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# Occurrence of blackleg and current preventive measures against outbreaks in the Canton of Bern

**Inaugural Dissertation**

To be awarded the Doctoral Degree of the
Vetsuisse Faculty University of Bern

submitted by

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# Summary

Vetsuisse-Fakultät Universität Bern 2024

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**Occurrence of blackleg and current preventive measures against outbreaks in the Canton of Bern**

Blackleg is an acute, lethal infectious disease caused by *Clostridium chauvoei,* characterized by severe necrohemorrhagic myositis and myocarditis.

While the disease has caused substantial economic loses in the past, the number of diseased cattle has been decreasing in the last 30 years in Switzerland. Subsequently, the status of blackleg has been changed and the disease is no longer reportable since 2022.

Considering the potential persistence of *C. chauvoei* spores in the environment, blackleg may however still be prevalent in certain areas of the Canton of Bern. Therefore, in our study, we evaluated the spatio-temporal distribution of blackleg from 1992-2023 and currently implemented prophylactic measurements used by veterinarians in the risk areas of the Canton of Bern.

Our results show that most of the cases occurred in areas still defined as risk areas by the Cantonal Veterinary Office, however some occurred in areas no longer listed as risk areas since 2020. In parallel, veterinarians reported suspected cases in recent years as well as a decreased acceptance of vaccination by farmers in risk areas.

Lack of official monitoring together with reduced blackleg awareness and decreasing willingness of farmers to vaccinate together with long environmental persistence of *C. chauvoei* spores poses a risk for disease reoccurrence. Veterinarians practicing in affected areas throughout Switzerland should be aware of this and act accordingly once blackleg outbreaks are suspected.

Keywords: Blackleg, Canton of Bern, Clostridium chauvoei, risk area

Bern, 07.11.2024

Iva Cvitas

Bern, 07.11.2024

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# Zusammenfassung

Vetsuisse-Fakultät Universität Bern 2024

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**Vorkommen von Rauschbrand und aktuelle Präventionsmassnahmen gegen Ausbrüche im Kanton Bern**

Rauschbrand ist eine akute, oft tödlich verlaufende Infektionskrankheit, die durch *Clostridium chauvoei* verursacht wird und durch eine schwere nekro-hämorrhagische Myositis sowie Myokarditis gekennzeichnet ist.

Obwohl die Krankheit in der Vergangenheit erhebliche wirtschaftliche Schäden verursachte, hat sich die Zahl der betroffenen Rinder in der Schweiz in den letzten 30 Jahren deutlich verringert. Daher wurde Rauschbrand 2022 von der Meldepflicht ausgenommen.

Aufgrund der potenziellen Umweltpersistenz von *C. chauvoei*-Sporen könnte die Krankheit jedoch weiterhin in bestimmten Regionen des Kanton Bern vorkommen. In unserer Studie analysieren wir die Verbreitung von Rauschbrand von 1992 bis 2023 sowie die von Tierärzt:innen in den Risikogebieten angewandten prophylaktischen Massnahmen.

Unsere Ergebnisse zeigen, dass die meisten Fälle in Gebieten auftraten, welche weiterhin als Risikogebiete gelten; jedoch traten einige auch in seit 2020 nicht mehr als Risikogebiete eingestuften Regionen auf. Gleichzeitig meldeten Tierärzt:innen in den letzten Jahren Verdachtsfälle und berichteten von einer nachlassenden Impfbereitschaft der Landwirt:innen.

Das Fehlen einer offiziellen Überwachung, gemeinsam mit abnehmendem Bewusstsein der Erkrankung und der langen Umweltpersistenz der *C. chauvoei* Sporen erhöht das Risiko eines Wiederauftretens der Krankheit. Tierärzt:innen in betroffenen Gebieten der Schweiz sollten sensibilisiert sein und beim Verdacht auf Rauschbrand entsprechend handeln.

Rauschbrand, Kanton Bern, Clostridium chauvoei, Risikogebiet

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# Publication manuscript

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## Abstract

Blackleg is an acute, lethal, infectious disease caused by *Clostridium chauvoei*. It affects mainly cattle and is characterized by severe necrohemorrhagic myositis and myocarditis. While the disease has caused substantial economic losses in the past, the number of diseased cattle has been decreasing in the last 30 years. Subsequently, the status of blackleg has been officially changed in Switzerland and the disease is no longer reportable since 2022. Considering the potential persistence of *C. chauvoei* spores in the environment, blackleg may however still be prevalent in certain areas of the Canton of Bern, an important and large agricultural region of Switzerland. In this study, we evaluated both the spatio-temporal distribution of blackleg from 1992-2023 and the currently implemented prophylactic measurements used by veterinarians in the risk areas of the Canton of Bern. Our results show that most of the cases occurred in areas still defined as risk areas by the Cantonal Veterinary Office, however some occurred in areas no longer listed as risk areas since 2020. In parallel, veterinarians reported suspected cases in recent years as well as a decreased acceptance of vaccination by farmers in risk areas.
The combination of lack of blackleg monitoring, reduced disease awareness, decreasing willingness of farmers to vaccinate and the long environmental persistence of *C. chauvoei* spores represent a risk for reoccurrence of the disease. Veterinarians practicing in once affected areas, in the Canton of Bern and elsewhere in Switzerland, should be aware of this and act accordingly once blackleg outbreaks are suspected.

