International Conference on Population and Development*. *A/CONF.171/13/Rev.1*.

https://www.refworld.org/docid/4a54bc080.html

UN Water. (2006). *Gender, water and sanitation: A policy brief.* UN, New York.

UNICEF, WaterAid, & WSUP (Eds.). (2018). *Female-friendly public and community toilets: A guide for planners and decision makers*. WaterAid. washmatters.wateraid.org/female-friendly-toilets

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development.* United Nations.

United Nations Population Fund. (2006). *Status of reproductive morbidities in Nepal.* http://un.org.np/sites/default/files/report/tid_67/2009-03-17-UNFPA-status-modbidity.pdf.

United Nations Population Fund. (2014). *Programme of action. Adopted at the International Conference on Population and Development, Cairo, 5-13 September 1994*. https://www.unfpa.org/sites/default/files/event-pdf/PoA_en.pdf

Väänänen, A., Kevin, M. V., Ala-Mursula, L., Pentti, J., Kivimäki, M., & Vahtera, J. (2005). The double burden of and negative spillover between paid and domestic work: Associations with health among men and women. *Women & Health*, *40*(3), 1–18. https://doi.org/10.1300/J013v40n03_01

van Breukelen, G. J. P. (2013). ANCOVA Versus CHANGE from baseline in nonrandomized studies: The difference. *Multivariate Behavioral Research*, *48*(6), 895–922. https://doi.org/10.1080/00273171.2013.831743

Van Geelen, H., Ostergard, D., & Sand, P. (2018). A review of the impact of pregnancy and childbirth on pelvic floor function as assessed by objective measurement techniques. *International Urogynecology Journal*, *29*(3), 327–338. https://doi.org/10.1007/s00192-017-3540-z

van Zyl, C., Badenhorst, M., Hanekom, S., & Heine, M. (2021). Unravelling 'low-resource settings': A systematic scoping review with qualitative content analysis. *BMJ Global Health*, *6*(6), e005190. https://doi.org/10.1136/bmjgh-2021-005190

Venkataramanan, V., Geere, J.-A. L., Thomae, B., Stoler, J., Hunter, P. R., & Young, S. L. (2020). In pursuit of 'safe' water: The burden of personal injury from water fetching in 21 low-income and middle-income countries. *BMJ Global Health*, *5*(10), e003328. https://doi.org/10.1136/bmjgh-2020-003328

Verburgh, M., Verdonk, P., Appelman, Y., Brood-van Zanten, M., & Nieuwenhuijsen, K. (2020). "I get that spirit in me"—Mentally empowering workplace health promotion for female workers in low-paid jobs during menopause and midlife. *International Journal of Environmental Research and Public Health*, *17*(18), 6462.

https://doi.org/10.3390/ijerph17186462

Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-report index of habit strength. *Journal of Applied Social Psychology*, *33*(6), 1313–1330. https://doi.org/10.1111/j.1559-1816.2003.tb01951.x

Vladimirova, M., & Amudzhiyan, D. (2020). Comparative analysis of the reproductive behavior of mothers and daughters of roma origin in the region of Plovdiv. *Knowledge - International Journal*, *43*(4), 729–734.

Vlassoff, C. (2007). Gender differences in determinants and consequences of health and illness. *Journal of Health, Population, and Nutrition*, *25*(1). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3013263/

Vorderstrasse, A., Lewinski, A., Melkus, G. D., & Johnson, C. (2016). Social support for diabetes self-management via ehealth interventions. *Current Diabetes Reports*, *16*(7), 56. https://doi.org/10.1007/s11892-016-0756-0

Walker, G. J. A., & Gunasekera, P. (2011). Pelvic organ prolapse and incontinence in developing countries: Review of prevalence and risk factors. *International Urogynecology Journal*, *22*(2), 127–135. https://doi.org/10.1007/s00192-010-1215-0

Wallston, K. A., Wallston, B. S., Smith, S., & Dobbins, C. J. (1987). Perceived control and health. *Current Psychology*, *6*(1), 5–25. https://doi.org/10.1007/BF02686633

Wamoyi, J., Balvanz, P., Gichane, M. W., Maman, S., Mugunga, S., Majani, E., & Pettifor, A. (2020). Decision-making and cash spending patterns of adolescent girls and young women participating in a cash-transfer intervention in Tanzania: Implications for sexual health. *Global Public Health*, *15*(4), 587–597. https://doi.org/10.1080/17441692.2019.1692891

Wang, H.-H., Wu, S.-Z., & Liu, Y.-Y. (2003). Association between social support and health outcomes: A meta-analysis. *The Kaohsiung Journal of Medical Sciences*, *19*(7), 345–350. https://doi.org/10.1016/S1607-551X(09)70436-X

Wang, Q., Hay, M., Clarke, D., & Menahem, S. (2014). Associations between knowledge of disease, depression and anxiety, social support, sense of coherence and optimism with health-related quality of life in an ambulatory sample of adolescents with heart disease. *Cardiology in the Young*, *24*(1), 126–133. https://doi.org/10.1017/S1047951113000012

Warner, L. M., & French, D. P. (2020). Self-efficacy interventions. In M. S. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (1st ed., pp. 461–478). Cambridge University Press.

https://doi.org/10.1017/9781108677318.032

Waters, L., Reeves, M., Fjeldsoe, B., & Eakin, E. (2012). Control group improvements in physical activity intervention trials and possible explanatory factors: A systematic review. *Journal of Physical Activity and Health*, *9*(6), 884–895. https://doi.org/10.1123/jpah.9.6.884

Waters, T. R., MacDonald, L. A., Hudock, S. D., & Goddard, D. E. (2014). Provisional recommended weight limits for manual lifting during pregnancy. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *56*(1), 203–214. https://doi.org/10.1177/0018720813502223

Wehmeyer, M. L., & Bolding, N. (2001). Enhanced self-determination of adults with intellectual disability as an outcome of moving to community-based work or living environments. *Journal of Intellectual Disability Research*, *45*(5), 371–383. https://doi.org/10.1046/j.1365-2788.2001.00342.x

White, M., Adams, J., & Heywood, P. (2009). How and why do interventions that increase health overall widen inequalities within populations? In S. J. Babones (Ed.), *Social inequality and public health* (1st ed., pp. 65–82). Bristol University Press. https://doi.org/10.46692/9781847423221.006

Wickham, H. (2016). *Ggplot2: Elegant graphics for data analysis* (2nd ed. 2016). Springer International Publishing: Imprint: Springer. https://doi.org/10.1007/978-3-319-24277-4

Wight, D., Plummer, M., & Ross, D. (2012). The need to promote behaviour change at the cultural level: One factor explaining the limited impact of the MEMA kwa Vijana adolescent sexual health intervention in rural Tanzania. A process evaluation. *BMC Public Health*, *12*(1), 788. https://doi.org/10.1186/1471-2458-12-788

Williams, A. L., & Merten, M. J. (2013). Romantic relationships among women experiencing obesity: Self-perception and weight as barriers to intimacy. *Family and Consumer Sciences Research Journal*, *41*(3), 284–298. https://doi.org/10.1111/fcsr.12020

Wills, T. A. (1991). Social support and interpersonal relationships. In *Prosocial behavior.* (pp. 265–289). Sage Publications, Inc.

Wingood, G. M., & DiClemente, R. J. (2000). Application of the Theory of Gender and Power to examine HIV-related exposures, risk factors, and effective interventions for women. *Health Education & Behavior*, *27*(5), 539–565. https://doi.org/10.1177/109019810002700502

Workman, C. L., & Ureksoy, H. (2017). Water insecurity in a syndemic context:

Understanding the psycho-emotional stress of water insecurity in Lesotho, Africa. *Social Science & Medicine, 179*, 52–60. https://doi.org/10.1016/j.socscimed.2017.02.026

World Bank (Ed.). (2022). *Gender data portal*. https://genderdata.worldbank.org/

World Economic Forum (Ed.). (2022). *Global Gender Gap Report 2022*. http://reports.weforum.org/globalgender- gap-report-2022.

World Health Organization (Ed.). (1998). Development of the World Health Organization WHOQOL-BREF quality of life assessment. *Psychological Medicine, 23*(3), 551–558.

World Health Organization. (2010). *A conceptual framework for action on the social determinants of health: Debates, policy & practice, case studies*. http://apps.who.int/iris/bitstream/10665/44489/1/9789241500852_eng.pdf

World Health Organization (Ed.). (2012). Women's health beyond reproduction: Meeting the challenges. *Bulletin of the World Health Organization*, *90*(7), 478–478. https://doi.org/10.2471/BLT.12.103549

World Health Organization (Ed.). (2016). *Pregnancy, childbirth, postpartum and newborn care a guide for essential practice*. World Health Organization.

World Health Organization, & UNICEF. (2017). *Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines*. World Health Organization. https://apps.who.int/iris/handle/10665/258617

World Health Organization, & Unicef (Eds.). (2019). *Progress on household drinking water, sanitation and hygiene 2000-2017: Special focus on inequalities*.

World Health Organization, & United Nations Children's Fund (UNICEF). (2017). *Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines.* World Health Organization. https://apps.who.int/iris/handle/10665/258617

Yakıt Yeşilyurt, S., Özengin, N., & Topçuoğlu, M. A. (2022). Comparing the efficacy of the Knack maneuver on pelvic floor muscle function and urinary symptoms using different teaching methods: A prospective, nonrandomized study. *International Urogynecology Journal*, *33*(10), 2895–2903. https://doi.org/10.1007/s00192-022-05213-6

Young, H. P. (2015). The evolution of social norms. *Annual Review of Economics*, *7*(1), 359–387. https://doi.org/10.1146/annurev-economics-080614-115322

Young, M. F., Nguyen, P., Kachwaha, S., Tran Mai, L., Ghosh, S., Agrawal, R., Escobar-Alegria, J., Menon, P., & Avula, R. (2019). It takes a village: An empirical analysis of how husbands, mothers-in-law, health workers, and mothers influence breastfeeding practices in Uttar Pradesh, India. *Maternal & Child Nutrition*, e12892. https://doi.org/10.1111/mcn.12892

Youngmann, R., Zilber, N., Workneh, F., & Giel, R. (2008). Adapting the SRQ for ethiopian populations: A culturally-sensitive psychiatric screening instrument. *Transcultural Psychiatry*, *45*(4), 566–589. https://doi.org/10.1177/1363461508100783

Yount, K. M. (2002). Like mother, like daughter? Female genital cutting in Minia, Egypt. *Journal of Health and Social Behavior*, *43*(3), 336–358. https://doi.org/10.2307/3090208

Zeeman, L., Sherriff, N., Browne, K., McGlynn, N., Mirandola, M., Gios, L., Davis, R., Sanchez-Lambert, J., Aujean, S., Pinto, N., Farinella, F., Donisi, V., Niedźwiedzka-Stadnik, M., Rosińska, M., Pierson, A., Amaddeo, F., Health4LGBTI Network, Taibjee, R., Toskin, I., … De Sutter, P. (2019). A review of lesbian, gay, bisexual, trans and intersex (LGBTI) health and healthcare inequalities. *European Journal of Public Health*, *29*(5), 974–980. https://doi.org/10.1093/eurpub/cky226

Zegeye, B., Olorunsaiye, C. Z., Ahinkorah, B. O., Ameyaw, E. K., Budu, E., Seidu, A.-A., & Yaya, S. (2022). Understanding the factors associated with married women's attitudes towards wife-beating in sub-Saharan Africa. *BMC Women's Health*, *22*(1), 242. https://doi.org/10.1186/s12905-022-01809-8

Zhang, C.-Q., Fang, R., Zhang, R., Hagger, M. S., & Hamilton, K. (2020). Predicting hand washing and sleep hygiene behaviors among college students: Test of an integrated social-cognition model. *International Journal of Environmental Research and Public Health*, *17*(4), 1209. https://doi.org/10.3390/ijerph17041209

Zhang, C.-Q., Zhang, R., Schwarzer, R., & Hagger, M. S. (2019). A meta-analysis of the Health Action Process Approach. *Health Psychology*, *38*, 623–637. https://doi.org/10.1037/hea0000728

Zimmer-Gembeck, M. J. (2013). Young females' sexual self-efficacy: Associations with personal autonomy and the couple relationship. *Sexual Health*, *10*(3), 204–210. https://doi.org/10.1071/SH12139

Zuo, J., & Bian, Y. (2001). Gendered resources, division of housework, and perceived fairness-a case in urban China. *Journal of Marriage and Family*, *63*(4), 1122–1133. https://doi.org/10.1111/j.1741-3737.2001.01122.x

Appendix

Appendix I: Supplementary information: The physical burden of water carrying and women's psychosocial wellbeing: Evidence from rural Nepal

Appendix II: Supplementary information: Understanding safe water-carrying practices during pregnancy and postpartum: A mixed-methods study in Nepal

Appendix III: Supplementary information: Women's cognitions on reproductive health behavior are interrelated: A dyadic study

Appendix IV: Supplementary information: Self-efficacy and social support enable women to take care of their pelvic floor health: A nonrandomized controlled trial in rural Nepal

Appendix I: Supplementary information

The physical burden of water carrying and women's psychosocial wellbeing: Evidence from rural Nepal

Table S1

Items

Concept	Items
Physical burden (SUVA, the Swiss National Accident Insurance Fund, 2019)[1,2]	
Weight	Please indicate the number of different types of containers being carried. *30l Gagri/Plastic bucket; 20l Gagri/Plastic bucket; 10l Gagri/Plastic bucket; 20 l Plastic bottle; 10 l Plastic bottle; 2-5 l Plastic bottle; others (in liters)*
Distance	Enter distance between household and water source (meters)
Frequency	How many trips do you conduct per day to your primary drinking water source in rainy season?
Emotional distress (Youngmann et al., 2008)	Do you often have headaches? *0 = no; 1 = yes*
	Is your appetite poor? *0 = no; 1 = yes*
	Do you sleep badly? *0 = no; 1 = yes*
	Are you easily frightened? *0 = no; 1 = yes*
	Do your hands shake? *0 = no; 1 = yes*
	Do you feel nervous, tense or worried? *0 = no; 1 = yes*
	Is your digestion poor? *0 = no; 1 = yes*
	Do you have trouble thinking clearly? *0 = no; 1 = yes*
	Do you feel unhappy? *0 = no; 1 = yes*
	Do you cry more than usual? *0 = no; 1 = yes*
	Do you find it difficult to make decisions? *0 = no; 1 = yes*
	Is your daily work suffering? *0 = no; 1 = yes*
	Are you unable to play a useful part in life? *0 = no; 1 = yes*
	Have you lost interest in things? *0 = no; 1 = yes*
	Do you feel you are a worthless person? *0 = no; 1 = yes*
	Has the thought of ending your life been on your mind? *0 = no; 1 = yes*
	Do you have uncomfortable feelings in your stomach? *0 = no; 1 = yes*
	Are you easily tired? *0 = no; 1 = yes*
	Do you find it difficult to enjoy your daily activities? *0 = no; 1 = yes*

Appendix I

Concept	Items
Quality of life[2] (World Health Organization, 1998)	How would you rate your quality of life? *0 = very poor to 1 = very good*
	How satisfied are you with your health? *0 = not satisfied at all to 1 = very satisfied*
	To what extent do you feel that physical pain prevents you from doing what you need to do? *0 = not at all to 1 = very much*
	How much do you enjoy life? *0 = not at all to 1 = very much*
	How safe do you feel in your daily life? *0 = not safe at all to 1 = very safe*
	Are you able to accept your bodily appearance? *0 = not at all to 1 = very much*
	Have you enough money to meet your needs? *0 = not at all to 1 = very much*
	How well are you able to get around? *0 = not at all to 1 = very much*
	How satisfied are you with your personal relationships? *0 = not satisfied at all to 1 = very satisfied*
	How satisfied are you with your sex life? *0 = not satisfied at all to 1 = very satisfied*
	How satisfied are you with the conditions of your living place? *0 = not satisfied at all to 1 = very satisfied*
	How satisfied are you with your access to health services? *0 = not satisfied at all to 1 = very satisfied*
Daily functioning (de Jong et al., 2016) [2]	Please rate the severity by which water carrying reduces your daily functioning
	0 = not at all to 1 = very much
Uterine prolapse	Based on the examined symptoms, does the study participant have uterine prolapse? *0 = no; 1 = yes*
Terrain	Do you have to walk uphill or downhill to carry the container filled with water from the primary water source back home during the dry season?
	1 = uphill; 2 = downhill; 3 = uphill and downhill; 4 = flat

Note. Gagri is a traditional water pot in Nepal. [1]Calculated according to recommendations on calculating risk assessment for lifting and carrying suggested by the Swiss National Accident Insurance Fund (SUVA, the Swiss National Accident Insurance Fund, 2019). [2]All items used a five-point Likert scale and were recoded to a range between 0 to 1; *0 = not at all*, 0.25 = *somewhat* 0.5 = *rather* 0.75 = *quite 1 = very much.*

Appendix I

Table S2

Generalized estimating equations of objective physical burden of carrying water and psychosocial well-being (emotional distress, quality of life, and daily functioning)

	Emotional distress					Quality of life					Functioning in daily activities				
			95% CI					95% CI					95% CI		
	Estimate	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*	*Estimate*	*SE*	*LL*	*U L*	*p*
Intercept	0.36	0.07	0.23	0.49	< 0.001	0.59	0.03	0.53	0.64	< 0.001	0.87	0.08	0.71	1.03	< 0.001
Physical burden	0.16	0.07	0.02	0.30	0.029	0.05	0.06	-0.06	0.16	0.387	-0.39	0.09	-0.56	-0.21	< 0.001
Age	< 0.01	< 0.01	< 0.01	< 0.01	0.700	< 0.01	< 0.01	< 0.01	< 0.01	0.880	< 0.01	< 0.01	< 0.01	< 0.01	0.419
Education[1]	-0.01	0.01	-0.02	< 0.01	0.135	0.01	< 0.01	0.01	0.02	< 0.001	< 0.01	< 0.01	< 0.01	0.01	0.337
Socio-economic status[2]	-0.24	0.06	-0.36	-0.12	< 0.001	0.10	0.03	0.04	0.15	0.001	0.19	0.11	-0.03	0.41	0.085
Currently pregnant	< 0.01	0.02	-0.04	0.04	0.912	0.03	0.02	-0.01	0.08	0.113	-0.06	0.02	-0.10	-0.01	0.014
Delivered in last 3 months	0.01	0.04	-0.07	0.10	0.767	< 0.01	0.03	-0.07	0.06	0.890	0.01	0.05	-0.10	0.11	0.920
Other heavy loads carried (in kg)	-0.01	0.01	-0.04	0.01	0.343	0.01	0.02	-0.03	0.05	0.604	0.02	0.10	-0.18	0.21	0.881
Ethnicity[3]															
Brahmin	0.02	0.01	< 0.01	0.04	0.106	-0.01	0.01	-0.03	0.02	0.492	-0.12	0.02	-0.15	-0.09	< 0.001
Tamang	-0.04	0.01	-0.06	-0.01	0.003	-0.01	0.01	-0.03	< 0.01	0.074	-0.14	0.02	-0.17	-0.10	< 0.001
Newar	0.01	0.01	-0.01	0.03	0.203	0.01	0.01	-0.01	0.02	0.413	-0.12	0.02	-0.16	-0.09	< 0.001
Chhetri	0.01	0.02	-0.03	0.05	0.744	< 0.01	0.02	-0.04	0.04	0.924	-0.14	0.06	-0.25	-0.02	0.026
Dalit	0.06	0.02	0.03	0.10	0.001	< 0.01	0.01	-0.02	0.02	0.732	-0.05	0.02	-0.09	-0.01	0.021
Rai and Limbu	-0.02	0.01	-0.05	< 0.01	0.093	-0.01	0.01	-0.03	0.02	0.638	-0.03	0.03	-0.08	0.02	0.200

Note. *N* = 980 (*n* = 21 distance missing). 5 communities. *Estimate* = Parameter Estimates. *SE* = Standard Error. *CI* = Confidence interval. Probability distribution: normal, link function: identity. All *p*-values are two-tailed. [1]Higher values refer to a higher level of education: *0 = Illiterate , 1 = Informal education, 2 = Pre-primary, 3 = Primary passed, 4= Lower secondary passed, 5= Secondary, 6 = Higher secondary and above*. [2]An index (0.0-1.0) was calculated using principle component analysis (Krishnan, 2010). [3]Reference = other

S3 Sample syntax for SPSS

```
**Calculating physical burden according to an adapted version of the risk assessment for lifting and carrying suggested by SUVA, the Swiss National Accident Insurance Fund (SUVA, the Swiss National Accident Insurance Fund, 2019)
** The adapted formula includes the following weighted risk variables: (Weight + environmental condition)*(carrying frequency*distance).
RECODE weight (Lowest thru 4.9999=1) (5 thru 9.999=2) (10 thru 14.999=4)
(25 thru Highest=25) (15 thru 24.999=7) INTO weight_category.
VARIABLE LABELS  weight_category 'suva category weight'.
EXECUTE.

RECODE distance_cor (Lowest thru 299.9999=1) (300 thru 999.99=2) (1000 thru Highest=4)
INTO distance_category.
VARIABLE LABELS  distance_category 'suva category distance'.
EXECUTE.

COMPUTE suva_o= (trips_rainyseason_all*distance_category) * (weight_category+1).
VARIABLE LABELS  suva_o 'suva risk evaluation without body posture'.
EXECUTE.

**Recoding to 0-1 scale
DESCRIPTIVES VARIABLES=suva_o
  /STATISTICS=MEAN STDDEV MIN MAX.
COMPUTE suva_o_r=(suva_o-2)/(416-2).
EXECUTE.

**Grand-mean centering
DESCRIPTIVES VARIABLES=suva_o_r
  /STATISTICS=MEAN .
COMPUTE suva_o_GM=  suva_o_r- 0.0653.

 *** Example to calculate main effect (emotional distress) in GEE
GENLIN  em_dis (REFERENCE=FIRST) WITH suva_o_GM age
education SI_SES curr_pregnant delivered kilos_day_all_wins_trans  by eth
  /MODEL suva_o_GM age education SI_SES curr_pregnant delivered kilos_day_all_wins_trans eth
 INTERCEPT=YES
 DISTRIBUTION=NORMAL LINK=IDENTITY
  /CRITERIA METHOD=FISHER(1) SCALE=1 MAXITERATIONS=100 MAXSTEPHALVING=5 PCONVERGE=1E-006(ABSOLUTE)
```

```
   SINGULAR=1E-012 ANALYSISTYPE=3(WALD) CILEVEL=95 LIKELIHOOD=FULL

  /REPEATED SUBJECT=vdc_municipality WITHINSUBJECT=Participant_ID SORT=YES COR-
RTYPE=EXCHANGEABLE ADJUSTCORR=YES
    COVB=ROBUST MAXITERATIONS=100 PCONVERGE=1e-006(ABSOLUTE) UPDATECORR=1
  /MISSING CLASSMISSING=EXCLUDE
  /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION (EXPONENTIATED) COVB.

*** Example to calculate moderation effect (uterine prolapse on emotional distress) in GEE
GENLIN  em_dis (REFERENCE=FIRST) WITH suva_o_GM age
education SI_SES curr_pregnant delivered kilos_day_all_wins_trans uterus_prolapse by eth
  /MODEL suva_o_GM suva_o_GM*uterus_prolapse uterus_prolapse age education SI_SES curr_pregnant de-
livered kilos_day_all_wins_trans  eth
 INTERCEPT=YES
 DISTRIBUTION=NORMAL LINK=IDENTITY
  /CRITERIA METHOD=FISHER(1) SCALE=1 MAXITERATIONS=100 MAXSTEPHALVING=5 PCON-
VERGE=1E-006(ABSOLUTE)
    SINGULAR=1E-012 ANALYSISTYPE=3(WALD) CILEVEL=95 LIKELIHOOD=FULL
  /REPEATED SUBJECT=vdc_municipality WITHINSUBJECT=Participant_ID SORT=YES COR-
RTYPE=EXCHANGEABLE ADJUSTCORR=YES
    COVB=ROBUST MAXITERATIONS=100 PCONVERGE=1e-006(ABSOLUTE) UPDATECORR=1
  /MISSING CLASSMISSING=EXCLUDE
  /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION (EXPONENTIATED) COVB.
```

Appendix II: Supplementary information

Understanding safe water-carrying practices during pregnancy and postpartum: A mixed-methods study in Nepal

Table S1

Items and descriptive statistics

Concept	Items	*M*	*SD*	Cronbach's alpha
Safe water-carrying[1]	How often in one week did you carry water during pregnancy? / How often in one week did you carry water in the three months after delivery?, *1 = every day to 5 = no days*	0.40	0.38	0.78
Risk perception[1]	Compared to other women with the same age, how much higher or lower are your chances of getting uterine prolapse? *-2 = lower* to *2 = higher*[1]	0.70	0.33	1 item
Outcome expectancies[1]	How much do you agree to the following statements *1=agree not at all to 5 = agree very much* I would protect myself from negative health impact if I avoided water-carrying during pregnancy and after delivery I would prevent uterine prolapse if I avoided water carrying during pregnancy	0.78	0.25	0.84
Self-efficacy[1,2]	How sure are you that you can always avoid to carry your water during and after pregnancy? How sure are you that you can always avoid to carry your water during and after pregnancy even if it might be difficult for your household to have enough water? How sure are you that you can always avoid to carry your water during and after pregnancy even if someone in your family (e.g. your mother-in-law) told you to?	0.42	0.34	0.91
Intention[1,2]	How strongly do you intend to always avoid water carrying during and after pregnancy? How strongly do you intend to reduce water carrying during and after pregnancy? How frequently do you intend to avoid carrying water during and after pregnancy?	0.63	0.29	0.83
Injunctive norm[1,2]	How much would people who are important to you approve if you carry water during and after pregnancy? (reverse coded) How much would other people in your community approve if you avoided water carrying during and after pregnancy? How much would people who are important to you approve if you avoided water carrying during and after pregnancy?	0.56	0.25	0.66 (0.72[3])
Descriptive norm	How many women in your community carry water during and after pregnancy?*1 = Almost nobody (0%)* to *5 = almost all of them (100%)*[2]	0.57	0.27	1 item

Appendix II

Concept	Items	*f*	*f%*	Cronbach's alpha
Instrumental support	Who will assure your household's water supply in case you cannot carry enough water during and after pregnancy? (multiple answers possible) *1 = Husband; Mother-in-law; Father in law; Daughters/Sons; Other family member; Other men of the community; Other women of the community; Other; 0 = Nobody*	823	89%	
	Husband	538	58%	
	Mother-in-law	259	28%	
	Father in law	97	11%	
	Daughters	141	15%	
	Sons	103	11%	
	Other family member	191	21%	
	Other men of the community	16	2%	
	Other women of the community	10	1%	
	Other	46	5%	
	Nobody	98	11%	
Action planning	Can you tell me what you can do to avoid carrying water during and after pregnancy? (multiple answers possible, no options prompted) *1 = Ask for help; Carry less water; Tell other people I don't want to carry water; Buy water; other specific plan*; *0 = No plan*	783	85%	
	Ask for help	462	50%	
	Carry less water	549	60%	
	Tell other people I don't want to carry water	112	12%	
	Buy water	5	1%	
	Other *(most frequently named: connecting pipe from source to home)*	23	3%	
	No plan	138	15%	
Coping planning	Which difficulties may arise that can prevent you from avoiding carrying water during and after pregnancy?			
	How can you overcome difficulties that prevent you from avoiding to carry water during and after pregnancy? [4] (multiple answers possible, no options prompted)*1= Ask someone for help; Tell that I do not want to carry water; other specific coping plan; 0 = No plan*	557	60%	
	Ask someone for help	468	51%	
	Tell that I don‘t want to carry water	64	7%	
	Other specific coping plan	100	11%	
	No plan	364	40%	

Note. n = 921, M = Mean, SD = Standard deviation, f = frequency. [1]All continuous items were recoded to a range between 0 to 1; [2]*0 = not at all* to *5 = very much;* [3]without first field site; [4] This question was also asked when respondents did not mention any specific difficulty.

Table S2

Sample characteristics for quantitative data

Concept	Options	*M*	*SD*
Age		34.5	8.6
Number of pregnancies		2.9	1.6
Socioeconomic status[1]		0.5	0.1
	How much land does your family own?	54.8	73.6
	How many rooms does your house have?	2.9	1.5
	Does anyone from your household own any of these items? Radio, TV, solar panel, mobile phone, bicycle, motor bike, car, fridge, watch (sum)	3.2	2.0
		f	*f*%
	What kind of fuel do you use MAINLY for cooking?		
	Wood (= 0)	573	62%
	Gas (= 1)	348	38%
	What is the average expenditure of your family per month?		
	Less than 2400 Nepali Rupees (~ 20 US$)	77	8%
	2500 to 4800 Nepali Rupees (~ 40 US$)	200	22%
	4900 to 9600 Nepali Rupees (~ 80 US$)	269	29%
	9700 to 24000 Nepali Rupees (~ 200 US$)	232	25%
	>25000 Nepali Rupees (~ 208 US$)	105	11%
	Are you the owner of your house? (yes = 1)	902	98%
Education	Illiterate	176	19%
	Informal education	257	28%
	Pre-primary	51	6%
	Primary passed	138	15%
	Lower secondary passed	94	10%
	Secondary	103	11%
	Higher secondary and above	102	11%
Involved in economic activities		653	71%
	Agriculture	521	57%
	Other (trading, government service, daily laborer)	132	13%
Religion			
	Hinduism	654	71 %
	Buddhism	255	27%
	Others	12	1 %
Marital status			
	Married	887	96%
	Widowed	33	4%
Living without husband	1 = yes	198	21%
Currently pregnant	1 = yes	41	4%
Delivered last 3 months	1 = yes	24	2%
Ethnicity	Brahmin	283	31%
	Tamang	275	30%
	Newar	55	6%
	Chhetri	53	6%
	Dalit	115	13%
	Rai and Limbu	126	14%
	Others	14	2%

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Concept	Options	*f*	*f*%
Main source in rainy season	Private tap, hand pump or tank delivery in the court or in the house	448	49%
	Shared tap, hand pump, tank delivery or surface water in the close neighborhood	232	25%
	Community tap, hand pump, tanker delivery or surface water in the village	210	23%
	Water source further away than the village	31	3%

Note. n = 921, M = Mean, SD = Standard deviation, f = frequency. [1]An index was calculated using principle component analysis (Krishnan, 2010).

Table S3

Bivariate correlations between all constructs

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Safe water-carrying [1]																					
2	Risk perception	0.10 **																				
3	Outcome expectancies	0.19 **	0.59 **																			
4	Self-effcacy	0.46 **	0.19 **	0.29 **																		
5	Intention	0.36 **	0.28 **	0.39 **	0.47 **																	
6	Action planning	0.19 **	0.16 **	0.23 **	0.34 **	0.33 **																
7	Coping planning	0.15 **	0.07 *	0.12 **	0.27 **	0.21 **	0.31 **															
8	Instrumental support	0.17 **	-0.05	0.04	0.23 **	0.17 **	0.12 **	0.07 *														
9	Injunctive norm[1]	0.36 **	0.16 **	0.26 **	0.63 **	0.45 **	0.29 **	0.27 **	0.22 **													
10	Descriptive norm	0.06	0.09 **	0.04	0.06	0.06	-0.04	< 0.01	-0.05	0.12 **												
11	Age	-0.15 **	-0.02	-0.08 *	-0.14 **	-0.17 **	-0.10 **	-0.01	-0.16 **	-0.14 **	0.08 *											
12	Socioeconomic status	0.15 **	0.17 **	0.18 **	0.16 **	0.17 **	0.11 **	0.05	0.10 **	0.14 **	-0.05	-0.01										
13	Living without husband	0.01	-0.01	-0.02	-0.02	-0.03	0.01	-0.05	-0.08 *	-0.05	0.04	0.02	-0.06									
14	Currently pregnant	0.04	-0.02	-0.01	0.06	0.06	< 0.01	-0.01	0.06	0.06	0.02	-0.26 **	-0.03	-0.06								
15	Currently delivered	0.06	0.01	-0.03	0.10 **	0.04	-0.01	-0.01	0.06	0.08 *	0.01	-0.18 **	0.02	0.05	-0.04							

Appendix II

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Education	0.20**	0.18**	0.16**	0.22**	0.21**	0.15**	-0.01	0.15**	0.15**	-0.02	-0.61**	0.19**	0.05	0.15**	0.17**						
16	Brahmin	0.04	0.16**	0.09**	<0.01	0.02	-0.04	-0.02	-0.02	-0.07*	0.06	0.12**	0.25**	0.04	-0.04	0.05	0.12**					
17	Tamang	-0.02	-0.10**	-0.11**	0.04	-0.06	0.04	0.06	-0.01	0.05	-0.05	.08*	-0.06	0.01	-0.03	0.03	-0.12**	-0.44**				
18	Newar	0.02	-0.04	0.02	0.01	<0.01	0.02	0.03	0.04	0.06	-0.01	0.03	0.05	<0.01	-0.03	-0.04	-0.02	-0.17**	-0.16**			
19	Chhetri	0.02	0.04	0.06	0.03	0.09**	0.05	-0.03	-0.05	<0.01	-0.01	0.04	0.01	0.04	0.01	-0.04	0.02	-0.17**	-0.16**	-0.06		
20	Dalit	-0.07*	-0.05	0.03	-0.06	-0.01	-0.05	-0.02	<0.01	-0.05	-0.04	-0.12**	-0.22**	-0.02	<0.01	-0.04	-0.06	-0.25**	-0.25**	-0.10**	-0.09**	
21	Rai and Limbu	0.02	-0.03	-0.06	-0.04	-0.01	<0.01	-0.05	0.05	0.01	0.03	-0.19**	-0.11**	-0.06	0.11**	-0.01	0.04	-0.27**	-0.26**	-0.10**	-0.10**	-0.15**
22	Others	-0.01	<0.01	0.01	0.03	0.04	0.03	0.03	0.01	0.07*	0.02	-0.06	0.05	-0.04	-0.03	-0.02	0.02	-0.08*	-0.08*	-0.03	-0.03	-0.05

Note. Significance levels: * $p < 0.05$, * * $p < 0.01$ (two-tailed). [1] How often in one week do you carry water during pregnancy? / How often in one week do you carry water in the three months after delivery?, *1 = no days to 5 = every day*

Appendix II

Table S4

Sample guideline for qualitative interviews

Discourse and dimension	Leading questions	Optional follow-up questions
Introduction and inclusion criterion	Hello. My name is [x] and this is [y]. I am working with Dhulikel Hospital on a study on women's health and their quality of life here in Kavre District *Date:* *ID of respondent:*	
Part 1: Free exploration women's daily routine		
Carrying behavior	Please tell me about your daily routine	What do you like in your day? What don't you like? Why?
Feelings and thoughts about tasks in daily routine	Are there any tasks that make your body feel weak or hurting? Are there any tasks that give you mental stress? Why?	
Part 2: Free exploration consequences water carrying	First, we would like you to tell us a bit more about your task to carry water	
Carrying behavior	How much water do you carry and how often?	Why? Do you change this quantity/ amount for any reason?
	Which other loads do you carry?	When? How much, how often?
	Do you prefer carrying water or carrying other loads? Why?	
	When did you start carrying water?	Were your carrying tasks different when you were a girl?
	Did your carrying tasks change when you moved from your parents house to your in-laws house?	
Psychological consequences water carrying	Can you describe your thoughts and feelings about daily water carrying?	Are there times you cannot go for water carrying? Why? Tell me about the incident(s)? How do you feel when this happens?
Physical consequences water carrying	How does your body feel when you carry water?	During water carrying After water carrying How does this affect your life?
Social consequences	Please tell me more about how water carrying is organized in your village What would you do in the time you usually carry water if you had not to carry water? Now? When you were a girl?	*If their carrying behavior changed (e.g. in birth home they didn't carry water or they have a household tap now etc.):* Did anything in your life change since you carry water/ do not carry water anymore?

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
Intervention acceptance: Safe carrying technique	How can you change your carrying routine to prevent yourself from health impacts?	
	What do you think would be a safe carrying technique regarding to amount, body position and tools?	
	Would you like to implement the safe carrying technique in your daily life? Why?/ Why not?	
	What would you need to implement the safe carrying technique in your life?	
	How do you think you could learn it?	
	Do you think it is feasible for you to carry only small gagris (10-15 liter) or less?	
	Why?	
Part 3: Free exploration mother-in-law		
General family structures	Please tell me about your household members and their role in your family	
	Please tell me about your mother-in-law	
Responsibilities in-laws	What do you expect from her? What does she expect from you?	
Relationship quality	How would you describe your relationship with your mother-in-law?	How can you tell when you are happy with your mother-in-law?
		How can you tell when you are not happy with your mother-in-law?
Relationship with husband	Please tell me about your husband's types of support	*If she doesn't mention any problem:* Imagine you had a broken leg and needed to stay in bed. Still, you need to carry grass for the animals. How would your family members help you to solve the problem and make you feel better about it?
	Have you ever had any problem and your family helped you to solve the problem and to make you feel good about it?	
	What did your mother-in-law do to help you? What did she say?	
	What did/would your husband do to help you? What did/would he say?	
Part 4: Free exploration social support water carrying	What do you think and how do you feel about carrying water alone or in a group?	
General group behavior	Do you go alone or in a group?	Why, why not?
		Who goes with you?
Support	Does anyone except you carry water for your family?	Any other person from your family?
		Any other person outside your family?
		Why? Why not?
	Did you ever help someone from another household to carry their water? Why? Why not?	