## Key words
Blackleg, Canton of Bern, cattle, Clostridium chauvoei, risk area, vaccine acceptance

## Introduction

*Clostridium chauvoei*, a gram-positive, anaerobic, rod-shaped, spore-forming bacterium, is the causative agent of blackleg, an acute, infectious disease causing significant losses in cattle but also other ruminants and wild animals worldwide.[8,16] Cattle aged between six and 24 months are most commonly affected.[1,9] Clinically, blackleg is characterized by a severe necrotizing and hemorrhagic myositis[1], affecting mostly muscles of the hindlimbs, chest, diaphragm, heart and tongue[7], fever and ultimately rapid death of the affected animal. In the peracute form, affected animals are most commonly found dead without any previous signs of illness.[7] In the acute form, swelling and crepitus of the affected muscles are typical clinical signs.[17] Animals usually get infected with *C. chauvoei* through oral uptake of spores from contaminated soil, water, feed, or less frequently, through wound infection.[17] The spores have the ability to cross the intestinal mucous membrane, and subsequently distribute via the bloodstream to several tissues, including skeletal and cardiac muscle.[2] There they can remain dormant until a localized hypoxic or anoxic event, e.g. through local trauma, occurs. The establishment of anaerobic conditions enables germination of the spores, subsequent bacterial proliferation, and production of toxins, ultimately leading to muscular necrosis and hemorrhage.[7] Environmental contamination is mainly caused by spores released from carcasses of animals that succumbed to blackleg.[17] These spores are highly resistant to environmental conditions and can persist in the environment for extended periods of several years to potentially decades.[1]

In Switzerland, blackleg occurs endemically. During the 19$^{th}$ and 20$^{th}$ century, it was the cause of substantial economic losses.[14] Most cases in Switzerland were reported in the following regions: Mountains of Bernese Oberland, Alps of the cantons of Fribourg, Jura, Schwyz, Lucerne, St. Gallen, Vaud, and Valais.[12] Until 2009, the disease had a status of “epizootic disease to be controlled”, as defined in the animal disease ordinance (Animal disease ordinance, Art. 4 and 5). This implied for the Canton of Bern that a vaccination program for animals in defined risk areas was financed by the animal disease fund, which is kept by the canton. Cattle between two months and three years of age were vaccinated between February and June. Furthermore, suspected cases were reported to the Cantonal Veterinary Office for surveillance and bacteriologically or epidemiologically confirmed cases were reported publicly every other week.

Risk areas have been defined since the early 20$^{th}$ century. A list of risk areas has been created and continuously updated by the Cantonal Veterinary Office based on locations where cases occurred. Due to decreasing number of cases, the status of the disease in Switzerland has been changed to “epizootic disease to be monitored” in 2009. Thus, in the Canton of Bern, vaccination and testing were not financially supported anymore, however, these were still highly recommended for cattle that were transferred to known risk areas. In addition, animal losses were no longer compensated by the animal disease fund. Confirmed cases were still reported publicly every week in the InfoSM reporting system, the data bank of the FSVO.[13]

Since November 2022, blackleg has not been listed as an epizootic disease in Switzerland anymore. Therefore, cases occurring after November 2022 are not reported and control of blackleg is in the responsibility of the livestock owners.[16] Risk areas, as defined by the Cantonal Veterinary Office, are still publicly listed [11] but have not been updated since 2020. Vaccination is recommended in areas where blackleg has occurred in the past, however, all costs must be covered by the owners. Currently, a multivalent clostridial vaccine, Bovilis Bravoxin ®, is licensed for Switzerland (TAM, swissmedic.ch). This vaccine contains toxoid antigens of *Clostridium perfringens* type A, B, C, D, *Clostridium novyi, Clostridium septicum, Clostridium tetani, Clostridium sordellii* and

*Clostridium haemolyticum*, as well as a formaldehyd and thiomersal inactivated whole cell bacterial culture of *Clostridium chauvoei.*[10]
Considering the potential persistence of *C. chauvoei* spores in the environment, we hypothesized that blackleg is still prevalent in certain areas of the Canton of Bern, an important and large agricultural region of Switzerland.[6] Therefore, we evaluated the epidemiological situation of blackleg in the Canton of Bern from 1992 to 2023. In addition, we performed a survey to determine current prophylactic practices used by veterinarians in blackleg risk areas in the Canton of Bern.