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
	Did you ever ask someone from another household for help to carry your water? Why did you need help? What did they say? What would stop you from asking other people to help you carrying water?	
Part 4a: Water carrying during and after pregnancy rating task- picture task social beliefs (randomize order) This is Chenbagam, she delivered 2 weeks ago with her second child. She walks 30 minutes uphill and downhill per day, carrying water from the water scheme to her house 	What do you think, what kind of women is she? Why? What do other people think about her? Why? What would her mother-in-law do/ say to her? Why? What would her husband do/ say to her? Why? What do you think? How does she feel? Why?	*If participant perceives the behavior as something negative:* What can help her to improve the situation? What can she do? What can other people do? What can we (Dhulikel Hospital) do?
This is Baijanthi, she delivered 2 weeks ago with her second child. She stays at home and does NOT carry water from the water scheme that is 30 minutes uphill and downhill from the house 	What do you think, what kind of a woman is she? Why? What do other people think about her? Why? What would her mother-in-law do/ say to her? Why? What would her husband in law do/ say to her? Why? What do you think? How does she feel? Why?	

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Discourse and dimension	Leading questions	Optional follow-up questions
Part 4b: Free exploration water carrying in periods of pregnancy/childbirth	Tell me about your daily routine during and in the three months after pregnancy	
Behavior	Do you change your working routine during and shortly after pregnancy?	
	Why / Why not?	
	How was your water carrying routine during pregnancy?	Whose decision was it that you carried water/ did not carry water?
	Did you change the amount of water or the frequency?	Was it the same for all the months of pregnancy?
		How did you feel about water carrying during pregnancy?
	How was your water carrying routine in the three months after delivery?	How did you feel about water carrying in the three months after delivery?
	Whose decision was it that you carried water/ did not carry water?	
	Did you change the amount of water or the frequency?	
	Was it the same for all the months after delivery?	
Knowledge	What are risks and benefits of carrying water during or after pregnancy?	
Coping	How does your household get water when you cannot go for water carrying because of pregnancy?	
Social support	How does your family behave when you are pregnant?	Does your family support you in water carrying?
	What will your family members say if you decide to stay at home during pregnancy instead of water carrying? What will they do?	Which family member supports you?
		What do they do to support you?
		How does your husband behave when you are pregnant?
		How do your in-laws behave when you are pregnant?
Intervention acceptance: Not carrying during/ after pregnancy	What do you need to avoid carrying water and other heavy loads during and after pregnancy?	
Intervention acceptance: Not carrying during/ after pregnancy – Social support	Is there any person who can help you?	
	From within your family?	
	How can this person be motivated to help you?	
	From your neighborhood?	
	If your neighbor woman carried loads for you when you were pregnant, would you also carry loads for her every time she is pregnant?	

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
Intervention acceptance: Not carrying during/ after pregnancy – Structural support	Is there anything you can buy by money that can help you to avoid carrying heavy loads during and after pregnancy? Where can you get the money to get this?	
Part 5: Free exploration risks water carrying (Optional part)		
Security	Are you talking to anyone on the way to water carrying? To whom?	*If men:* what are you talking about?
	Can you tell me a about risks and dangers for women when they carry water?	
	Are you aware of any dangers women might face when they carry water? On the way/ During night/ when it's dark?	Have you ever faced any danger when you went for water carrying?
	What do you think, what is the reason for these dangers?	
Violence	What do you think about how risky it is for you to get verbally or physically attacked on your way to water carrying? Why?	The following question is about your personal experience, you do not need to answer if you don't want to: Did anything like telling you bad things or hurting your body when water carrying ever happen to you? *If yes:* Sometimes, people find it difficult to talk about unpleasant things that have happened to them. How do you feel telling me about this incident? *In case of telling about bad things she told/ done to her:* People do not have the right to do such things to you. I am very impressed how strong you are to live with this. What helps you to stay that strong and come over these events? Is there anyone you can talk to, anyone you can trust? What would you recommend to other women in the same situation, when someone says or does something bad to them?
Coping/ protection	What needs to be changed to reduce these dangers on the way to water carrying? What can be done and by whom?	What can you do to feel security when you carry water? What would you recommend to other women who feel insecure?
Part 6: Free Exploration Uterine Prolapse (Knowledge; Optional part)	Did you ever hear about uterine prolapse? Can you tell me about it?	

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
Risk knowledge		Can you tell me about the reasons why women get uterine prolapse?
Knowledge on prevention	How can you avoid uterine prolapse?	*If she says not carrying heavy loads/ any other reason:* How can you assure that you do/ don't do this?
Knowledge on treatment/ support	Which persons in a women's life will help her when she has uterine prolapse? To feel better about your situation To perform your daily tasks To give your information on how to improve your situation? What can women do if they have uterine prolapse? Who or what can help them? Where can they go?	*If they mention the hospital:* Are there any alternative places to go besides the hospital? If they mention: Alternative medicine: Which steps did the people take? Which advice, concrete action did you and the people helping you take? How does it help you? How does it affect your body? What about this option do you like more than going to a hospital? What about this option do you like less than going to a hospital?
	We have heard of women in this area having uterine prolapse but many of them do not come to visit the hospital. What do you think why? What would prevent you from going to the hospital if you had uterine prolapse? What can women with uterine prolapse do to prevent their condition from getting worse?	
Intervention acceptance: Pelvic floor exercise	What can you do to strengthen your pelvic floor? Would you like to learn pelvic floor exercise if you knew how to do it? Why? Why not?	Let us talk about the pelvic floor. Do you think the pelvic floor is important for women's health? Why? Why not?
Intervention acceptance: Pessary ring	What kind of help would you like us (Dhulikhel Hospital) to provide to women with uterine prolapse? Have you heard about the pessary ring? *If she did not:* It is a ring that will be inserted into the vagina to put back the uterus into the right place. Do you think it can help when you have uterine prolapse? Why/ why not? How do you like it? What would prevent you from using the pessary ring if you had uterine prolapse?	

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
For women without uterine prolapse only	Sometimes, people find it difficult to talk about unpleasant things that have happened to them. How do you feel talking to me today about uterine prolapse?	
	Would anything in your life change if you had uterine prolapse?	
Psychological consequences	How do you feel when you think about that you have uterine prolapse?	Did anything in your mood change since you have uterine prolapse? What changed?
Social consequences/ social support	Do other people know that you have uterine prolapse? How would they react if they knew?	Did your economic situation change since you suffer from uterine prolapse? Why?
For women with uterine prolapse only		
History	When did you first notice that you had uterine prolapse and what did you do?	Did anything in your life change since you have uterine prolapse?
	Can you tell me how life is with uterine prolapse?	
	Please tell me about it. How do you feel about this/these impact(s)?	
Family consequences/ domestic violence	What does your mother-in-law say regarding the uterine prolapse?	Does she know about your uterine prolapse?
		Does she support you?
		Does she say anything good or bad?
	Whom do you have in your life that supports you, or who you trust?	
	The following questions refer to you and your husband. If you do not want to answer, just give me a sign. You do not need to tell me why.	Does he know about your uterine prolapse?
		If yes: How do you feel about that he knows?
	What does your husband say regarding your uterine prolapse?	
	What does he do?	
	What does he say?	
	Did his behavior towards you change since you have uterine prolapse?	
	Did your behavior towards him change since you have uterine prolapse?	
	Did your sex life change since you have uterine prolapse? How?	Are you both satisfied with the amount and quality of sex?
		Did you feel pain?
		Did you tell your husband? How did he react?
		Do you feel mental stress?
	In case of telling about forced sexual relation or any other incidents of physical/ emotional violence:	How often did this happen?
		What helps you to stay that strong and come over these events?
	Sometimes, people find it difficult to talk about unpleasant things that have happened	Did you tell anybody about it? Why/ Why not?

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
	to them. How do you feel telling me about this incident? People do not have the right to do these things to you. I am very impressed how strong you are after this. What would you recommend to other women in the same situation, when someone says or does something bad to them?	
For women with uterine prolapse only: Part 7: Free exploration quality of health services for uterine prolapse	What did you do to be helped when you suffered from uterine prolapse?	
Accessibility	Can you tell where you would go for help because of uterine prolapse? Who took the decision that you went for health care?	Can you choose to come there yourself, or did you need permission from somebody else? Who? Are there times when you wanted to go to a health center but couldn't? Why?
Quality of health care	How were you helped? Where there any advice or treatment they suggested that you refused? Why?	Which steps did the people helping you take to deal with your situation? Which advice, concrete action did you and the people helping you take?
	Did you receive the help you wanted?	How satisfied have you been with the help you received?
	Did you receive any other help (alternative methods?)	
Part 8: Probing	Which questions were difficult for you to answer? Is any question irrelevant in your opinion? Is any question missing in your opinion?	
Part 9: Socio-demographic questions	Finally, I have some personal questions. Again, we will keep this information strictly anonymous: What is your ethnicity? How old are you? What are your household's monthly expenses? Are you in a relationship? How many children do you have? What is your highest education? Name: District: Municipality: Phone Number:	

Appendix II

Discourse and dimension	Leading questions	Optional follow-up questions
	We recognize and commend your strength and courage, and thank you for taking the time to talk with us about your experiences. You have helped us a lot in understanding risks and benefits of water carrying. The information you shared with us will help to find strategies to support women in the field of water carrying, so that others may be helped by your experience. Is there anything we did not mention yet you would like to add? Do you have any questions for us?	

Note. Instructions and information for the interviewers are written in italics.

Table S5

Sample characteristics and carrying behavior derived from qualitative interviews

	Women in reproductive age (n = 12)	Mother-in-law (n = 5)	Husband (n = 4)
	f	*f*	*f*
Ethnicity[1]			
Brahmin	5	2	2
Tamang	1	1	1
Newar	1		
Chhetri	2	1	
Dalit	2	1	1
Rai and Limbu	1		
Education			
Illiterate	2	4	2
Informal education			
Pre-primary	2	1	
Primary passed	2		
Lower secondary passed	2		
Secondary	4		1
Higher secondary and above			1
Living conditions			
Single / living with children	1		
Nuclear family	4		2
Joint family	7	5	2
Behavior during pregnancy			
Like usual	7	5	
Carrying less amount	4		
No carrying after second half	1		
No carrying at all			
Behavior 3 months postpartum			
Like usual / after less than 2 weeks		3	
Carrying less amount up to 3 months		1	
No carrying up to 2 weeks	3		
No carrying up to 1 month	2		
No carrying up to 2 months	4		
No carrying up to 3 months	3	1	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
Age	33.2(10.0)	56.6 (8.7)	49.5 (6.6)
Monthly expenses	20791 (13393)	9900 (3664)	21750 (102ß7)
Number of children	2.3 (0.8)	4.8 (3.6)	3.3 (1.3)

Note. *M* = Mean, *SD* = Standard deviation, *f* = frequency. [1]Some women changed their ethnicity, ethnicity corresponds to ethnicity after marriage

Table S6

Additional quotations for qualitative themes

Theme	Quotation
Amount and frequency of carrying	"*I carried about 9 to 10 gagris [containers] of water because we had buffalos and cattle. I carried a 15-20 liter gagri in a doko [basket to carry loads].”* 9_wife: 143.
	"*Did you carry that much water all throughout your pregnancy? R: Yes.”* 9_wife: 144 – *145.*
High risk perception but low personal vulnerability	
Pain	"*It may cause back pain [to carry during pregnancy]. There would be no pros. Some people say that bleeding occurs if a woman carries water immediately after delivery. It didn't happen to me.”* 5_daughterinlaw: 157.
Mental health	*"[Carrying during and after pregnancy] might affect the baby and the mental condition of the woman.* 9_husband: 110 – 111.
Child's health	*"When they carry water at the waist it affects the baby greatly."* 9_husband: 113.
Complications during pregnancy	*"They might also need a C-section [if they carry water during pregnancy]."* 5_motherinlaw: 143.
	"She fell down sometimes, and she had to worry when she was pregnant. She had to carry water when she was pregnant as well." 9_husband: 55.
Miscarriage	*"She might get a miscarriage [if she carries during pregnancy]; she may be weak."* 5_motherinlaw: 143.
Uterine prolapse	*"When carrying heavy loads and doing a lot of hard chores for the woman who just delivered the baby there may be the risk of prolapse."* 5_motherinlaw: 163.
	"I felt worried, but it was needed. I was worried that she might get uterine prolapse and bleeding; she might fall ill." 6_husband: 87.
Removal of uterus	*"If you carry heavy loads, then a uterus prolapse might happen and you need to operate, need to take out the uterus. There are also many people whose uterus has been removed, but I don't have [that problem]."* 1_woman: 279.
Compensatory beliefs	*"During pregnancy, if you carry heavy loads, you shouldn't squat during those times, you shouldn't walk very fast."* 9_wife: 198.
	"In my opinion, she [the women who carries water] is really healthy and maybe has no physical illness and pain. […] She should eat healthily and do oil massage and rest so she is safe." picture task carry 11_daughterinlaw: 111– 125.
Negative and positive outcome expectancies for the avoidance of carrying	
Less exercises	*When my wife had to carry water, she had many demerits but now that she doesn't carry water, she has less exercise."* 9_husband: 37.
Healthy child	**"***Other people will say that you don't have to carry water and you get the chance to rest so you can put on some weight and your child is healthy."* picture task not carry 9_husband: 85.
	"*She [woman in picture task] doesn't have to carry water, so it is nice. Her family will be healthy."* picture task not carry 7_daughterinlaw: 152.

Appendix II

Theme	Quotation
Low response efficacy	*"It would've been good if we didn't have to work at all and could have enough rest. However, it [uterine prolapse] can happen to those who don't work too."* 8_motherinlaw: 189.
Karma beliefs	*"She [not carrying woman] might behave well or she might be from a good family. When a person is good, everybody will treat her well."* picture task not carry 12_wife: 305.
	"*Some say that it was God's decision [that they have uterine prolapse like my wife, so stay at home and don't tell anyone about the problem.* 9_husband: 133.
Ability, not carrying when sick	*"When I was pregnant, I could carry water on my own, so he [husband] rarely carried."* 12_wife: 179.
	"Did you carry the same amount for the whole nine months? - Only when I was sick I used to carry less." 8_motherinlaw: 134 – 135.
Affective Attitudes	*During past days I liked it [water-carrying], so I carried water. Now these days I don't like carrying water, so I don't carry: that's it (laughing)."* 1_woman: 85.
Being greedy	*"My wife also carried water like this woman [in the picture task], so she has uterus prolapse. I always tell her she faced this prolapse not because of me but because of her greed to carry more water."* picture task carry, 11_fatherinlaw: 69.
Social influence and decision making	
Carrying before marriage	"*I used to carry when I was not married, when I was 12 or 13 years. It's been seven years since I got married, but before that as well I used to carry loads."* 2_woman: 82.
Family influence	*"She is not able to work but her family must also be like that (bad and culturally strict), if they were good then they would have cared about that women isn't it? I think they are not a good family. I think they should have said 'you are not able to earn money', the pressure will also come from the home. [To interviewer] Isn't it like that Miss? That's human nature. It depends on the family."* picture task carry 1_woman: 307.
Decision making control by family members	*"We all decided that she wouldn't carry heavy loads [during pregnancy]. It's bad to carry heavy loads during and after pregnancy, so my sisters didn't allow her to carry heavy loads. My wife didn't have to carry heavy loads for about 5 months."* 9_husband: 104–105.
	"I decided not to make her [daughter-in-law] work [when she was pregnant]." 10_motherinlaw: 160.
	Contradictory quote: *"Everyone [in the family] decided that [to carry during pregnancy and shortly after delivery], but mostly me."*12_wife: 161.
Hierarchical vs. shared decision making in families	"*Her husband may be in a dilemma whether to listen to his mother and let her work or to make his own decision and not let her work. He should also listen to the main person of the family. He might be following his mother."* 12_wife: 137.
	"I decide that myself [whether my wife carries water during and after pregnancy]. My mother and father suggested me to support my wife and take care of her." 11_fatherinlaw: 108–109.
Family division of labor	"*It is easy if she [daughter-in-law] helps out. It is satisfying to have her here. She cleans, cooks and washes dishes, and lets me rest. This satisfies me. […] [Our relationship] is good. She does all the work and lets me rest.*" 7_motherinlaw: 63 – 67.