## Material and Methods

### Study area

This study focuses on the Canton of Bern, Switzerland, with a surface area of 5'960 km$^2$, including approximately 1'500 Alpine pastures.[6] The canton is divided into four court regions: Bernese Jura Seeland, Emmental Oberaargau, Bern-Mittelland, and Bernese Oberland.[4] Within the Canton of Bern, cattle are often moved between different areas. Emmental Oberaargau counts approximately 53'000 cattle, Oberland approximately 49'000, Mittelland 44'000 and Bernese Jura Seeland around 26'000 cattle.[6]

### Data collection

The data on officially reported blackleg cases in the Canton of Bern has been collected from the data bank of the Federal Food Safety and Veterinary Office (FSVO), the InfoSM reporting system,[13] and the Institute of Veterinary Bacteriology (IVB, Vetsuisse-Faculty, University of Bern, Switzerland). The blackleg cases were stratified by location with geographical coordinate and date of the case. Risk areas were defined by the Cantonal Veterinary Office based on the occurrence of cases in the past. A list of these areas was updated until 2020. Based on the geographical coordinates, risk areas and confirmed blackleg cases were transferred to geographical maps.

### Maps

The creation of the maps was conducted using an open-source geographical information system (QGIS 3.30, 's-Hertogenbosch. qgis.org). To simplify the case occurrence on the maps, the years between 1992 and 2023 were stratified into the following four time periods: 1992-1999, 2000-2009, 2010-2019, 2020-2023. Seven cases could not be precisely located due to lack of information about the exact location of the animal investigated and are therefore not shown on the map.

### Questionnaire

Veterinarians practicing in the Canton of Bern were asked to complete a questionnaire (available on request from authors). In total 18 veterinarians, 15 of them actively practicing, three recently retired, took part in the study. Fifteen of them were practicing in the risk areas, whereas three have been practicing in areas bringing animals to alpine pastures in risk areas. The selection of the veterinarians for the study was conducted in collaboration with the Cantonal Veterinary Office.
The questionnaire was split in four parts: the first part involved questions regarding the veterinary practice participants are employed at, the second part comprised questions

about clinical blackleg cases the practicing veterinarians have seen, and the third and fourth part involved questions regarding the preventive measures, including current vaccination plans.
It contained 16 closed and six open-ended questions and on average, it took participants approximately 10 minutes to complete. A paper version of the questionnaire was produced, which was used to interview the participants. Out of 18 interviews, 17 were held in the presence of the participating person and the first author, one was conducted via telephone. The interviews were performed between November 2023 and May 2024.

Data analysis
Descriptive data analysis of the cases as well as encoding of the questionnaire was conducted in Microsoft Excel 2024. The responses of the questionnaire were entered manually. NCSS 12 Software (2024, NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/ncss) was used to perform descriptive statistics. For the analysis of the questionnaire, frequency tables were done.

## Results

### Temporal and spatial distribution of reported blackleg cases in the Canton of Bern from 1992-2023

Altogether, 45 cases of blackleg were reported during the period of 1992-2023. Most cases occurred between 2010 and 2019, however, five cases were reported from 2020 to 2022. In nine out of 30 years, no cases were officially reported (Figure 1).
In the year of 2023, no cases of blackleg were detected in the laboratory of IVB in Bern. Furthermore, due to changes in the epidemiological status of the disease, FSVO has no information on the possible occurrence of blackleg in 2023.

Most cases were reported during summer, from June to September, which coincides with the Alpine pasture period (Figure 2).