Appendix II

Theme	Quotation
	"My eldest daughter-in-law lives here, and it's easier. I carry less now." 5_motherinlaw: 27.
	"*It got so much easier after she came. She carried all the loads*." 7_motherinlaw: 35.
Descriptive norms	"*Everybody had to fetch water. Everybody had trouble due to water problems. If women woke up late, then they had to worry about not having enough water."* 11_fatherinlaw: 41.
	"Other people will think that it is normal [to carry after delivery]: 'We also did all the work like her, and she should also do so.' " picture task carry 12_wife: 133.
Injunctive norms	
Disapproval of resting	*"They [family members] might have behaved badly. They would have criticized me [for resting during pregnancy] and talked behind my back; compared me."* 9_wife: 172 – 173.
	"[Other women might say] bad things. They [other women] might have said she's sleeping and I need to bring water…' (Laughing). … They must have said that the younger one [herself] is sitting and the elder one [sister in law] is coming to fetch the water." 3_woman: 190.
	Contradictory quote: *"She [mother-in-law] is happy with whatever I do. She looks after my kids when I 'm not around. I feel happy when she helps out. She's happy with me."* 5_daughterinlaw: 79.
Approval of carrying	*"She [mother-in-law] might think that her daughter-in-law has brought water from far away and she has taken good care of her and her family, so she might be good to her daughter-in-law. … She stays home and works really hard, so her husband may be happy with her. He [husband] must be reassured to have such a strong wife."* picture task carry, 5_daughterinlaw: 111–117.
Disapproval of carrying	*"'Why is she carrying water just after having delivered her baby?' They [other people] say things like this. She shouldn't carry water*." picture task carry, 6_wife: 106.
Approval of resting	"*Other women must have said nice things to her [the woman who is resting after delivery]. She did a good job, and her body will also be good due to not working in the postpartum period."* picture task not carry 2_woman: 215.
	"*Others also told us that we should rest two months, so I did."* 10_daugtherinlaw: 170.
Comply norms	*"The people said that we should carry loads when we're pregnant, so I did."* 12_wife: 179.
	"*Poor mother-in-law, what she will say? During that time [in the past], the culture was like that. Everyone worked during that time, even they want to say don't work if you can't, the trend was like that (daughter-in-law needs to work at any phase of her life)"* 1_woman: 245.
	Contradictory quote: *"They [in-laws] said things, but I rested anyway."* 6_wife: 155 - 156 .
Caring husband	**"***He [husband] didn't allow me to work when I was feeling unwell."* 11_daughterinlaw: 177.
	"*He [my son] also behaves well. He doesn't hit her [daughter-in-law]; he tells her to rest and take care of her body and eat well. Tells her to do just the work she can."* 5_motherinlaw: 151.
Mother-in -laws expectations	"*Her mother-in-law might have scolded her: 'I (mother-in-law) work and you're resting, sitting, and eating'; must have said that. (Laughing). That's what the mother-in-law says"*

Appendix II

Theme	Quotation
towards daughter-in-law	picture task carry 3_woman: 146.
Mother-in-law satisfaction when fulfilling work tasks	*"She's done as much as she can. We can't mistreat her, and we have been together and happy. She doesn't complain and I don't complain either."* 5_motherinlaw: 67.
	Contradictory quote: *"No matter how much we [daughters-in-law] help, she doesn't count us."* 11_daughterinlaw: 75.
Mother-in-law being aggressive	"*My mother-in-law complained about me to him [husband], and she also used to beat me."* picture task carry 16_woman: 160.
Making plans and overcoming barriers: Safe carrying techniques	
Body posture	"*If people are carrying heavy loads, then their body should bend a little. If people are carrying fewer loads, then they should walk straight."* 11_motherinlaw: 69.
Carrying less weight	"*One shouldn't carry too much load or travel too long distances; should get much-needed rest."* 8_motherinlaw: 163.
	"I think it is okay to carry between 5 and 10 liters." 11_daughterinlaw: 53.
	"*Yes, it is possible [to carry small containers]. We can carry less water and make more trips."* 12_wife: 84–85.
	"*Did you carry that much water all throughout your pregnancy? R: Yes."* 9_wife: 144–145.
Reduce frequency	*"I told her [daughter-in-law] to do less work. She brought water daily [during pregnancy] one or two times. [On normal days she carried] five to six times a day.* 5_motherinlaw: 135–137.
Use helping tools	*"What do you need to use safe carrying techniques?" -R: "I need ropes and doko [basket for the water container that is carried with straps on the forehead or shoulders] and sack."* 5008_daugtherinlaw_5007: 80–81.
	"I cannot carry water on my waist. I use a doko to be safe." 8_daughterinlaw: 62–63.
	"*In the past, people used to carry water in gagris [containers] on their waist, but now we carry it hanging in the hands ,and we use a doko for far away. I think it is healthy if we don't carry water by putting loads on the waist or head or shoulder."* 11_daughterinlaw: 51.
Ask for help	*"[The woman who carries after delivery can]may ask somebody like neighbors for help, saying she [is] unable to do it and she will help them [in return] when they are in need*." picture task carry, 12_wife: 275.
Change lifestyle	*"We should learn other economic activities and stop rearing animals, so we won't have to carry grass. We can earn money and bring home LPG gas and we won't have to carry firewood."* 12_wife: 81.
Pelvic floor exercise	"*Yes, I'll learn it [pelvic floor exercise] and I'll also teach it to others. … If something bad happens, then it becomes very hard for a woman. If I learn it, then maybe I can be healthy. I can also teach it to others. Even if it happens to me [something bad like uterine prolapse], I can make others aware. I am concerned about the new generation."* 9_wife: 229–231.
Lack of options and necessity to of carrying water	

Appendix II

Theme	Quotation
Lack of options	*"Even if I say I don't like [carrying], nobody is going to help me. So for me, everything is good. If I say … I don't want to work [still] no one is going to help me. And if I enjoy, then nobody is going to harm me. Does it make any difference what others think?"* 1_woman: 29.
Obligation:	*"I knew we shouldn't carry heavy loads [during pregnancy] but due to compulsion I had to."* 12_wife: 155.
Structural conditions	*"These days. I don't need to go to the river and travel long. There are taps in the houses, so it's easier now."* 3_woman: 87.
	"These days they don't carry water. The husband brings water for them by carrying it in his motorbike. There's one house where there's a pregnant lady, and the husband brings water for her." 3_woman: 176.
Sources not always reliable	*"Only when water doesn't come from the tap do we go to fetch water. Otherwise, we don't have to."* 8_daughterinlaw: 19.
	"We used to get water from here, at the water spring. But that water spring [from where I used to collect water] is dry now." 1_woman: 111.
Social support	
Instrumental support family	*"When they were sick, then other people in the family carried water for them. There are mothers-in-law, fathers-in-law, and sisters-in-law who bring the water. So if somebody is ill, then they would not need to go to fetch water."* 2_woman: 183.
Instrumental support others	*"The villagers won't do anything for her. Perhaps one day one will bring food for her, the second day they will bring food, but they'll never bring it every day. So, her own husband must do it or her mother-in-law or father in law must do it."* picture task carry 15_woman: 240.
	"*Yes [I help out my neighbors]. When they're sick and unable and when no one is there."* 5_motherinlaw: 92.
Informational support	*Doctors can give medicines and raise awareness. The husband and other family members can also suggest her to go for checkups."* 10_motherinlaw: 191.
Emotional support	*"They (other people) should console her."* picture task carry 9_wife: 115.
	"[After delivery] my mother came to support me and console me. I was young when I gave birth. The babies were 4 kg when delivered. My mother comforted me." 12_wife: 106–107.
Lack of instrumental support	*"Even when I'm not able to there's no one to carry for me."* 6_wife: 43.
Support insufficient	*"When I was pregnant my husband rarely helped me. … The relatives came to help sometimes in the emergency time after I gave birth."* 12_wife: 173–189.
Husband not always available	*"I didn't let her carry heavy loads. I helped as much as I could when I was available, but in her post pregnancy period, she had to carry loads after about 2 to 3 months."* 9_husband: 95.
Husband buys water or hires	"*Water is needed anyway, so I carry it in a big gagri [container]. Just 2 days ago, I brought water in a bus by paying a fare. Now it may be enough for 10-12 days, but after that we have to go and fetch water again."* 6_husband: 17.

Appendix II

Theme	Quotation
someone to help his wife.	*"My husband helps out, and when my sons are home, they help. Some days ago, we even brought water in a truck due to a water shortage."* 6_wife: 87.
	"I brought her mother and kept her at our home to help my wife after she gave birth." 9_husband: 96.
Mutual support husband wife	"*I carry more water then [when my wife is sick]. If I fall sick, then she carries all the water, and when she is ill, then I carry for her. The load shifts."* 6_husband: 31.
Reasons to help or not mother-in-law	
Being weak / old	"*Mother-in-law and father-in -law already expired so who will do this? I need to do it myself. I have brothers-in-law, but they travelled abroad. So who will do it?"* 3_woman: 65.
	"*I am weak now, so I can't carry much [during the pregnancy and postpartum period of my daughter-in-law]. When I was stronger, I used to work, and it didn't feel bad.*" 5_motherinlaw: 33.
Her personality	*"If her mother-in-law is nice, then she'll say that she'll look after her kids. If the mother-in-law isn't nice, then she'll say that her daughter-in-law must carry water and do all the work herself."* picture task carry 7_daughterinlaw: 136.
Relationship quality	*"As I've said, maybe the mother-in-law … has some discrimination-like feeling against her. She is her daughter-in-law and not her daughter, so she may behave rudely."* picture task carry 11_daughterinlaw: 115.
Own past behavior	*"She might say that 'I did it in my days and so should you. I worked even more, and you should work too'"*. picture task carry 12_husband: 79.
Traditional /modern mother-in-law	*"She must have a modern mother-in-law, so she may not say anything to her. (Laughing) Isn't it? The traditional mother-in-law will say that they used to do this and that"*. picture task not carry 15_woman: 250.
Caring / loving as a reason for instrumental support	*"When the husband doesn't care, then she must feel like she shouldn't have married. Won't she think like that? She'll definitely think like that. He spends his life like that and I'm suffering. She must feel like that."* picture task carry, 15_woman: 230.
	"If she [mother-in-law] loves her, then she'll bring water by herself, won't she?" picture task carry 2_woman: 205.
Two different sides of mothers-in-law (being a resource or a threat to women's health)	*"If her mother-in-law is nice, then she'll say that she'll look after her kids. If the mother-in-law isn't nice, then she'll say that her daughter-in-law must carry water and do all the work herself."* picture task carry 7_daughterinlaw: 136.

S7 SPSS SYNTAX to model two generalized estimating equations (GEE).

```
**Predictors of behavioral intention
GENLIN  intend (REFERENCE=FIRST) WITH selfeff outex risk1 injnorm descnorm gen_ins_support age livingwithouthusband curr_pregnant delivered education SI_SES_b by eth mainsource_rainyseason
 /MODEL risk1 outex selfeff  injnorm descnorm gen_ins_support  age  SI_SES_b  livingwithouthusband curr_pregnant delivered
education eth  mainsource_rainyseason
 INTERCEPT=YES
 DISTRIBUTION=NORMAL LINK=IDENTITY
 /CRITERIA METHOD=FISHER(1) SCALE=1 MAXITERATIONS=100 MAXSTEPHALVING=5 PCONVERGE=1E-006(ABSOLUTE)
  SINGULAR=1E-012 ANALYSISTYPE=3(WALD) CILEVEL=95 LIKELIHOOD=FULL
 /REPEATED SUBJECT=vdc_municipality WITHINSUBJECT=Participant_ID SORT=YES CORRTYPE=EXCHANGEABLE ADJUSTCORR=YES
  COVB=ROBUST MAXITERATIONS=100 PCONVERGE=1e-006(ABSOLUTE) UPDATECORR=1
 /MISSING CLASSMISSING=EXCLUDE
 /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION (EXPONENTIATED) COVB.

*****Predictors of behavior
GENLIN  safe_carry (REFERENCE=FIRST) WITH selfeff injnorm descnorm
intend gen_ins_support actionplanning_re coping_re age livingwithouthusband
 education SI_SES_b curr_pregnant delivered by eth mainsource_rainyseason
 /MODEL selfeff injnorm descnorm intend gen_ins_support  actionplanning_re coping_re age SI_SES_b livingwithouthusband curr_pregnant delivered
education eth mainsource_rainyseason
 INTERCEPT=YES
 DISTRIBUTION=NORMAL LINK=IDENTITY
 /CRITERIA METHOD=FISHER(1) SCALE=1 MAXITERATIONS=100 MAXSTEPHALVING=5 PCONVERGE=1E-006(ABSOLUTE)
  SINGULAR=1E-012 ANALYSISTYPE=3(WALD) CILEVEL=95 LIKELIHOOD=FULL
 /REPEATED SUBJECT=vdc_municipality WITHINSUBJECT=Participant_ID SORT=YES CORRTYPE=EXCHANGEABLE ADJUSTCORR=YES
  COVB=ROBUST MAXITERATIONS=100 PCONVERGE=1e-006(ABSOLUTE) UPDATECORR=1
 /MISSING CLASSMISSING=EXCLUDE
 /PRINT CPS DESCRIPTIVES MODELINFO FIT SUMMARY SOLUTION (EXPONENTIATED) COVB.
```

Appendix III: Supplementary information

Women's cognitions on reproductive health behavior are interrelated: A dyadic study

Table S1

Items overview

Concept	Items
Avoid carrying	Think about your last pregnancy. How often in one week do you carry water during pregnancy? / How often in one week do you carry water in the three months after delivery?, 5 = *no days to 1 = every day*
Risk perception	Compared to other women with the same age, how much higher or lower are your chances of getting uterine prolapse? *-2 = lower to 2 = higher*[1]
Outcome expectancies	How much do you agree to the following statements? *1 = agree not at all to 5 = agree very much*
	I would protect myself from negative health impact if I avoided water-carrying during pregnancy and after delivery.
	I would prevent uterine prolapse if I avoided water carrying during pregnancy.
Self-efficacy[1]	How sure are you that you can always avoid to carry your water during and after pregnancy?
	How sure are you that you can always avoid to carry your water during and after pregnancy even if it might be difficult for your household to have enough water?
	How sure are you that you can always avoid to carry your water during and after pregnancy even if someone in your family (e.g. your mother-in-law) told you to?
Intention[1]	How strongly do you intend to always avoid water carrying during and after pregnancy?
	How strongly do you intend to reduce water carrying during and after pregnancy?
	How frequently do you intend to avoid carrying water during and after pregnancy?
Action planning	Can you tell me what you can do to avoid carrying water during and after pregnancy? *1 = Ask for help; Carry less water; Tell other people I don't want to carry water; Buy water; other specific plan; 0 = No plan*
Coping planning	Which difficulties may arise that can prevent you from avoiding carrying water during and after pregnancy?
	How can you overcome difficulties that prevent you from avoiding to carry water during and after pregnancy? *1= Ask someone for help; Tell that I do not want to carry water; other specific coping plan; 0 = No plan*
Injunctive norm[1]	How much would people who are important to you approve if you carry water during and after pregnancy?
	How much would other people in your community approve if you avoided water carrying during and after pregnancy?
	How much would people who are important to you approve if you carry water during and after pregnancy? *(reverse coded)*

Appendix III

Concept	Items
Descriptive norm	How many women in your community carry water during and after pregnancy? 1 = Almost nobody (0%) to 5 = almost all of them (100%)
Relationship quality (Fletcher et al., 2000)	How satisfied are you with your relationship with your mother-/daughter-in-law?
	How happy are you with your relationship with your mother-/daughter-in-law?
	How committed are you to your relationship with your mother-/daughter-in-law?
	How dedicated are you to your relationship with your mother-/daughter-in-law?
	How much do you trust your mother-/daughter-in-law?
	How much can you count on your mother-/daughter-in-law?
	How dependable is your mother-/daughter-in-law?
	0 = not satisfied/happy/committed/dedicated/ trust her/ count on her/ dependable at all to 1 = very much satisfied/happy/committed/dedicated/ trust her/ count on her/ dependable

Note. All items used a five-point Likert scale and were recoded to a range between 0 to 1; [1]*0 = not at all*, 0.25 = *somewhat* 0.5 = *rather* 0.75 = *quite 1 = very much.* Psychosocial cognitions are based on the Health Action process Approach (Schwarzer, 2008).

S2 Sample syntax to model actor and partner effects of intention and behavior to avoid carrying

**INTENTION

**Model 1b

MIXED

actor_intend WITH actor_family_role_2 actor_selfeff actor_outex actor_risk1 actor_injnorm actor_descnorm

partner_selfeff partner_outex partner_risk1 partner_injnorm partner_descnorm

/CRITERIA=CIN(95) MXITER(1000000) MXSTEP(25) SCORING(1) SINGULAR(0.0000000001) HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)

/FIXED = actor_family_role_2 actor_risk1 actor_outex actor_selfeff actor_injnorm actor_descnorm

partner_risk1 partner_outex partner_selfeff partner_injnorm partner_descnorm

actor_risk1*actor_family_role_2 actor_outex*actor_family_role_2 actor_selfeff*actor_family_role_2 actor_injnorm*actor_family_role_2 actor_descnorm*actor_family_role_2

partner_risk1*actor_family_role_2 partner_outex*actor_family_role_2 partner_selfeff*actor_family_role_2 partner_injnorm*actor_family_role_2 partner_descnorm*actor_family_role_2 actor_risk1*partner_risk1 actor_outex*partner_outex actor_selfeff*partner_selfeff actor_injnorm*partner_injnorm actor_descnorm*partner_descnorm

/PRINT = SOLUTION TESTCOV COVB

/REPEATED = actor_Participant_ID | SUBJECT(householdno)

COVTYPE(CS).

**BEHAVIOR

COMPUTE filter_nomother=(actor_family_role = 2).

FILTER BY filter_nomother.

EXECUTE.

**Model 2

MIXED

actor_carrying_vulnerable_d_r WITH actor_selfeff actor_intend actor_injnorm actor_descnorm actor_actionplanning_re actor_coping_2 partner_selfeff partner_intend partner_injnorm partner_descnorm partner_actionplanning_re partner_coping_2

/CRITERIA=CIN(95) MXITER(1000000) MXSTEP(25) SCORING(1) SINGULAR(0.0000000001) HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001, ABSOLUTE)

/FIXED =actor_selfeff actor_intend actor_injnorm actor_descnorm actor_actionplanning_re actor_coping_2 partner_selfeff partner_intend partner_injnorm partner_descnorm partner_actionplanning_re partner_coping_2

/PRINT = SOLUTION TESTCOV COVB.

Table S3

Effects of actor's and partner's cognitions on behavioral intention to avoid water carrying during pregnancy and postpartum, model 1a) and its moderation by the family role (model 1b)

	Model 1a)					Model 1b)				
				95% CI					95% CI	
Parameter	*Estimate*	*SE*	*p*	*LL*	*U L*	*Estimate*	*SE*	*p*	*LL*	*UL*
Intercept	0.16	0.13	0.199	-0.09	0.42	0.21	0.14	0.122	-0.06	0.48
Family Role- Daughter in law	-	-	-	-	-	-0.06	0.12	0.621	-0.29	0.17
Actor effects										
A_Risk perception	0.01	0.08	0.851	-0.14	0.17	0.01	0.08	0.885	-0.15	0.17
A_Outcome expectancies	0.11	0.12	0.356	-0.13	0.35	0.12	0.13	0.341	-0.13	0.37
A_Self-efficacy	0.13	0.07	0.048	0.00	0.26	0.06	0.07	0.359	-0.07	0.20
A_Injunctive norm	0.40	0.10	< 0.001	0.20	0.60	0.26	0.11	0.017	0.05	0.48
A_Descriptive norm	-0.02	0.12	0.858	-0.25	0.21	-0.01	0.13	0.964	-0.25	0.24
A_Risk perception*role	-	-	-	-	-	0.02	0.08	0.827	-0.14	0.18
A_Outcome expectancies*role	-	-	-	-	-	-0.22	0.11	0.041	-0.43	-0.01
A_Self-efficacy*role	-	-	-	-	-	0.09	0.12	0.465	-0.15	0.32
A_Injunctive norm*role	-	-	-	-	-	0.15	0.14	0.296	-0.13	0.43
A_Descriptive norm*role	-	-	-	-	-	0.01	0.09	0.936	-0.16	0.18
Partner effects										
P_Risk perception	-0.08	0.08	0.321	-0.23	0.08	-0.10	0.09	0.285	-0.28	0.08
P_Outcome expectancies	-0.01	0.12	0.929	-0.25	0.23	-0.07	0.14	0.620	-0.34	0.20
P_Self-efficacy	-0.20	0.07	0.002	-0.33	-0.07	-0.14	0.12	0.243	-0.37	0.10
P_Injunctive norm	0.04	0.10	0.670	-0.16	0.24	0.25	0.16	0.123	-0.07	0.57
P_Descriptive norm	0.11	0.12	0.334	-0.12	0.35	-0.10	0.09	0.285	-0.28	0.08
P_Risk perception*role	-	-	-	-	-	0.04	0.08	0.616	-0.12	0.20
P_Outcome expectancies*role	-	-	-	-	-	0.03	0.11	0.794	-0.18	0.24
P_Self-efficacy*role	-	-	-	-	-	-0.02	0.12	0.887	-0.25	0.22
P_Injunctive norm*role	-	-	-	-	-	-0.06	0.14	0.650	-0.35	0.22
P_Descriptive norm*role	-	-	-	-	-	-0.18	0.09	0.036	-0.36	-0.01
Actor Partner Interactions										
A_Risk perception*P_Risk perception	0.09	0.10	0.359	-0.11	0.29	0.10	0.10	0.320	-0.10	0.30
A_Outcome expectancies* P_Outcome expectancies	0.08	0.15	0.568	-0.20	0.37	0.20	0.15	0.196	-0.10	0.50
A_Self-efficacy*P_Self-efficacy	0.40	0.13	0.002	0.15	0.65	0.36	0.15	0.019	0.06	0.66
A_Injunctive norm*P_Injunctive norm	-0.11	0.17	0.539	-0.45	0.24	-0.23	0.22	0.297	-0.67	0.21
A_Descriptive norm*P_Descriptive norm	-0.09	0.18	0.621	-0.45	0.27	-0.07	0.18	0.706	-0.41	0.28

Note. *N* = 476, *Estimate* = Parameter Estimates. *SE* = Standard Error. CI = Confidence interval. A = Actor, P = Partner; Family role: Daughter-in-law = 0; Mother-in-law = 1.