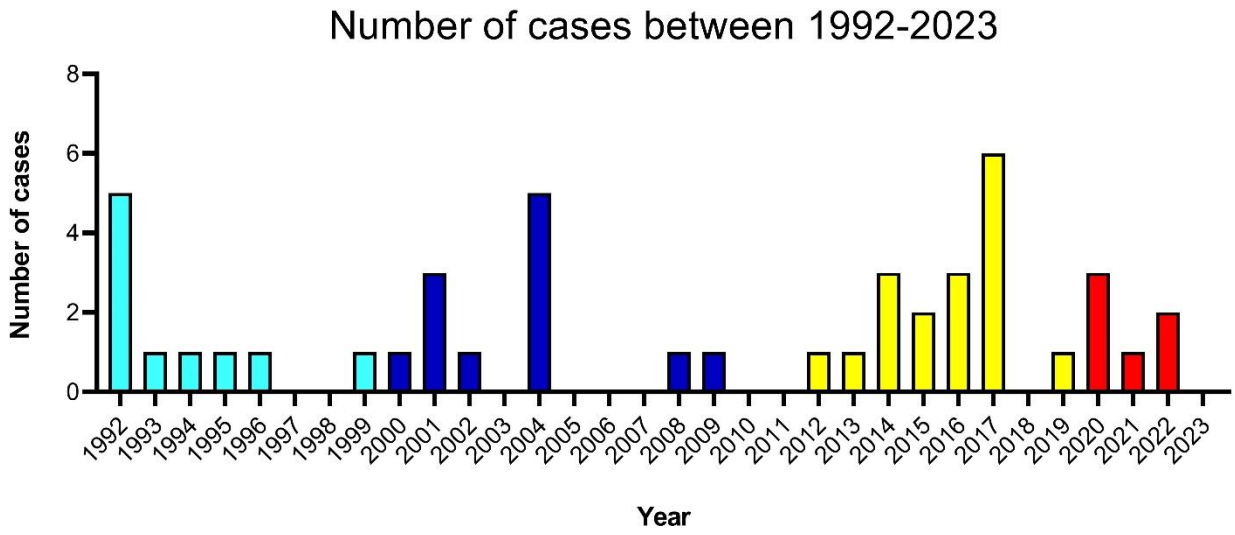


**Figure 1: Number of officially reported blackleg cases per year.** Color code corresponds to defined time periods: 1992-1999; 2000-2009; 2010-2019; 2020-2023

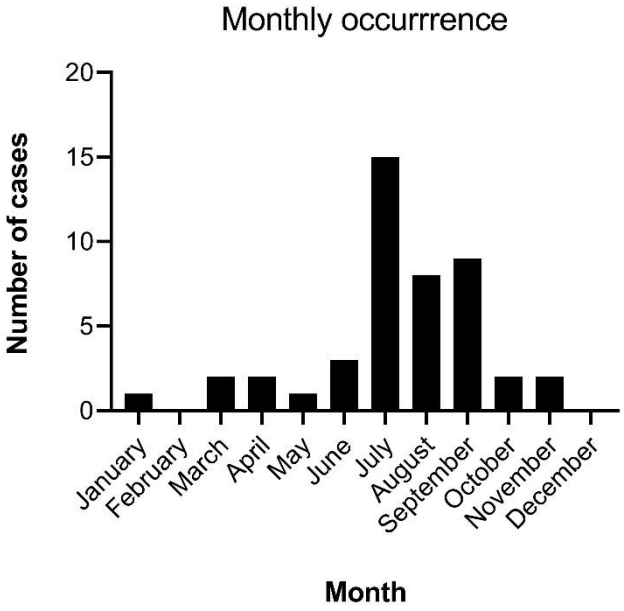


**Figure 2: Monthly occurrence of blackleg**

Plotting each reported case with clear localization data of the succumbed animal onto maps with published risk areas shows that most of the cases (n = 30) occurred in those areas still listed as risk areas in 2023 (Figure 3). However, since 2020, three cases occurred in areas that were no longer listed as risk areas in 2023. These areas were still listed in 2019, but were subsequently removed.

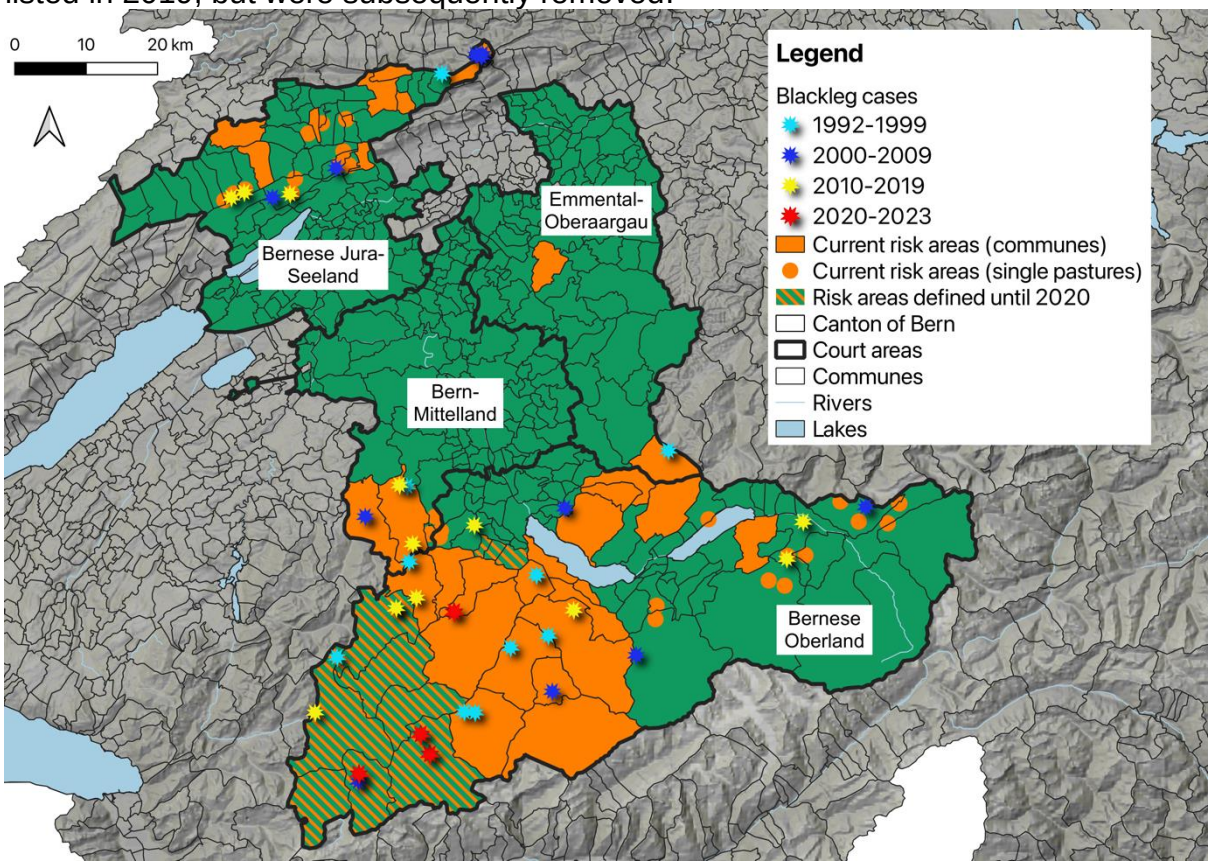


**Figure 3: Spatial distribution of officially reported blackleg cases in Canton of Bern from 1992-2023.** Currently published risk areas (2024, last update 2020) are marked in orange. The line pattern marks the risk areas published until 2020, which were subsequently removed from the list. The stars mark blackleg cases occurring between 1992-2022 in the Canton of Bern color-coded into defined time periods in which cases have occurred (1992-1999; 2000-2009; 2010-2019; 2020-2023).

## Results of the survey

### Respondent demographics

In total, 18 veterinarians working in 18 different veterinary practices took part in the survey. Participants were actively practicing (n=15), or recently retired veterinarians (n=3). Fifteen out of 18 veterinarians practiced in at least one of the defined risk areas. Three did not have any risk areas within their practice area (Table 1), however, they performed vaccinations in non-risk areas for animals that were seasonally transferred to alpine pastures in declared risk areas. The average age of the participating veterinarians was 58 years, with the oldest being 80 years and the youngest 34 years old.

### Occurrence of cases

Fourteen veterinarians (73.68%) reported to have seen at least one clinical case of blackleg in their career, that include bacteriologically confirmed as well as clinically

suspected cases. Eight of them only saw cases sporadically (sporadic was defined by the author as less than five per career so far, Table 2), six have seen frequent cases up to several per year over a period of time. Overall, the occurrence of suspected blackleg cases has been reported in all time periods from 1992-2023, with the highest proportion of 40.74% between 2010-2019 (participants were able to select more than one answer). Importantly, four veterinarians (12.90%) saw suspected cases in 2023, which, due to change in epidemiological status of the disease, were not followed up. Frequent cases were only described in the Oberland region.
To those veterinarians who saw sporadic cases only (defined as less than five per career so far) we asked specific questions about the place of the occurrence as well as if the case was confirmed by a laboratory or not. Veterinarians seeing lower number of blackleg cases, remembered many specific details about single cases.
In total, 12 sporadic cases were described by eight veterinarians. In 50% of the cases, these occurred on alpine pastures. Twenty-five percent of the cases were located in the valley, the remaining 25% occurred on pastures, located between the valley and the alpine pasture, where in some regions cattle are kept during May and June before being moved to the final alpine pastures (Table 2).
Measures that were taken after the occurrence of a blackleg case were mainly vaccination of the remaining cattle (72.22%) (Table 1). None of the veterinarians observed a case in cattle, which had previously been vaccinated.

## Vaccination

Sixteen out of 18 veterinarians (88.8%) regularly performed vaccinations during the last two years (Table 3). The range of applied dosages varied widely from 8 to 1000. Eight veterinarians (44.44%) used 11-100 vaccine dosages per year, six veterinarians (33.33%) used 101-300 dosages per year. The main reasons for vaccination were the occurrence of cases in this area in the past (44.44%), cattle being transferred to summer pastures in risk areas (38.89%) as well as prophylactic measures in case of known environmental changes such as soil excavations (16.67%, Table 3).
Most of the interviewed veterinarians (77.78%), however, reported a decrease in vaccination since 2009, as well as after 2022 (72.22%), despite them still recommending vaccine to the farmers. Only one participant noted an increase in vaccinations since 2022 due to cases occurring in their practice area during that time (Table 3). The number of animals in alpine pastures remained constant over this time period.[3]
The majority of participants reported similar arguments against the use of the vaccine, which were mostly mutually dependent.
The most frequently mentioned reason against use was the decreasing number of blackleg cases (38.46%). Furthermore, the need for two injections was mentioned as a reason for denying immunization. Veterinarians reported that it was not always possible to perform a second immunization before moving cattle to the alpine pasture and applying a second booster vaccination on the alpine pasture would have been a huge effort. The occurrence of side effects is another important aspect (23.08%), especially for farmers participating with their cattle at shows. Local swellings (66.67%) and abscesses at injection sites (23.81%) were reported as the most frequent side effects (Table 3). Two participants additionally named reduced general condition of the animal or fever. These findings correspond to the manufacturer’s specifications.[10]