Appendix III

Figure S1

Interaction plot for actor's self-efficacy and behavioral intention to avoid water carrying loads during pregnancy and postpartum moderated by partner's self-efficacy

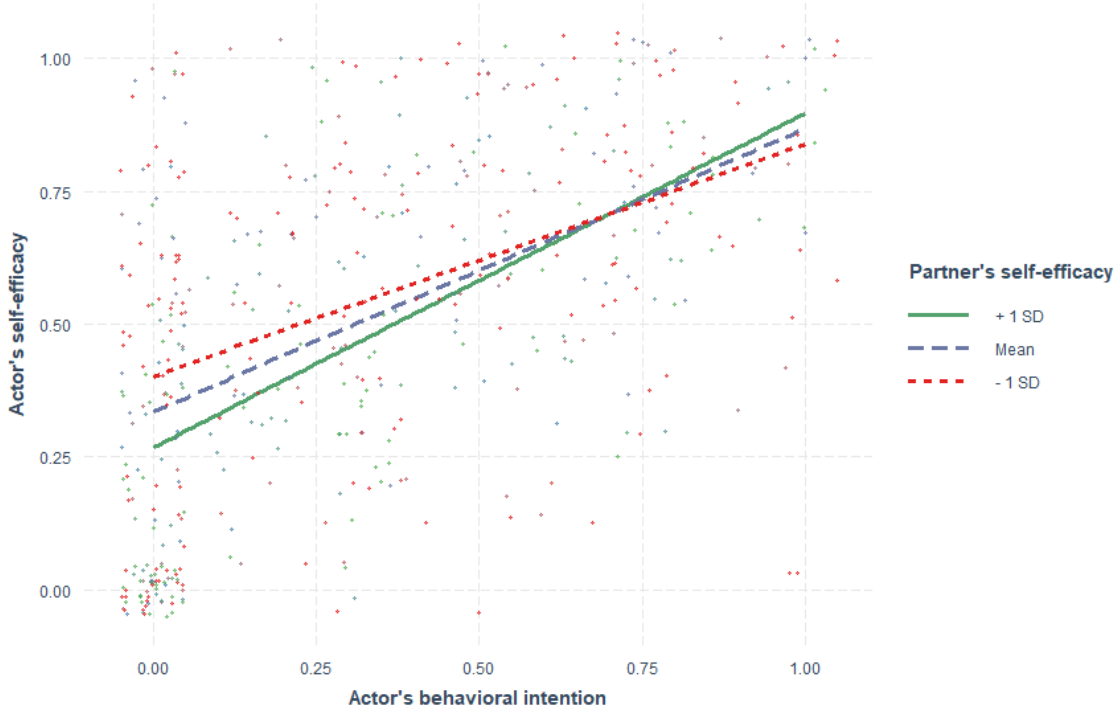


Figure S2

Interaction plot for actor's outcome expectancies (left)/ partner's descriptive norms (right) and behavioral intention to avoid water carrying moderated by family role

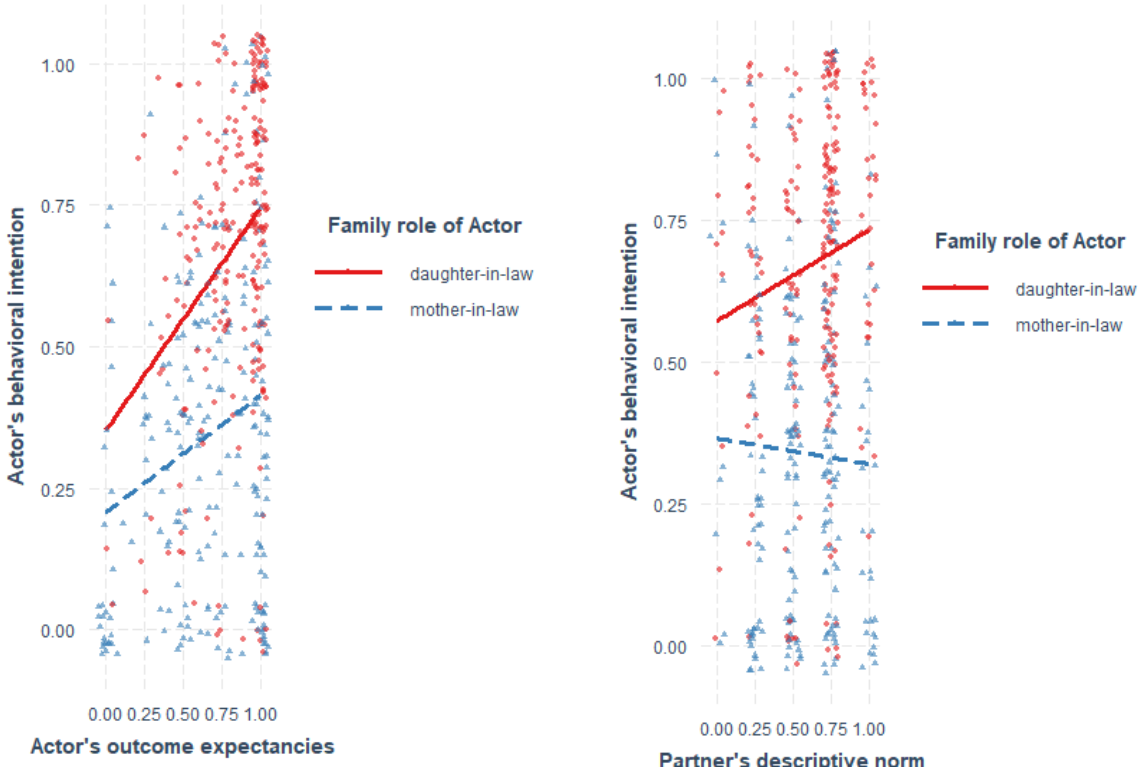


Figure S3

Interaction plot for partner self-efficacy and behavioral intention to avoid water carrying loads during pregnancy and postpartum moderated by relationship quality

Table S4

Effects of actor's and partner's cognitions on behavioral intention to avoid water carrying during pregnancy and postpartum, and its moderation by relationship quality (model 1c)

	Model 1c)				
				95% CI	
Parameter	*Estimate*	*SE*	*p*	*LL*	*UL*
Intercept	0.22	0.18	0.239	-0.14	0.57
Relationship Quality (RQ)	-0.27	0.23	0.248	-0.73	0.19
Actor effects					
A_Risk perception	0.10	0.15	0.495	-0.19	0.40
A_Outcome expectancies	0.30	0.17	0.087	-0.04	0.63
A_Self-efficacy	0.14	0.17	0.411	-0.20	0.48
A_Injunctive norm	0.50	0.20	0.016	0.09	0.90
A_Descriptive norm	-0.06	0.17	0.719	-0.40	0.28
A_Risk perception*RQ	-0.08	0.19	0.672	-0.47	0.30
A_Outcome expectancies*RQ	-0.17	0.21	0.429	-0.59	0.25
A_Self-efficacy*RQ	0.04	0.23	0.849	-0.41	0.49
A_Injunctive norm*RQ	-0.15	0.26	0.566	-0.66	0.36
A_Descriptive norm*RQ	0.14	0.18	0.421	-0.21	0.49
Partner effects					
P_Risk perception	-0.15	0.13	0.249	-0.40	0.10
P_Outcome expectancies	0.06	0.17	0.741	-0.28	0.39
P_Self-efficacy	-0.54	0.17	0.001	-0.88	-0.21
P_Injunctive norm	0.31	0.20	0.112	-0.07	0.70
P_Descriptive norm	0.05	0.17	0.761	-0.28	0.38
P_Risk perception*RQ	0.15	0.18	0.416	-0.21	0.50
P_Outcome expectancies*RQ	-0.01	0.23	0.979	-0.45	0.44
P_Self-efficacy*RQ	0.53	0.23	0.020	0.08	0.97
P_Injunctive norm*RQ	-0.39	0.26	0.142	-0.91	0.13
P_Descriptive norm*RQ	0.17	0.19	0.371	-0.20	0.53
Actor Partner Interactions					
A_Risk perception*P_Risk perception	0.06	0.10	0.589	-0.15	0.26
A_Outcome expectancies* P_Outcome expectancies	0.02	0.16	0.923	-0.29	0.32
A_Self-efficacy* P_Self-efficacy	0.35	0.13	0.007	0.10	0.60
A_Injunctive norm*P_Injunctive norm	-0.10	0.17	0.580	-0.44	0.25
A_Descriptive norm*P_Descriptive norm	-0.17	0.18	0.347	-0.53	0.19

Note. *N* = 476, *Estimate* = Parameter Estimates. *SE* = Standard Error. CI = Confidence interval. A = Actor; P = Partner; RQ = relationship quality.

Table S5

Effects of actor's and partner's cognitions on daughter-in-law's behavior to avoid water carrying during pregnancy and postpartum (2a), and its moderation by relationship quality (model 2b)

	Model 2 a)									
				95% CI					95% CI	
Parameter	*Estimate*	*SE*	*p*	*LL*	*U L*	*Estimate*	*SE*	*p*	*LL*	*UL*
Intercept	0.18	0.11	0.114	-0.04	0.39	-0.58	0.37	0.114	-1.30	0.14
Relationship Quality (RQ)	-	-	-	-	-	1.21	0.55	0.029	0.13	2.29
Actor Effects										
A_Self-efficacy	0.37	0.09	<0.001	0.20	0.54	0.04	0.28	0.874	-0.51	0.60
A_Behavioral intention	0.29	0.09	0.001	0.12	0.46	0.90	0.33	0.007	0.25	1.55
A_Injunctive norm	0.05	0.12	0.676	-0.19	0.29	0.48	0.40	0.235	-0.31	1.27
A_Descriptive norm	-0.03	0.08	0.726	-0.19	0.13	-0.20	0.24	0.416	-0.67	0.28
A_Action planning	0.02	0.08	0.782	-0.13	0.17	-0.05	0.21	0.826	-0.46	0.37
A_Coping planning	-0.03	0.04	0.450	-0.12	0.05	-0.03	0.15	0.858	-0.32	0.27
A_Self-efficacy*RQ	-	-	-	-	-	0.38	0.39	0.329	-0.38	1.14
A_Behavioral intention*RQ	-	-	-	-	-	-0.79	0.44	0.071	-1.65	0.07
A_Injunctive norm*RQ	-	-	-	-	-	-0.68	0.56	0.227	-1.78	0.43
A_Descriptive norm*RQ	-	-	-	-	-	0.21	0.34	0.542	-0.46	0.87
A_Action planning*RQ	-	-	-	-	-	0.12	0.33	0.721	-0.53	0.76
A_Coping planning*RQ	-	-	-	-	-	-0.04	0.22	0.859	-0.46	0.39
Partner Effects										
P_Self-efficacy	0.34	0.12	0.005	0.11	0.58	0.53	0.42	0.218	-0.31	1.36
P_Behavioral intention	-0.16	0.09	0.072	-0.34	0.01	-0.16	0.28	0.558	-0.72	0.39
P_Injunctive norm	-0.31	0.12	0.010	-0.55	-0.08	0.16	0.43	0.715	-0.69	1.01
P_Descriptive norm	0.03	0.08	0.725	-0.14	0.20	0.30	0.28	0.283	-0.25	0.85
P_Action planning	0.05	0.05	0.335	-0.05	0.14	-0.11	0.17	0.500	-0.44	0.22
P_Coping planning	-0.12	0.05	0.025	-0.22	-0.02	-0.24	0.21	0.253	-0.64	0.17
P_Self-efficacy*RQ	-	-	-	-	-	-0.27	0.62	0.664	-1.48	0.95
P_Behavioral intention*RQ	-	-	-	-	-	-0.06	0.40	0.885	-0.84	0.73
P_Injunctive norm*RQ	-	-	-	-	-	-0.63	0.61	0.306	-1.84	0.58
P_Descriptive norm*RQ	-	-	-	-	-	-0.47	0.41	0.248	-1.27	0.33
P_Action planning*RQ	-	-	-	-	-	0.21	0.23	0.377	-0.25	0.66
P_Coping planning*RQ	-	-	-	-	-	0.17	0.29	0.548	-0.40	0.75

Note. *N* = 238, *Estimate* = Parameter Estimates. *SE* = Standard Error. CI = Confidence interval. A= Actor (referring to the daughter-in-law in these models); P = Partner (referring to the mother-in-law in these models), RQ = relationship quality.

Appendix IV: Supplementary information:
Self-efficacy and social support enable women to take care of their pelvic floor health: A nonrandomized controlled trial in rural Nepal

Table S1

Item wordings for all secondary outcomes

Concept	Cronbach's Alpha		Items
	BL	FU	
Carried weight per trip	-	-	In the last 7 days, what was the usual weight of water [of other loads (e.g., grass, fodder, firewood)] you carried per trip? Open answer in kg
Protective lifting index	-	-	The index used the following formula: Score protective lifting* Frequency protective lifting
Protective lifting score[1]	-	-	How was your breath during lifting? *0 = Inhale; 1 = Exhale; 0 = Hold breath; 0 = Not aware of; 0 = Other* What did you do with your pelvic floor during lifting? *1 = Tightening; 0 = Relax; 0 = Did not feel the pelvic floor; 0 = I don't know; 0 = Other*
Protective lifting frequency	-	-	In the last 7 days, how often did you exhale when lifting loads? In the last 7 days, how often did you tighten your pelvic floor when lifting loads? *1 = (Almost) never (0%); 2 = Sometimes (25%); 3 = Half of the times (50%); 4 = Most of the times (75%); 5 = (Almost) always (100%).*
Self-efficacy (Schwarzer et al., 2003)	Weight: .92 Protective lifting .91	Weight: .95 Protective lifting .94	How sure are you that you can always stick to your goal weight [use protective lifting techniques]? (Motivational self-efficacy) How sure are you that you reduce the weight you carry [exhale and tighten pelvic floor at the same time]? (Motivational self-efficacy) Even if it might be difficult for you to get work done on time [to remember all steps], how sure are you that you can always stick to your goal weight [use protective lifting techniques]? (Maintenance self-efficacy) Even if someone in your family (e.g., your social partner) told you to carry more [you do not immediately feel a physical health improvement], how sure are you that you can always stick to your goal weight [use protective lifting techniques]? (Maintenance self-efficacy)

Appendix IV

Concept	Cronbach's Alpha BL	Cronbach's Alpha FU	Items
			Even if you carried more than your goal weight [forget to use protective lifting techniques] one day, how sure are you that you can reduce carried weight [use protective lifting techniques] the next days again? (Recovery self-efficacy) *1 = Not at all sure to 5 = Very sure.*
Social support (Schwarzer & Schulz, 2013)	Weight: .91	Weight: .93 Protective lifting .94	How much do you agree to the following statements… This person made me feel valued and important when I carried less weight [used protective lifting techniques]. (Emotional support) This person comforted me when I was feeling bad because I carried less weight [used protective lifting techniques]. (Emotional support) This person carried weight for me [practiced protective lifting techniques with me]. (Instrumental support) This person helped me to find an option to carry less weight for the household [to use protective lifting techniques] (e.g., hire someone, bring water and food by car). (Instrumental support). This person took care of carrying if I could not manage to carry higher amount of weight on my own. (Instrumental support) This person helped me find something positive about carrying less weight. (Informational support) This person gave me information on possibilities to reduce carried weight [explained the protective lifting techniques to me]. (Informational support) This person explained protective lifting techniques to me. (Informational support) *-2 = strongly disagree to 2 = strongly agree.*
Coping	-	-	What may compel you to reduce carried weight [use protective lifting techniques]? Pre-coded answer options to open question: *Need for carried items in family.* *Someone tells me to carry more.* *Other people expect me to carry more.* *People will make fun of me when carrying small amounts.* *It will take too much time to carry less.* *I like carrying more weight.* *No difficulties.* *I don't know.*

Appendix IV

Concept	Cronbach's Alpha BL	Cronbach's Alpha FU	Items
			Other.
			[I do not know how to do it.]
			[I am not used to applying these techniques.]
			[I forget about using these techniques.]
			[I don't like/ do not feel comfortable to use these techniques.]
			[People will make fun of me using these techniques.]
			[It will take too much time using these techniques.]
			[There is nothing that may hinders me.]
			[I don't know.]
			[Other.]
			How can you overcome these difficulties? *0 = Mentions no plan; 1 = Mentions plan*
Illness-related personal control (Moss-Morris et al., 2002)	.73	.77	There is a lot which I can do to control my symptoms.
			What I do can determine whether my symptoms get better or worse.
			The course of my symptoms depends on me.
			Nothing I do will affect my symptoms.
			I have the power to influence my symptoms.
			My actions will have no effect on the outcome of my symptoms.
			1 = Agree not at all to 5 = Agree very much.
Quality of life (Rocha et al., 2012)	.83	.85	How satisfied are you with the conditions of your living place?
			How satisfied are you with yourself?
			How satisfied are you with your personal relationships?
			Have you enough money to meet your needs?
			How satisfied are you with the conditions of your living place?
			1 = Not at all satisfied to 5 = Very satisfied.
Daily functioning, (Kaz de Jong et al., 2016)	-	-	Please rate the severity by which carrying loads reduces your daily functioning.
			1 = Not at all severe to 5 = Very severe.
Pelvic floor contraction knowledge	-	-	Can you tell me whether the following are techniques to tighten the pelvic floor? *1 = Imagine to stop flow of urine; 0 = Bring shoulder blades together; 1 = Feeling a lift inside the pelvis; 1 = Small tightening of muscles in lower stomach; 0 = Bend knees; 0 = Lift toes up; 0 = Imagine to press as if going for defecation; 1 = Feeling a squeeze inside the pelvis.*
Perception of pelvic floor muscles during lifting	-	-	Did you feel any muscles tightening during lifting? If yes, which ones? *0 = Back; 0 = Stomach; 0 = Legs; 0 = Head; 0 = Neck; 0 = Muscles of arms; 1 = Pelvic floor; 0 = Other.*