## Discussion

In summary, our results show that most of the officially reported blackleg cases occurred in the areas defined as risk areas. However, some cases also occurred in the areas that were no longer included in the list of risk areas of the Canton of Bern since 2021. This indicates the difficulties of predicting and defining risk areas accurately. Moreover, since the disease is no longer actively monitored, and cases still occur in the Canton of Bern, it is likely that the level of knowledge on previous and future risk areas will decrease. Currently, risk areas in the Canton of Bern are mainly limited to the Bernese Oberland and the northern area of Bernese Jura-Seeland. Other regions (Bern-Mittelland and Emmental-Oberaargau) count less risk areas and have recorded only individual blackleg cases.

Since the disease is no longer reportable, no more official data about the number of cases is available from 2023 onwards. In the Institute of Veterinary Bacteriology at Vetsuisse Bern, in 2023, no cases of *C. chauvoei* were isolated. However, in our survey, four practicing veterinarians noted suspected cases of blackleg in 2023, suggesting that the disease is still prevalent in certain areas of the Canton of Bern.

In parallel, our survey revealed a decreasing willingness of farmers to vaccinate cattle against blackleg. This reduction in prophylaxis, as well as reduced disease awareness and monitoring, together with the biology of *C. chauvoei*, could pose significant risks for reoccurrence of the disease. Spores of *C. chauvoei* are known to be highly resistant to environmental influences and disinfectants and persist over long periods of up to several decades in different environments.[1,5,17] Thus, recurrent outbreaks in once contaminated environments are typical. Factors such as soil type, flooding events, annual rainfall as well as recent soil excavations have been associated with the occurrence of blackleg.[15,17]

It has to be noted that the focus of this study is on the blackleg risk areas so the selection of the veterinarians was not randomly and led to a selection bias.

It is also possible that animals become infected while grazing on contaminated pastures, while disease manifests much later in a different location. If animals are not disposed immediately, postmortem opening of the carcass can lead to contamination of new areas. To prevent this, continuous immune prophylaxis in known risk areas is important.

Although this study has focused on the Canton of Bern, similar situations could occur in other areas of Switzerland with large cattle populations and alpine pastures. Veterinarians practicing in once affected areas, in the Canton of Bern and elsewhere in Switzerland, should be aware of the continuing threat of blackleg disease and act accordingly once outbreaks are suspected.

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# Appendix

## Tables

**Number and % of veterinarians practicing per officially defined risk areas**

| | Count | Percent |
|---|---|---|
| Risk area | 15 | 83.33% |
| No risk area | 3 | 16.67% |

**Number and % of veterinarians and the size of farms (as number of cattle per farm in four categories)**

| | | |
|---|---|---|
| 0-100 | 4 | 23.53% |
| 101-300 | 7 | 41.18% |
| 301-500 | 4 | 23.53% |
| >500 | 2 | 11.76% |

**Number and % of veterinarians according to the percentage of cattle from farms going to summer pastures in four categories**

| | | |
|---|---|---|
| 0-25% | 2 | 11.76% |
| 26-50% | 2 | 11.76% |
| 51-75% | 3 | 17.65% |
| 76-100% | 10 | 58.82% |

**Number and % of veterinarians according to whether they observed blackleg case or not**

| | | |
|---|---|---|
| Observed blackleg case | 14 | 73.68% |
| Did not observe blackleg case | 4 | 21.05% |

**Number and % of suspected blackleg cases reported by 18 veterinarians working in Canton of Bern in different time periods**

| | | |
|---|---|---|
| 1992-1999 | 7 | 22.58% |
| 2000-2009 | 3 | 9.68% |
| 2010-2019 | 11 | 35.48% |
| 2020-2022 | 6 | 19.35% |
| 2023 | 4 | 12.90% |

**Case frequency (n)**

| | | |
|---|---|---|
| Regular | 6 | 42.86% |
| Sporadic (< 5 cases per career) | 8 | 57.14% |

**Number and % of veterinarians reporting different types of measures) taken after outbreaks**

| | | |
|---|---|---|
| Vaccination implemented | 13 | 72.22% |
| Farm blocked | 3 | 16.67% |
| Change of pasture | 1 | 5.56% |
| Vaccination recommended (but not done) | 1 | 5.56% |

**Table 1:** Results of a questionnaire to 18 veterinarians practicing in Canton of Bern in relation to size of the practice area, suspected blackleg cases and case frequency as well as measures against blackleg. Results are displayed in absolute and relative numbers.

| Case occurrence ((n), only sporadic cases) | Count | Percent |
|---|---|---|
| Alpine pasture | 6 | 50.00% |
| Valley | 3 | 25.00% |
| Pre-alpine (Voralp) | 3 | 25.00% |
| **Confirmation ((n), only sporadic cases)** | | |
| Yes | 8 | 66.67% |
| No | 4 | 33.33% |

**Table 2:** Answers to section of the questionnaire containing questions case frequency with a special focus on sporadic cases. Results are displayed in absolute and relative numbers.

| Vaccine usage | Count | Percent |
|---|---|---|
| Yes | 16 | 88.89% |
| No | 2 | 11.11% |
| **Number of vaccinated animals (per year)** | | |
| None | 2 | 11.11% |
| 1-10 | 1 | 5.56% |
| 11-100 | 8 | 44.44% |
| 101-300 | 6 | 33.33% |
| >300 | 1 | 5.56% |
| **Vaccinations 2009-2022** | | |
| Decreasing | 14 | 77.78% |
| Constant | 4 | 22.22% |
| Increasing | 0 | |
| **Vaccinations since 2022** | | |
| Decreasing | 13 | 72.22% |
| Constant | 4 | 22.22% |
| Increasing | 1 | 5.56% |
| **Recommendation of vaccination** | | |
| Yes | 13 | 72.22% |
| No | 5 | 27.78% |

| | | | |
|---|---|---|---|
| **Reasons for use of vaccine** | | | |
| Occurrence of cases | | 8 | 44.44% |
| Summer pastures | | 7 | 38.89% |
| Environmental changes | | 3 | 16.67% |
| **Reasons against use of vaccine** | | | |
| Decreasing number of cases | | 5 | 38.46% |
| Side effects | 3 | | 23.08% |
| Financial aspect | | 2 | 15.38% |
| Delivery Difficulties | 1 | | 7.69% |
| Two injections | | 1 | 7.69% |
| No interest from farmers | | 1 | 7.69% |
| **Observed side effects** | | | |
| Local swelling | 14 | | 66.67% |
| Abscesses | 5 | | 23.81% |
| Decreased general condition | | 1 | 4.76% |
| Fever | 1 | | 4.76% |

**Table 3:** Answers to **s**ection of the questionnaire containing questions regarding the vaccine usage and number of vaccinated animals as well as reasons for and against vaccination and the potential side-effects. Results are displayed in absolute and relative numbers.

Supplementary table

| Date | Commune |
|---|---|
| 15.03.1992 | Adelboden |
| 15.04.1992 | Saanen |
| 15.09.1992 | Reichenbach im Kandertal |
| 15.09.1992 | Wimmis |
| 15.09.1992 | Schangnau |
| 15.08.1993 | Frutigen |
| 15.06.1994 | Adelboden |
| 15.11.1995 | Oberwil im Simmental |
| 15.07.1996 | Rüschegg |
| 11.09.1999 | Corcelles |
| 17.08.2000 | Orvin |
| 09.07.2001 | Lauenen |
| 16.08.2001 | Hasliberg |
| 23.08.2001 | Guggisberg |
| 09.01.2002 | Sauge |
| 22.07.2004 | Heiligenschwendi |
| 03.09.2004 | Schelten |
| 19.09.2004 | Schelten |
| 22.09.2004 | Schelten |
| 20.10.2004 | Lauterbrunnen |
| 13.08.2008 | Reisiswil* |
| 24.07.2009 | Kandergrund |
| 16.07.2012 | Rüschegg Heubach* |
| 01.03.2013 | Rüschegg |
| 02.07.2014 | Aeschi bei Spiez* |
| 04.07.2014 | Boltigen |
| 05.11.2014 | Meiringen |
| 13.08.2015 | Rüschegg |
| 14.08.2015 | Boltigen |
| 15.07.2016 | Frutigen* |
| 16.07.2016 | Aeschi bei Spiez* |
| 22.08.2016 | Oberwil im Simmental |
| 22.04.2017 | Saanen |
| 22.05.2017 | Meiringen |
| 22.06.2017 | Uebeschi |
| 06.07.2017 | Reichenbach im Kandertal |
| 27.07.2017 | Courtelary |
| 27.07.2017 | Cortébert |
| 27.10.2019 | Orvin |
| 29.06.2020 | Lauenen |
| 05.07.2020 | Erlenbach im Simmental |
| 14.07.2020 | Zwischenflüh* |
| 17.09.2021 | Schwenden im Diemtigtal* |
| 15.07.2022 | Lenk |
| 08.09.2022 | Lenk |

**Table 1:** List of the dates and communes with official blackleg cases between 1992-2023. *No information about the exact localisation available.