Appendix IV

Concept	Cronbach's Alpha		Items
	BL	FU	
Use of pelvic floor muscles during lifting	-	-	How did you tighten the pelvic floor muscles? *1 = Imagine stopping flow of urine; 1 = Feeling a lift inside the pelvis; 1 = Feeling a squeeze inside the pelvis; 1 = Small tightening of muscles in lower stomach; 0 = I don't know; 1 = Other.*
Pain (Pathak et al., 2018; S. Sharma et al., 2017)	.69	.61	How much pain did you feel in your pelvis in the last 4 weeks? How much pain did you feel in your lower back in the 4 last weeks? How much pain did you feel in your lower abdominal or genital area in the last 4 weeks? *0 = No pain to 10 = Worst pain possible.*
Pelvic organ prolapse (Hagen et al., 2009)	.75	.58	How often in the last 4 weeks did you have a feeling of something coming down from or in your vagina? How often during the last 4 weeks have you had the following symptoms: An uncomfortable feeling or pain in your vagina which is worse when standing? A heaviness or dragging feeling in your lower abdomen/tummy? A heaviness or dragging feeling in your lower back? A need to strain (push) to empty your bladder? A feeling that your bladder has not emptied completely? A feeling that your bowel has not emptied completely? *1 = Never to 5 = Always.*
Urinary incontinence (Grøn Jensen et al., 2022)	-	-	Do you sometimes accidentally leak urine? *0 = Never to 2 = Yes, often.* How often do you leak urine? *0 = Never to 5 = All the time.*
Impact of urinary incontinence (Barber et al., 2001)	.76	.74	How much are you bothered by leaking urine? How much are you bothered by urine leakage related to activity, e.g., working, lifting, coughing, or sneezing? *1 = Not at all to 5 = Very much.*
Impact of pelvic organ prolapse (Barber et al., 2001)	-	-	How much are you bothered by any symptoms of pelvic organ prolapse related to activity, e.g., working, lifting, coughing, or sneezing? *1 = Not at all to 5 = Very much.*

Note. BL = Baseline FU = Follow up. Items using a five-point Likert scale were asked in structured face-to-face interviews and supported by a visual 5-dot (Harter et al., 2020). [1]Protective lifting score was calculated summing the points of two items (*0 = unprotective lifting* to *2 = protective lifting*

S2

Pelvic physiotherapy training for the health practitioners

The health practitioners were intensively trained in pelvic floor muscle contraction and pelvic floor protective lifting by the third author (pelvic physiotherapist). As the training of a co-contraction maneuver is based on the motor learning principles of the PFM (Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018) the instructions of pelvic floor muscle contractions are based on a sensorimotor training, which helps women to better feel and contract their PFM (Leech et al., 2022; Luginbuehl et al., 2015, 2022). The training includes very specific, precise, and detailed information and verbal instructions and practice of the PFM contraction with the help of visual aids, such as imagining to squeeze and lift a sponge with the pelvic floor muscles and, as a next step, a pelvic floor muscle co-contraction during lifting. In the context of this study, the practitioners were additionally trained in a stepwise instruction of pelvic floor protective lifting, which includes the co-contraction of the pelvic floor muscles as well as exhaling breath before and during lifting the load (Bø, 2004; Hagins et al., 2004; Kawabata et al., 2010; Sarno & Hameed, 2018).

Table S3

Intervention activities and behavior change techniques (BCTs) (Michie et al., 2013) to promote self-efficacy and social support at the example of target behavior 1: Reducing the carried weight

Source of Self-efficacy (Bandura, 1977)	**Information only control**	**Self-efficacy**	**Self-efficacy + Social support**
	Control Activity (Activity 1) Woman receives information on recommended weight limits *[Instruction on how to perform a behavior, 4.1]* to prevent pelvic organ prolapse *[Information about health consequences, 5.1]*. (See first part of Figure1). She is informed about the benefits reducing pelvic pressure may imply *[Information about health, environmental, social and emotional consequences, 5.1, 5.3, 5.6].*		
Performance Accomplishments Verbal Persuasion Emotional Arousal		**Activity 2 Focus on success:** Woman reflects with practitioner upon past successes in reducing carried weight. They indicate feelings related to this success *[Focus on past success, 15.3; Monitoring of emotional consequences, 4.5].*	**Activity 2 SS Focus on success:** The woman and her partner both think of situations when the main participant successfully reduced carried weight *[Focus on past success, 15.3].* They indicate feelings related to this success *[Monitoring of emotional consequences, 5.4; Social support unspecified, 3.1].*
Vicarious Experience Verbal persuasion		**Activity 6 Video of successful other:** is shown to the woman (see Screenshot Figure5). The video indicates a rural woman who states how she achieved to reduce carried weight, two scenes: 1) She is shown in a situation where she decides carrying the small water container or bottles instead of carrying the big water container 2) The woman stands in the field and fills her basket (traditional "doko") with grass /or firewood. Next to her, there is another basket, which has the typical high overload of grass/wood. The woman stops filling her basket before the weight is over 12 kg *[Instruction on how to perform the behavior, 4.1; Demonstration of the behavior, 6.1*; *vicarious reinforcement, 16.3].* Then she encourages that the participant can adopt the same behavior, e.g. *"I don't want to carry too heavily. I am confident I can carry less load if I decide to do so. – If I can do it you can do it" [Verbal persuasion, 15.1].* The woman says that she is confident that she can start carrying less (motivational self-efficacy), that she is confident that she can overcome difficulties to carry less (coping self-efficacy) and that she is confident to get back to carrying less after carrying more one day (recovery self-	**Activity 6 SS Video of successful other:** is shown to the woman (see Screenshot Figure5). The woman and partner watch the video with the two scenes (see above) together. The difference is, that the woman in the video has a mother-in-law or husband who supports her by telling her to reduce weight and by carrying a part of the weight for her *[Instruction on how to perform the behavior, 4.1; Information about health consequences, 5.1; Problem solving, 1.2; Verbal persuasion, 15.1; Vicarious reinforcement, 16.3; Practical support 3.2; Information about others' approval, 6.3]*. The mother-in-law appreciates the behavior. Then she encourages that the participant can adopt the same behavior, e.g. *"I will help her to carry less. Together we can do it, you are also capable to carry less. If she can do it, you can do it" [Verbal persuasion, 15.1; Emotional support 3.3].* The woman and husband discuss that they are confident that by supporting her, she can start carrying less (motivational self-efficacy), that she is confident that she can overcome difficulties to carry less (coping self-efficacy) and that she is confident to get back to carrying less after carrying more one day (recovery self-efficacy) *[Demonstration of behavior 6.1; Vicarious reinforcement 16.1; Verbal persuasion 15.1; Practical support 3.2; Emotional support, 3.3].*

Source of Self-efficacy (Bandura, 1977)	Information only control	Self-efficacy	Self-efficacy + Social support
		efficacy) *[Demonstration of behavior 6.1; Vicarious reinforcement 16.1; Verbal persuasion 15.1].*	
Performance Accomplishments Verbal Persuasion Emotional Arousal		**Activity 7 Using templates of success:** The woman visualizes herself reducing carried weight in the future. She receives templates of a figure to draw her face on it and different weights (water containers, wood, grass, see Figure4). She is instructed to stick the weights to the figures hands/ basket to indicate how this little version of herself is capable of carrying less weight (grass) [*Mental rehearsal of successful performance, 15.2; Problem solving, 1.2].* The practitioner reassures her and asks her to describe how she feels about the success. She is asked to draw a smiley face on the figure who successfully carried less *[Verbal persuasion, 15.1; Monitoring of emotional consequences, 5.4]*.	**Activity 7 SS Using templates of success:** The woman and her partner both use the template to visualize the main participant reducing carried weight in the future. [*Mental rehearsal of successful performance, 15.2; Problem solving, 1.2; Practical support 3.2].* The practitioner reassures them and asks both to describe how they feel about the main participant's success. They are asked to draw a smiley face on the figures who successfully carried less (representing the main participant) *[Verbal persuasion, 15.1; Monitoring of emotional consequences, 5.4; Information about others' approval, 6.3].*
Performance Accomplishments Verbal Persuasion Emotional Arousal		**Activity 8 Mental journey:** Practitioner leads woman through a meditative exercise where she imagines herself in the following scene: In the field, stopping to fill her basket with grass when the weight limit is reached *[Instruction on how to perform the behavior, 4.1; Mental rehearsal of successful performance, 15.2].* She is encouraged to repeat the following sentence in her head: *"I am sure, I can carry less weight" [Self-talk, 15.4].* Woman imagines walking with the basket, feeling happy and released for successfully carrying less weight *[Monitoring of emotional consequences, 5.4]***.** She is instructed to go into the positive / proud feeling regarding her decision to carry less *[Mental rehearsal of successful performance, 15.2; Verbal persuasion about capability, 15.1; Instruction on how to perform the behavior, 4.1; Monitoring of emotional consequences, 5.4]*.	**Activity 8 SS Mental journey:** Woman and her partner both listen to the meditative exercise where they imagine the following scene: In the field, the partner reminds the main participant to stop filling her basket with grass when the weight limit is reached. *[Mental rehearsal of successful performance, 15.2; Practical support 3.3; Information about others' approval, 6.3].* The woman is encouraged to repeat the following sentence in her head: *"I am sure, I can carry less weight" [Self-talk, 15.4].* Woman imagines walking with the basket, feeling happy and released for successfully carrying less weight. She is instructed to go into the positive / proud feeling regarding her decision to carry less. *[Mental rehearsal of successful performance, 15.2; Verbal persuasion about capability, 15.1; Instruction on how to perform the behavior, 4.1; Monitoring of emotional consequences, 5.4]*. The partner is instructed to imagine her carrying less weight and go into a feeling of proudness for her *[Emotional support 3.3; Information about other's approval 6.3].*

Table S4

Intervention activities and behavior change techniques (BCTs) (Michie et al., 2013) to promote self-efficacy and social support at the example of target behavior 2: Use protective lifting techniques

Source of Self-efficacy (Bandura, 1977)	**Information only control**	**Self-efficacy**	**Self-efficacy + Social support**
	Control Activity (Activity 3) Woman receives information on protective lifting: 1) exhale (breathe out) when lifting, 2) tighten the pelvic floor, by using validated leaflets and explanations by the practitioner, see Figure1- Figure3. *[Instruction on how to perform a behavior, 4.1].* A special focus is set on explanations and practices of pelvic floor anatomy, pelvic floor muscle awareness and contraction (in sitting position, not while lifting, see Activity 1.0) *[Instruction on how to perform the behavior, 4.1, Information about health consequences, 5.1]*. She is informed about the benefits protective lifting may imply *[Information about health, environmental, social and emotional consequences, 5.1; 5.3; 5.6].*		
Performance Accomplishments Verbal Persuasion Vicarious Experience		**Activity 4 Behavioral practice & positive feedback:** Practitioner demonstrates the protective lifting again, repeating the informational instructions and inviting the woman to join her *[Instruction on how to perform the behavior, 4.1; Demonstration of behavior, 6.1; Vicarious reinforcement, 16.3]*. They then practice the behavior together, 1. Lifting and breathing, 2. Lifting and tightening pelvic floor 3. Lifting and breathing + tightening pelvic floor *[Behavioral practice/rehearsal, 8.1].* The practitioner gives feedback on her performance, focusing on successes rather than correcting *[Verbal persuasion about capability, 15.1; Feedback on behavior, 2.2].*	**Activity 4 Behavioral practice & positive feedback:** Practitioner demonstrates the protective lifting again, repeating the informational instructions and inviting the woman and the social partner to join her *[Instruction on how to perform the behavior, 4.1; Demonstration of behavior, 6.1; vicarious reinforcement, 16.3]*. They then practice the behavior all together, 1. Lifting and breathing, 2. Lifting and tightening pelvic floor 3. Lifting and breathing + tightening pelvic floor *[Behavioral practice/rehearsal, 8.1; Social support unspecified, 3.1].* The practitioner gives feedback on her performance, focusing on successes rather than correcting and encourages the social partner to do the same *[Verbal persuasion about capability, 15.1; Feedback on behavior, 2.2; Emotional support, 3.3].*
Performance Accomplishments Verbal Persuasion Emotional Arousal		**Activity 5 Experience successful performance:** Practitioner films woman while practicing protective lifting techniques. Afterwards they watch the video together. She identifies with practitioner which components of protective lifting she has applied successfully *[Focus on past success, 15.3; Self-monitoring of behavior, 2.3]*. She describes her feelings about successfully applied techniques *[Focus on past success, 15.3; Monitoring of emotional consequences, 5.4].*	**Activity 5 SS Experience successful performance:** Woman and partner are filmed while practicing protective lifting techniques. Afterwards they watch the videos. They reflect successes together and are encouraged to identify successes of one another *[Focus on past success, 15.3*; *Self-monitoring of behavior, 2.3; Vicarious reinforcement 16.3; Support unspecified, 3.1].* Woman and partner describe their feelings about successfully applied techniques *[Focus on past success, 15.3*; *Monitoring of emotional consequences, 5.4; Emotional support, 3.3; Information about others` approval, 6.3].*

Source of Self-efficacy (Bandura, 1977)	**Information only control**	**Self-efficacy**	**Self-efficacy + Social support**
Performance Accomplishments Verbal Persuasion Emotional Arousal		**Activity 1.2 Using templates of success:** The woman visualizes herself using protective lifting techniques in the future. She receives templates of a figure to draw her face in it and different objects (pelvic floor, breath). The figure's body parts can be manipulated (e.g., knees can be bent). She is instructed to indicate how this little version of herself is capable of following each step for protective lifting, see Figure4) *[Mental rehearsal of successful performance, 15.2; Problem solving, 1.2].* The practitioner appreciates the activity and asks the main participant to describe how she feels about the success. She is asked to draw a smiley face on the figure who successfully used lifting techniques *[Verbal persuasion, 15.1; Monitoring of emotional consequences, 5.4].*	**Activity 1.2 SS Using templates of success:** They visualize together how the main participant engages in protective lifting techniques by both using the templates to draft the main participant using protective lifting techniques [*Mental rehearsal of successful performance, 15.2; Problem solving, 1.2; Practical support 3.2].* The practitioner appreciates the activity and asks both to describe how they feel about the main participant's success. They are asked to draw a smiley face on the figure who successfully used lifting techniques (representing the main participant) *[Monitoring of emotional consequences. 5.4; Information about others' approval, 6.3].*
Performance Accomplishments Verbal Persuasion Emotional Arousal		**Activity 1.3 Mental journey:** Practitioner leads woman through a meditative exercise where she imagines herself following each step of protective lifting when lifting a water container *[Mental rehearsal of successful performance, 15.2; Verbal persuasion about capability, 15.1; Instruction on how to perform the behavior, 4.1; Monitoring of emotional consequences, 5.4].* She is encouraged to repeat the following sentence in her head: *"I am sure, I can apply protective lifting techniques when lifting loads" [Self-talk, 15.4].* The woman imagines walking with the water container, feeling happy and released for successfully using protective lifting techniques *[Monitoring of emotional consequences, 5.4].* She is instructed to go into the positive / proud feeling regarding her decision to use protective lifting techniques *[Mental rehearsal of successful performance, 15.2; Verbal persuasion about capability, 15.1; Instruction on how to perform the behavior, 4.1; Monitoring of emotional consequences, 5.4].*	**Activity 1.3 SS Mental journey:** Woman and her partner both listen to the meditative exercise where they imagine the main participant following each step of protective lifting when lifting a water container, verbally supported by instructions of their partner *[Mental rehearsal of successful performance, 15.2; Practical support 3.3; Information about others' approval, 6.3].* The woman is encouraged to repeat the following sentence in her head: "*I am sure, I can apply protective lifting techniques when lifting loads" [Self-talk, 15.4].* The woman imagines walking with the water container, feeling happy and released for successful applying protective lifting techniques. She is instructed to go into the positive / proud feeling regarding her decision to use protective lifting techniques *[Mental rehearsal of successful performance, 15.2; Verbal persuasion about capability, 15.1; Instruction on how to perform the behavior, 4.1; Monitoring of emotional consequences, 5.4].* The partner is instructed to imagine her using protective lifting techniques and go into a feeling of proudness for her *[Emotional support 3.3; Information about other's approval 6.3].*

Source of Self-efficacy (Bandura, 1977)	**Information only control**	**Self-efficacy**	**Self-efficacy + Social support**
Vicarious Experience Verbal persuasion		**Activity 2.1: Video of successful other:** is shown to the woman (see Screenshot Figure5). The video indicates another rural woman who demonstrates protective lifting techniques *[Instruction on how to perform the behavior, 4.1; Vicarious reinforcement, 16.3].* Then she encourages the participant to adopt the same behavior, e.g. *"I am sure I can use these lifting techniques every time I carry loads! If I can do it, you can do it" [Verbal persuasion about capability, 15.1].* The woman says that she is confident that she can start using protective lifting techniques (motivational self-efficacy), that she is confident that she can overcome difficulties to use protective lifting techniques (coping self-efficacy) and that she is confident to get back to use protective lifting techniques after not using them one day (recovery self-efficacy) *[Demonstration of behavior, 6.1; Vicarious reinforcement, 16.1; Verbal persuasion about capability, 15.1].*	**Activity 2.1 SS Video of successful other:** Woman and partner watch the video with protective lifting techniques together (see Screenshot Figure5). The difference is that the woman in the video has a sister-in-law who supports her by reminding her how to perform the lifting. The sister-in-law practices the protective lifting as well *[Instruction on how to perform the behavior, 4.1; Demonstration of the behavior, 6.1; Vicarious reinforcement 16.3; Practical support 3.2; Emotional support 3.3; Information about others' approval, 6.3]*. The sister-in-law appreciated the behavior and says: "*That was well shown! I am confident you can always apply protective lifting techniques. You have learned them, and I am sure you will use them every time you lift loads."* Then she says that the participant can adopt the same behavior, "*If she can do it, you can do it" [Verbal persuasion, 15.1; Emotional support 3.3].* The woman and her sister-in-law discuss that they are confident that by supporting each other, they can start using protective lifting techniques (motivational self-efficacy), that they are confident to overcome difficulties to use protective lifting techniques (coping self-efficacy), and that they are confident to get back to use protective lifting techniques after not using them one day (recovery self-efficacy) *[Demonstration of behavior 6.1; Vicarious reinforcement 16.1; Verbal persuasion 15.1; Practical support 3.2; Emotional support, 3.3].*

Figure S5

Instructions on protective carrying behaviors

Figure S6

Instructions on protective lifting techniques: Correct breathing (Caagbay et al., 2017, 2020)

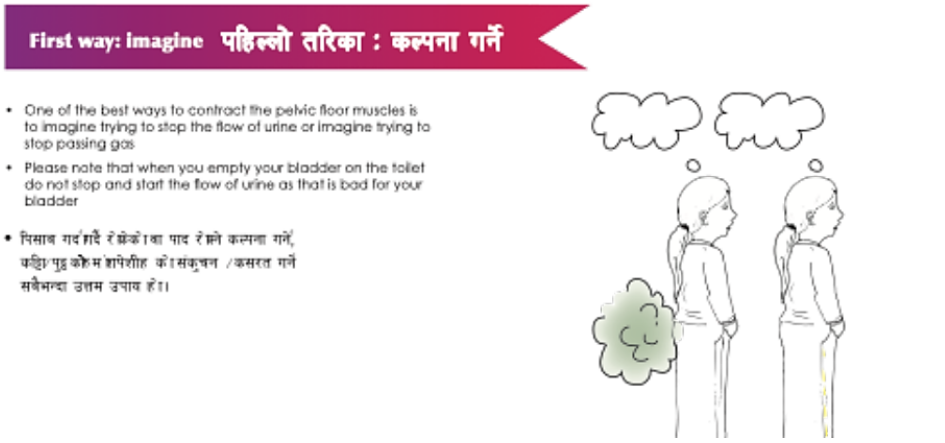
Breathing सास फेर्ने / श्वासप्रश्वास

- Never hold your breath when doing your pelvic floor muscle exercises
- Try to breathe normally and comfortably while exercising the muscles
- If you are having difficulty finding the right muscles you can use your breath to help. As you breathe in, the pelvic floor muscles should relax and move downwards. As you breathe out try and squeeze the pelvic floor muscles up and in with your breath
- Always remember to breathe out when you are lifting to help protect your pelvic organs
- Never hold your breath when you are straining or exerting yourself

- कट्टि/पुड्काे मक्मपेशीकाे सरत/व्यायाम गर्दा कहिले पनि सास नरेक्नुहाे।
- कसरत/व्यायाम गर्दा सामान्य रस्सजिलाे तरिकाले सास पेर्न/ श्वासप्रश्वास कोशिश गर्नुहाेस।
- यदि तपाँईलाई सही मांसपेशी पत्ता लगाउन गाह्राे भ तपाँई आफ्नाे सास/ सक्सप्रश्वा ाे मद्दत लिन सक्नु हुनेछ। जब तपाँईले सास भित्र लिँनुहुन्छ, कट्टि/पुड्काे मांसपेशी तनावमुक्त र लतिर हुनुपर्छ सास बाहिर फाल्दा तपाँईले ट्टि/पुड्काे मांसपेशी साथसँगै खुम उने र भित्र माथि तान्ने कोशिस गर्नुहाेस्।
- कट्टि/पुड्काे मांसपेशी खुम्चाएर माथि खिंच्दा सास फालेकाे हुनुपर्छ, यसले पेल्भिक अङ्गलाई सुरक्षित रहन मद्दत गर्छ।
- कहिले पनि शौच वा कसरत गर्दा सास नरेक्नुहाेस।

Figure S7

Instructions on protective lifting techniques: Tighten pelvic floor when lifting (Caagbay et al., 2017, 2020)



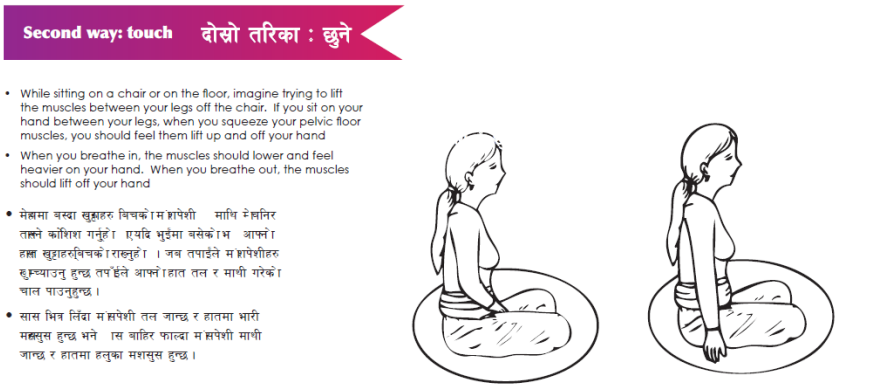


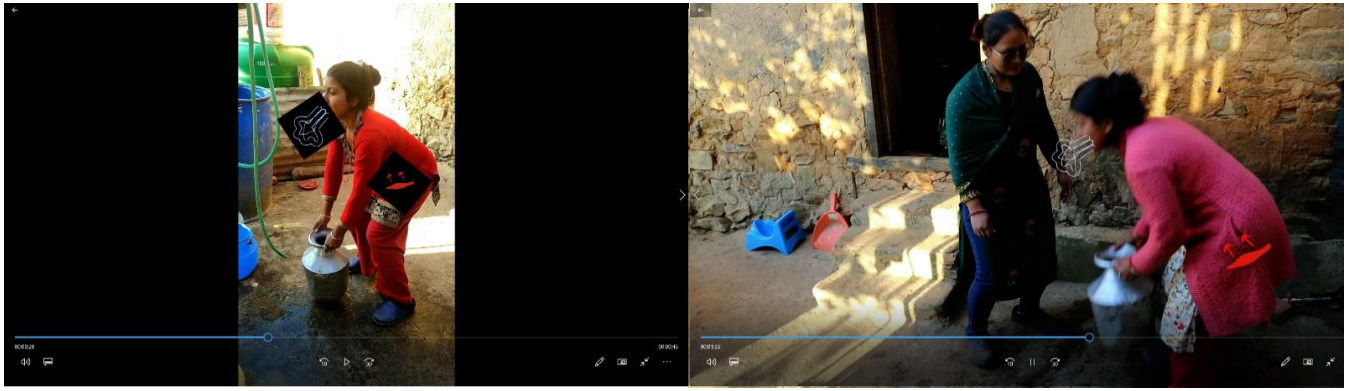
Figure S8

Templates to use for self-visualization (reducing weight and using protective lifting techniques) for intervention activity

Note. Example from an optimal solution (regarding water carrying) to be drafted by participant on the right

Figure S9

Screenshot from videos indicating successful others using protective carrying behaviors shown to the participants



Note. Promotion of self-efficacy on the left, promotion of self-efficacy + social support on the right

Table S10

Sample characteristics and baseline group differences

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group effects[2]
	f	*f*%	*f*	*f*%	*f*	*f*%	*f*	*f*%	*p*
Household income[1]	7614.4$_a$	7712.8	10773.2$_b$	7085.2	9098.0	8624.3	9167.6	7910.7	.027
Religion	$_a$		$_b$		$_b$				<.001
Hindu	62	62.0%	90	90.0%	94	94.0%	82	82.0%	
Buddhist	38	38.0%	10	10.0%	4	4.0%	52	17.3%	
Christian	0	0.0%	0	0.0%	2	2.0%	0	0.0%	
Other	2	2.0%	0	0.0%	0	0.0%	2	0.7%	
Education	$_a$		$_b$		$_b$				.004
Illiterate	46	46.0%	17	17.0%	30	30.0%	93	31.0%	
Informal education	12	12.0%	18	18.0%	14	14.0%	44	14.7%	
Pre-primary	5	5.0%	5	5.0%	6	6.0%	16	5.3%	
Primary passed	11	11.0%	8	8.0%	11	11.0%	30	10.0%	
Lower secondary passed	6	6.0%	14	14.0%	7	7.0%	27	9.0%	
Secondary	8	8.0%	21	21.0%	11	11.0%	40	13.3%	
Higher secondary and above	12	12.0%	17	17.0%	21	21.0%	50	16.7%	
Pregnancy/ postpartum status									
Currently pregnant	2	2.0%	9	9.0%	5	5%	15	6%	.101
Delivered in last 3 months	2	2.0%	1	1.0%	2	2%	5	2%	.793
Ethnicity	$_a$		$_b$		$_c$				<.001
Brahmins	38	38.0%	33	33.0%	53	53.0%	124	41.3%	
Chhetri	17	17.0%	2	2.0%	3	3.0%	22	0.1%	
Janajati	44	44.0%	62	62.0%	10	10%	116	38.7%	
Dalit	1	1.0%	3	3.0%	34	34%	38	12.7%	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	
Age	38.4$_a$	8.6	33.3$_b$	7.5	35.1$_b$	9.1	35.6	8.7	< .001

Note. N= 980, *f* = frequency, *f*% = relative frequency, *M* = Mean, *SD* = Standard deviation, X^2 = Chi-Square. All *p*-values are two-tailed. Frequencies with different subscripts differ at the p = .05 level by Chi-Square analyses of frequencies. Frequencies with different subscripts differ at the p = .05 level by Chi-Square analyses of frequencies. Means with different subscripts differ at the p = .05 level by Bonferroni-corrected post-hoc t-tests.[1] Household income was calculated, using the Organisation for Economic Co-operation and Development (OECD)-modified equivalence scale (Hagenaars et al., 1994). [2] Group effects represent whether the groups differed at baseline based on Chi-Square analyses or univariate ANOVA.

Table S11

Intervention fidelity in univariate ANOVA using follow up data

	Information only control	Self-efficacy	Self-efficacy + Social support	Overall	Group effect		
	f%	*f%*	*f%*	*f%*	*p*	η^2	*d*
What do you remember from the activities of our health professional 6 weeks ago? (open question)							
Learn to tighten pelvic floor muscles	$29\%_a$	41%	$47\%_b$	39%	.041	.02	-
Carrying less weight is good	73%	71%	84%	76%	.075	.02	-
Mentions protective lifting techniques (correctly)	$24\%_a$	$39\%_a$	$62\%_b$	41%	<.001	.10	-
Mentions protective lifting techniques (incorrectly)	19%	26%	14%	20%	.162	.01	-
We watched video of myself/ourselves	-	$7\%_a$	$22\%_b$	15%	.004	-	.35
We played with little figures (templates)	-	$10\%_a$	$33\%_b$	21%	<.001	-	.39
Watching video of other woman	-	$14\%_a$	$27\%_b$	20%	.030	-	.20
Mental journey	-	$2\%_a$	$11\%_b$	7%	.013	-	.40
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*p*	η^2	
How helpful did you find the instructions on pelvic floor contraction?[1]	2.94_a (1.26)	3.43_b (1.20)	3.57_b (1.01)	3.30 (1.12)	<.001	.05	-
How helpful did you find the instructions on recommended weight limits?[1]	3.02_a (1.12)	3.52_b (1.21)	3.27 (0.86)	3.27 (1.09)	.006	.04	-
How helpful did you find the instructions on protective lifting techniques?[1]	2.93_a (1.27)	3.51_b (1.21)	3.44_b (0.98)	3.29 (1.19)	<.001	.05	-
How would you rate the activities performed with our health professional?[1]	3.64_a (0.85)	3.85 (0.97)	3.99_b (0.77)	3.82 (0.87)	.021	.03	-

Note. *M* = Mean, *SD* = Standard deviation, *f*% = frequencies, η^2 = Eta-squared effect size with small (.01), medium (.06) and large (.14) effects (Cohen, 1988), Cohen's *d* with small (.20), medium (.50) and large (.80) effects (Cohen, 1988). Means (and frequencies transformed to values 0-1) with different subscripts differ at the p = .05 level by Bonferroni-corrected post-hoc t-tests.[1]1 = not at all to 5 = very much.

Table S12

Sensitivity analysis for intervention effects on protective carrying behaviors in repeated measures ANOVA

	Information only		Self-efficacy		Self-efficacy + Social support		Time effect		Group x Time effect	
	M	*SD*	*M*	*SD*	*M*	*SD*	*p*	η^2	*p*	η^2
Removing participants who did not receive intervention[3]										
Protective lifting (%)[1]							< .001	.52	.030	.03
Baseline	.10	.11	.19	.10	.09	.12				
Follow up	.33	.29	.41	.28	.43	.27				
Carried weight (kg)[2]								.20	.029	.03
Baseline	23.5	10.0	17.6	9.6	24.5	8.1				
Follow up	18.4	9.4	15.0	8.5	18.3	9.3				
Removing multivariate outliers										
Protective lifting (%)[1]							< .001	.50	.011	.03
Baseline	.10	.11	.10	.11	.09	.12				
Follow up	.30	.27	.39	.28	.42	.27				
Carried weight (kg)[2]								.27	.046	.02
Baseline	24.0	9.9	17.7	9.4	24.3	8.3				
Follow up	19.1	8.2	15.0	8.0	19.0	8.6				
Following intention to treat approach (ITT)										
Protective lifting (%)[1]							< .001	.46	.130[6]	.01
Baseline	.10	.11	.10	.11	.09	.12				
Follow up	.32	.29	.37	.29	.39	.29				
Carried weight (kg)[2]								.19	.038	.02
Baseline	23.2	10.3	18.2	9.7	23.4	8.7				
Follow up	18.4	9.7	15.8	8.9	17.8	9.3				

Note. *M* = Mean, *SD* = Standard deviation, η^2 = Eta-squared effect size with small (.01), medium (.06) and large (.14) effects (Cohen, 1988). All *p*-values are two-tailed. [1]Product of correctness and frequency of using protective lifting techniques (range: 0-1). [2]Mean of water and other loads carried in an average trip in kilograms. [3] *n* = 273, with *n* = 95 for information only, *n* = 89 for self-efficacy, *n* = 89 for self-efficacy + social support [4] *n* = 275 for outcome carried weight, with *n* = 93 for information only, *n* = 93 for self-efficacy, *n* = 89 for self-efficacy + social support, *n* = 257 for outcome protective lifting, with *n* = 93 for information only, *n* = 90 for self-efficacy, *n* = 84 for self-efficacy + social support. [5] *n* = 300, including *n* = 100 for information only, *n* = 100 for self-efficacy, *n* = 100 for self-efficacy + social support. [6] Group by time effect for protective carrying did not remain robust following intention to treat approach, still planned contrast comparing controls to interventions groups remained significant with *p* = .033, which was a small effect with Cohen's *d* = .3 (Cohen, 1988).

Table S13

Sensitivity analysis for the intervention effects on protective carrying behaviors adding sociodemographic variables to repeated measures ANOVA

	Protective lifting (%)				Carried weight (kg)			
Predictor	*F ratio*	*df*	*p*	$_{\text{Partial}}\eta 2$	*F ratio*	*df*	*p*	$_{\text{Partial}}\eta 2$
Time	.79	1	.376	.00	.61	1	.435	.00
Time*condition[3]	3.79	2	.024	.03	1.58	2	.208	.01
Time*age	3.76	1	.053	.01	.33	1	.561	.00
Time*education[4]	11.57	1	<.001	.04	.05	1	.828	.00
Time*income	.22	1	.641	.00	.01	1	.937	.00
Time*pregnant/ postpartum[5]	1.57	1	.211	.01	.30	1	.584	.00
Time*ethnicity: Chhetri[6]	5.07	1	.025	.02	.02	§1	.890	.00
Time*ethnicity: Janajati[6]	.13	1	.715	.00	.23	1	.632	.00
Time*ethnicity: Dalit[6]	.02	1	.892	.00	1.78	1	.183	.01

Note. *N* = 280, Outcome: Effects of different sociodemographic variables were tested in addition to the intervention effect and thus controlled in univariate ANOVA. *df* = degrees of freedom, partial η^2 = partial Eta-squared. All *p*-values are two-tailed. [1]Product of correctness and frequency of using protective lifting techniques (range: 0-1). [2]Mean of water and other loads carried in an average trip in kilograms. [3]Intervention conditions: control (=1), self-efficacy (=2), and self-efficacy + social support (=3). [4]Education: Higher values refer to higher level of education. [5]Pregnant/Postpartum (=1) vs. not pregnant/ postpartum (=0). [6]Ethnicities were compared to Brahmin (=reference category).

Table S14

Group and time effects on all preregistered secondary outcomes

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
Carrying behaviors											
Observed pl techniques during performance											
BL: Observed: Exhale during lifting	.48	.50	.38	.49	.34	.48	.40	.49	.345		
FU: Observed: Exhale during lifting	.65	.48	.67	.47	.87	.34	.73	.45			
Change score observed: exhale during lifting	$.17_a$	.68	$.29_b$	.99	$.53_c$	.55	.33	.66		<.001	.002
Carrying frequency[4]											
BL: Carrying frequency of water per week	15.58_a	8.02	11.51_b	9.23	12.14_b	7.68	13.11	8.51	<.001		
FU: Carrying frequency of water per week	12.38	7.10	9.28	5.22	9.78	6.14	10.50	6.34			
Change score carrying frequency of water per week	-3.20	9.50	-2.23	9.00	-2.36	8.81	-2.61	9.09		<.001	.732
BL: Carrying frequency of other goods per week	8.74_a	5.78	4.98_b	6.75	7.52_a	5.65	7.09	6.26	<.001		
FU: Carrying frequency of other goods per week	6.76	6.18	4.37	4.65	6.27	6.00	5.80	5.73			
Change score carrying frequency of other goods per week	-1.98	6.97	-.61	6.59	1.25	6.94	-1.29	6.83		.002	.385
Weight intended to carry during pregnancy / postpartum											
BL: Weight intended to carry during pregnancy / postpartum	10.59	7.72	10.53	8.88	9.96	7.23	10.37	7.96	.930		
FU: Weight intended to carry during pregnancy / postpartum	3.41	3.89	3.94	3.92	4.09	4.56	3.81	4.12			
Change score weight intended to carry pregnancy / postpar-tum	-7.18	8.24	-6.59	9.16	-5.87	8.23	-6.56	8.54		<.001	.583
Psychosocial determinants of protective carrying (Schwarzer et al., 2003; Tomberge, Shrestha, et al., 2021)											
Self-efficacy											
BL: Self-efficacy to rw	$.53_a$	.25	$.66_b$	.21	$.54_a$	.22	.57	.23	<.001		
FU: Self-efficacy to rw	.53	.27	.62	.26	.57	.23	.57	.26			
Change score self-efficacy to rw	.00	.33	-.04	.34	.03	.30	.00	.33		.961	.294
BL: Self-efficacy to use pl techniques	$.49_a$	.23	$.59_b$	.22	.52	.20	.54	.21	.002		
FU: Self-efficacy to use pl techniques	.52	.26	.59	.21	.58	.21	.57	.21			
Change score self-efficacy to use pl techniques	.04	.21	.00	.24	.05	.24	.03	.23		.025	.255
BL: Self-efficacy to rw during pregnancy / postpartum	$.61_a$	.26	$.70_b$	.21	.62	.23	.64	.24	.017		
FU: Self-efficacy to rw during pregnancy / postpartum	.70	.21	.76	.22	.73	.24	.73	.24			
Change score self-efficacy to rw during pregnancy /postpartum	.09	.27	.06	.30	.11	.29	.09	.29		<.001	.420