# Fragebogen Rauschbrandimpfung

In der folgenden Umfrage möchten wir die aktuelle Situation in Bezug auf die Rauschbrandprophylaxe in Gefahrengebieten im Kanton Bern ermitteln, sowie Informationen über die Praxiserfahrung mit Ausbrüchen und der Impfung zu erhalten.

**Name, Praxis, Funktion:**
**Jahrgang:**
**Geschlecht:**
**Datum:**

## Teil 1: Statistische Fragen zur Praxis

| Wie viele Rinderbetriebe betreut Ihre Praxis in etwa? |
|---|
| |

| Wie hoch ist der Anteil an Sömmerungsbetrieben in ihrer Praxis? |
|---|
| |

## Teil 2: Rauschbrand-Fälle

Haben Sie je einen klinischen Fall von Rauschbrand erlebt?

- ☐ Ja, einen
- ☐ Ja, mehrere und zwar ____ (Anzahl)
- ☐ Nein

Wenn ja, wann ist dieser Fall in etwa aufgetreten?

- ☐ 1991-1999
- ☐ 2000-2009
- ☐ 2010-2019
- ☐ 2020-2022

Wenn ja, wurde dieser Fall bestätigt oder war (und blieb) es ein Verdacht?

- ☐ Er wurde bestätigt
- ☐ Es war ein Verdacht

| Wenn ja, wo war es (Tal vs. Alp, Weide bekannt)? |
|---|
| |

Wissen Sie, ob das betroffene Tier/die betroffenen Tiere vorher geimpft wurden?

- ☐ Ja, sie wurden geimpft
- ☐ Nein, sie wurden nicht geimpft
- ☐ Nein, ich weiss es nicht

Welche Massnahmen haben Sie dem/der Landwirt/in empfohlen?

Wurden die Massnahmen im Betrieb umgesetzt?

- ☐ Ja
- ☐ Nein

**Teil 3: Häufigkeit der Impfung**

Impfen Sie heute (im letzten Jahr/in den letzten zwei Jahren) gegen Rauschbrand?

- ☐ Ja
- ☐ Nein

Wenn ja, wie viele Impfungen pro Jahr? (im letzten Jahr) wann war das letzte Mal?

Wenn nein, wieso nicht?

Welchen Impfstoff verwenden Sie?

Ist die Anzahl Impfungen (seit 2009) ab- oder zunehmend?

- ☐ Abnehmend
- ☐ Zunehmend
- ☐ Gleichbleibend

Können Sie einen Unterschied seit 2022 (Wegfall der Meldepflicht) feststellen?

- ☐ Abnehmend
- ☐ Zunehmend
- ☐ Gleichbleibend

**Teil 4: Empfehlung der Impfung**

Empfehlen Sie die Impfung (gegenwärtig)?

- ☐ Ja
- ☐ Nein

Wenn ja, wem (welchen Betrieben) spezifisch empfehlen Sie sie?

Wenn ja, für welche Tiere (Alterskategorie) spezifisch empfehlen Sie sie?

Wie viele Betriebe, von denen Sie die Impfung empfohlen haben, haben tatsächlich geimpft?

- ☐ Gering (< 30%)
- ☐ Mittel (30-60%)
- ☐ Hoch (> 60%)

**Teil 5: Nebenwirkungen der Impfung**

Haben Sie Nebenwirkungen der Impfung bemerkt, welche Sie selbst beobachtet haben oder die Ihnen gemeldet wurden?

- ☐ Ja, lokal
- ☐ Ja, systemisch
- ☐ Ja, lokal und systemisch
- ☐ Nein
- ☐ Ich Weiss nicht/ich bin unsicher

Welche Symptome konnten festgestellt werden?

Wann sind die Nebenwirkungen aufgetreten?

- ☐ Unmittelbar nach der ersten Impfung (erste Injektion)
- ☐ Unmittelbar nach der Boosterimpfung (zweite Injektion)
- ☐ Zeitlich verzögert (bis 1 Woche) nach der ersten Impfung (erste Injektion)
- ☐ Zeitlich verzögert nach der Boosterimpfung (zweite Injektion)
- ☐ Ich weiss nicht

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# Eigenständigkeitserklärung

Ich, erkläre hiermit, dass ich die vorliegende Dissertation selbständig verfasst habe und keine anderen als die angegebenen Quellen benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet.
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St. Gallen, 4.11.2024

Ort, Datum

Unterschrift Doktorand*in