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
Social support											
BL: Received social support to rw	$.58_a$	.22	$.67_b$	.23	.63	.23	.63	.23	.002		
FU: Received social support to rw	.49	.26	.61	.26	.55	.23	.55	.25			
Change score received social support to rw	-.09	.23	-.06	.29	-.08	.27	-.08	.26		<.001	.644
FU: Received social support to use pl	$.09_a$	.15	$.20_b$	.24	$.26_b$	.26	.18	.23	-	-	<.001
Intention											
BL: Intention to rw	$.58_a$	.22	$.64_b$	.25	.61	.23	.61	.23	.018		
FU: Intention to rw	.61	.23	.69	.23	.64	.20	.65	.22			
Change score intention to rw	.03	.26	.05	.33	.03	.28	.04	.29		.050	.924
BL: Intention to use pl techniques	$.57_a$	.23	$.67_b$	.23	$.67_b$	.19	.64	.22	.004		
FU: Intention to use pl techniques	.57	.23	.63	.22	.61	.20	.60	.22			
Change score intention to use pl techniques	.00	.23	-.04	.28	-.06	.25	-.04	.25		.026	.328
Knowledge											
BL: Knowledge on protective carrying behaviors	.50	.22	.53	.24	.54	.21	.53	.22	.051		
FU: Knowledge on protective carrying behaviors	.68	.22	.73	.25	.75	.22	.72	.23			
Change score knowledge on protective carrying behaviors	.18	.29	.20	.30	.21	.29	.19	.29		<.001	.829
BL: Knowledge on tightening pelvic floor[4]	.45	.20	.53	.22	.45	.19	.47	.21	.154		
FU: Knowledge on tightening pelvic floor	.52	.23	.53	.22	.55	.21	.53	.23			
Change score knowledge on tightening pelvic floor	.07	.27	.00	.30	.10	.28	.06	.29		<.001	.132
Risk perception											
BL: Risk perception to rw	.56	.32	.67	.27	.65	.27	.63	.29	.071		
FU: Risk perception to rw	.65	.24	.68	.31	.68	.24	.67	.27			
Change score risk perception to rw	.10	.34	.01	.29	.03	.32	.04	.31		.022	.285
BL: Risk perception to use pl techniques	.51	.27	.53	.33	.60	.28	.55	.29	.134		
FU: Risk perception to use pl techniques	.61	.23	.64	.26	.65	.22	.63	.24			
Change score risk perception to use pl techniques	.10	.29	.11	.28	.05	.30	.08	.29		<.001	.284

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
Outcome expectancies											
BL: Positive outcome expectancies to rw	$.73_a$	.20	$.80_b$	.20	$.67_a$	.24	.73	.22	<.001		
FU: Positive outcome expectancies to rw	.72	.20	.79	.19	.75	.17	.75	.19			
Change score positive outcome expectancies to rw	$-.01_a$	.26	$-.01_a$	.25	$.08_b$	.24	.02	.25		.190	.019
BL: Negative outcome expectancies to rw	.25	.27	.20	.33	.19	.27	.22	.29	.635		
FU: Negative outcome expectancies to rw	.14	.23	.18	.28	.14	.23	.16	.25			
Change score negative outcome expectancies to rw	-.11	.36	-.02	.36	-.05	.32	-.06	.34		.004	.207
BL: Outcome expectancies to use pl techniques	$.66_a$	.21	$.74_b$	.19	.72	.19	.71	.20	<.001		
FU: Outcome expectancies to use pl techniques	.67	.19	.76	.18	.71	.18	.71	.18			
Change score outcome expectancies to use pl techniques	.01	.20	.02	.24	-.01	.22	.00	.22		.677	.723
Action planning											
BL: Action planning to rw	.40	.49	.55	.50	.39	.49	.45	.50			
Ask for help	.38	.49	.50	.50	.38	.49	.42	.49	.862		
Do more trips with less weight	.48	.50	.45	.50	.61	.49	.51	.50	.240		
Hire someone	.18	.39	.12	.33	.10	.30	.13	.34	.235		
Tell other people I don't want to carry	.03	.17	.03	.17	.05	.22	.04	.19	.108		
No plan	.23	.42	.12	.33	.18	.39	.18	.38	.452		
Other	.02	.14	.00	.00	.02	.14	.01	.12			
FU: Action planning to rw	.32	.47	.35	.48	.32.	.47	.33	.47			
Ask for help	.41	.50	.37	.49	.43	.50	.40	.49			
Do more trips with less weight	.51	.50	.56	.50	.56	.50	.54	.50			
Hire someone	.13	.33	.07	.26	.10	.30	.10	.30			
Tell other people I don't want to carry	.03	.18	.06	.25	.11	.32	.07	.25			
No plan	.26	.44	.26	.44	.21	.41	.24	.43			
Other	.01	.10	.00	.00	.02	.15	.01	.10			
Change scores action planning to rw	-.07	.60	-.20	.63	-.07	.56	-.12	.60			
Ask for help	.01	.69	-.13	.60	.05	.63	-.02	.64			
Do more trips with less weight	.02	.63	.11	.63	-.05	.61	.03	.63		.524	.227
Hire someone	-.06	.41	-.05	.36	.00	.38	-.03	.38		.590	.174
Tell other people I don't want to carry	.00	.25	.03	.31	.06	.31	.03	.29		.091	.654
No plan	.04	.48	.14	.45	.03	.46	.06	.46		.096	.429
Other	.01	.15	.00	.00	.00	.21	.00	.15		.007	.391

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
BL: Action planning to use pl	.32	.47	.46	.50	.26	.44	.35	.48	.146		
FU: Action planning to use pl	.22	.42	.26	.44	.22	.42	.23	.42			
Change score action planning to use pl	.10	.56	-.20	.64	-.04	.49	-.12	.57		.002	.219
Coping planning											
BL: Has a coping plan to overcome difficulties to rw	$.54_a$	.50	$.73_b$	.44	$.59_a$	.50	.62	.49	.014		
FU: Has a coping plan to overcome difficulties to rw	.49	.50	.59	.50	.42	.50	.50	.50			
Change score has a plan to overcome difficulties to rw	-.05	.64	-.14	.59	-.17	.46	-.12	.57		<.001	.330
BL: Has a coping plan to overcome difficulties to pl	.47	.50	.63	.49	.58	.50	.56	.50	.083		
FU: Has a coping plan to overcome difficulties to pl	.40	.49	.49	.50	.44	.50	.44	.50			
Change score has a coping plan to overcome difficulties to pl	-.07	.60	-.14	.36	-.14	.52	-.12	.61		.002	.712
Barriers											
BL: Perceived barriers to rw	$.29_a$	.30	$.24_b$	.31	.27	.30	.27	.30	.027, 1 > 2		
FU: Perceived barriers to rw	.33	.35	.20	.27	.25	.29	.26	.31			
Change score perceived barriers to rw	.04	.41	-.04	.68	-.02	.36	-.01	.38		.619	.288
BL: Perceived barriers to use pl	.33	.32	.32	.29	.30	.30	.32	.30	.504		
FU: Perceived barriers to use pl	.34	.32	.29	.32	.28	.31	.30	.32			
Change score perceived barriers to use pl	.01	.37	-.03	.38	-.02	.35	-.02	.37		.385	.558
Response efficacy											
BL: General response efficacy pelvic organ prolapse	.66	.28	.65	.31	.70	.28	.67	.29	.820		
FU: General response efficacy pelvic organ prolapse	.71	.27	.69	.30	.66	.29	.69	.29			
Change score general response efficacy pelvic organ prolapse	.05	.34	.04	.41	-.04	.33	.02	.36		.771	.061
BL: Spiritual beliefs	.27	.28	.24	.28	.31	.31	.27	.29	.490		
FU: Spiritual beliefs	.17	.23	.17	.25	.15	.24	.17	.24			
Change score spiritual beliefs	.00	.34	-.07	.30	-.16	.35	.00	.33		<.001	.212
Identity											
BL: Identity rw	$.62_a$	.28	$.74_b$	.24	$.71_b$	.28	.69	.27	.011		
FU: Identity rw	.74	.27	.79	.30	.83	.23	.78	.27			
Change score identity rw	.12	.29	.05	.31	.12	.25	.09	.28		<.001	.122
BL: Identity pl	.47	.18	.50	.22	.51	.18	.49	.19	.074		
FU: Identity pl	.54	.16	.59	.17	.54	.14	.56	.16			
Change score identity pl	.07	.22	.09	.26	.03	.18	.07	.23		<.001	.181

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
Normative beliefs											
BL: Injunctive norms to rw	$.63_a$	.26	$.71_b$	.20	.68	.27	.67	.25	.036		
FU: Injunctive norms to rw	.61	.22	.66	.24	.65	.20	.64	.22			
Change score injunctive norms to rw	-.02	.31	-.05	.28	-.03	.23	-.03	.28		.082	.618
BL: Injunctive norms to use pl	.65	.24	.68	.22	.68	.27	.67	.24	.265		
FU: Injunctive norms to use pl	.61	.24	.65	.25	.62	.21	.63	.23			
Change score injunctive norms to use pl	-.04	.31	-.03	.29	-.05	.26	-.04	.29		.010	.949
BL: Descriptive norms to rw	.33	.27	.38	.30	.32	.24	.35	.27	.127		
FU: Descriptive norms to rw	.35	.25	.41	.29	.38	.23	.38	.25			
Change score descriptive norms to rw	.02	.31	.03	.33	.06	.25	.03	.30		.041	.792
BL: Descriptive norms to use pl	.38	.23	.40	.27	.43	.26	.40	.26	.441		
FU: Descriptive norms to use pl	.36	.24	.42	.24	.36	.23	.39	.24			
Change score descriptive norms to use pl	-.02	.28	.02	.30	-.07	.26	.01	.28		.158	.073
Attitudes on the gender division of labor											
BL: Attitudes on the gender division of labor	.33	.28	.30	.28	.38	.30	.34	.31	.390		
FU: Attitudes on the gender division of labor	.34	.28	.28	.31	.29	.29	.31	.29			
Change score attitudes on the gender division of labor	.01	.30	-.02	.34	-.01	.29	-.03	.31		.059	.122
Decision making											
BL: Decision making on weight by self	.86	.19	.91	.16	.91	.14	.89	.17	.294		
FU: Decision making on weight by self	.93	.14	.93	.11	.92	.16	.93	.14			
Change score decision making on weight by self	.07	.24	.02	.19	.01	.20	.04	.21		.018	.145
BL: Decision making on weight by family	.06	.11	.10	.21	.06	.13	.07	.16	.332		
FU: Decision making on weight by family	.04	.09	.04	.10	.04	.12	.04	.10			
Change score decision making on weight by family	-.02	.14	-.06	.24	-.02	.16	-.03	.19		.002	.343
BL: Decision making on pl by self	.88	.15	.89	.19	.90	.14	.90	.14	.838		
FU: Decision making on pl by self	.91	.13	.91	.13	.92	.14	.91	.13			
Change score decision making on pl by self	.03	.18	.02	.23	.02	.13	.01	.19		.040	.862
BL: Decision making on pl by family	.05	.11	.10	.22	.07	.16	.08	.17	.412		
FU: Decision making on pl by family	.05	.16	.04	.09	.03	.11	.04	.13			
Change score decision making on pl by family	$.00_a$	.17	$-.06_b$	.23	-.04	.18	-.04	.20		.003	.037

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
Psychosocial well-being											
Quality of life											
BL: Quality of life	$.48_a$	.17	$.57_b$	.17	$.52_a$	.17	.52	.17	<.001		
FU: Quality of life	.51	.15	.58	.18	.52	.15	.54	.16			
Change score quality of life	.03	.17	.01	.15	.00	.15	.02	.16		.076	.441
Illness-related personal control											
BL: Illness-related personal control	.62	.16	.64	.16	.65	.17	.63	.17	.285		
FU: Illness-related personal control	.64	.16	.69	.19	.68	.15	.67	.17			
Change score illness-related personal control	.02	.18	.06	.20	.03	.18	.04	.18		.002	.301
Daily functioning											
BL: Daily functioning	.38	.25	.34	.24	.42	.28	.38	.26	.110		
FU: Daily functioning	.37	.30	.30	.30	.32	.26	.33	.29			
Change score daily functioning	-.01	.30	-.04	.31	.00	.30	-.05	.31		.014	.057
Quality of relationships											
BL: Quality of relationships	$.63_a$	.21	$.70_b$	.20	.68	.17	.67	.20	.020		
FU: Quality of relationships	.63	.21	.69	.22	.69	.14	.67	.20			
Change score quality of relationships	.00	.15	-.01	.20	.01	.16	.00	.17		.967	.675
Physical health											
Perception and use of pelvic floor muscles											
BL: Feeling pelvic floor muscles during lifting	$.07_a$	.26	$.06_a$	.25	$.17_b$	.38	.10	.30	.008		
FU: Feeling pelvic floor muscles during lifting	.16	.37	.21	.41	.30	.46	.22	.42			
Change score feeling pelvic floor muscles during lifting	.09	.40	.15	.46	.13	.54	.12	.47		<.001	.606
BL: Use of pelvic floor muscles: Technique	.56	.51	.47	.51	.76	.44	.58	.50	.073		
FU: Use of pelvic floor muscles: Technique	.94	.24	.91	.30	.95	.22	.93	.26			
Change score use of pelvic floor muscles: Technique	.38	.50	.44	.66	.19	.51	.35	.59		<.001	.316
Pain											
BL: Pain[4]	.27	.19	.22	.24	.32	.24	.27	.23	.188		
FU: Pain[4]	.25	.25	.24	.23	.24	.26	.25	.25			
Change score pain	-.02	.24	$.02_a$	.26	$-.08_b$	.29	-.02	.27		.088	.039
Strain during lifting											
BL: Strain on pelvic floor during lifting	.17	.22	.20	.24	.18	.23	.18	.23	.623		
FU: Strain on pelvic floor during lifting	.16	.19	.18	.22	.17	.19	.17	.20			
Change score strain on pelvic floor during lifting	.01	.28	-.02	.30	-.01	.30	-.01	.29		.449	.852

Concept	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group [1]	Time[2]	Time x group[3]
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*	*p*	*p*
Pelvic organ prolapse											
BL: Symptoms of pelvic organ prolapse[4]	1.79	2.21	2.71	3.28	2.44	2.68	2.31	2.77	.062		
FU: Symptoms of pelvic organ prolapse[4]	1.21	1.76	1.61	1.92	1.37	2.18	1.39	1.96			
Change score symptoms of pelvic organ prolapse	-.58	2.60	-1.10	3.10	-1.07	2.68	-.92	2.80		<.001	.354
Impact of pelvic organ prolapse (“something coming down”)											
BL: Impact of pelvic organ prolapse [8]	.20	.11	.31	.25	.38	.32	.32	.27	.497		
FU: Impact of pelvic organ prolapse [9]	.17	.08	.48	.21	.33	.18	.38	.21			
Change score impact of pelvic organ prolapse [10]	-	-	.15	.57	.04	.06	.09	.37		.606	-
General impact of pelvic organ prolapse											
BL: General impact of pelvic organ prolapse [11]	.20	.22	.26	.26	.14	.22	.20	.24	.148		
FU: General impact of pelvic organ prolapse [12]	.10	.15	.13	.22	.15	.23	.12	.20			
Change score general impact of pelvic organ prolapse [13]	-.12	.99	$-.19_{a}$	.31	$-.04_{b}$	.32	-.12	.30		<.001	.018
Impact incontinence											
BL: How much are you bothered by leaking urine? [5]	.43	.16	.39	.26	.50	.29	.44	.25	.049		
FU: How much are you bothered by leaking urine? [6]	.51	.31	.30	.32	.55	.25	.45	.30			

	Information only control		Self-efficacy		Self-efficacy + social support		Overall		Group effects[1]	Time effects[2]	Time x group effects[3]
	f	*f*%	*f*	*f*%	*f*	*f*%	*f*	*f*%	*p*	*p*	*p*
Incontinence											
BL: Do you sometimes accidentally leak urine?											
Never	86	89.6%	78	83%	74	82.2%	238	85.0%	.551		
Sometimes	9	9.4%	17	17%	15	16.7%	40	14.3%			
Often	1	1.0%	0	0.0%	1	1.1%	2	0.7%			
FU: Do you sometimes accidentally leak urine?										<.001	.470
Never	89	92.7%	86	91.5%	83	92.2%	258	92.1%			
Sometimes	7	7.3%	8	8.5%	7	7.8%	22	7.9%			
Often	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
BL: How often do you leak urine? [5]									.480		
Never	0	0.0%	1	1.1%	1	1.1%	2	0.7%			
About once a week or less often	8	8.3%	11	11.7%	7	7.8%	26	9.3%			
Two or three times a week	1	1.0%	3	3.2%	4	4.4%	8	2.9%			
About once a day	0	0.0%	1	1.1%	4	4.4%	5	1.8%			
Several times a day	1	1.0%	0	0.0%	0	0.0%	1	0.4%			
FU: How often do you leak urine? [6]										.001	.412
Never	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
About once a week or less often	6	6.3%	7	7.4%	6	6.7%	19	6.8%			
Two or three times a week	1	1.0%	1	1.1%	1	1.1%	3	1.1%			
About once a day	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
Several times a day	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
BL: Do you sometimes accidentally leak fecal?									.373		
Never	0	0.0%	93	98.9%	0	0.0%	279	99.6%			
Sometimes	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
Often	0	0.0%	1	1.1%	0	0.0%	1	0.4%			
FU: Do you sometimes accidentally leak fecal?										.322	.373
Never	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
Sometimes	0	0.0%	0	0.0%	0	0.0%	0	0.0%			
Often	0	0.0%	0	0.0%	0	0.0%	0	0.0%			

Note. $N =$ 280, M = Mean, SD = Standard deviation, f = frequency, f% = relative frequency. All continuous items were recoded to a range between 0 to 1. All p-values are two-tailed. [1]Group effects in ANOVA represent whether the groups differed at baseline. [2]Time effects in ANOVA represent whether the variable changed from baseline to follow-up across groups [3]Group*Time interaction effects indicate that there was a significant difference in the change from baseline to follow-up between the groups. Means

with different subscripts differ at the $p = .05$ level by Bonferroni-corrected post-hoc t-tests. [4]Outliers > 3*SD* were adjusted to next highest value within $M + 3\ SD$ (Tabachnick & Fidell, 1983). The following variables contained univariate outliers (all > +3SD): 1 baseline outlier for knowledge to tighten the pelvic floor, 2 baseline and 7 follow up outliers for weight intended to carry during pregnancy / postpartum. 3 outliers for water carrying trips per day and 2 outliers for trips for other loads per day were corrected for baseline and 7 outliers for water trips per day and 6 outliers for other load's trips per day at follow up. Furthermore, we corrected 9 baseline and 5 follow up outliers for prolapse symptoms and 6 baseline and 3 follow up outliers for pain. [5] $n = 42$, [6] $n = 22$, only asked if participants reported to sometimes leak urine. [7] Change scores were only calculated when participant reported symptoms at baseline as well as follow up ($n = 12$). [8] $n = 26$, [9] $n = 13$, only asked if participants reported symptoms of pelvic organ prolapse. [10] Change scores were only calculated when participant reported symptoms at baseline as well as follow up ($n = 6$).[11] $n = 259$, [12] $n = 182$, only asked if participants reported symptoms of pelvic organ prolapse. [13] Change scores were only calculated when participant reported symptoms at baseline as well as follow up ($n = 172$).