Investigation of the Working Relationships of Ontario Veterinarians and their Small Ruminant Clients with a Focus on Provision of Postmortem Services

By

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ABSTRACT

Investigation of the Working Relationships of Ontario Veterinarians and their Small Ruminant Clients with a Focus on Provision of Postmortem Services

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There is a lack of morbidity and mortality information pertaining to adult small ruminants in Canada. The Small Ruminant Adult Mortality (SRAM) system provided support to veterinarians performing on-farm postmortems of adult small ruminants, to enhance disease surveillance and improve provision of health management advice. A novel animal health surveillance evaluation framework was developed and used to evaluate the SRAM system. The evaluation indicated that the SRAM system has great value for improving diagnosis of on-farm postmortems and for building veterinarian-producer relationships. Veterinarian and producer perceptions of health management and their working relationships were also explored, with the aim of improving use of veterinary services, including animal health surveillance-based services. Results indicated there were several barriers that prevented producers from using veterinary services. Future work should focus on developing interventions to reduce these barriers, to support the improvement of animal health surveillance and growth of the Canadian small ruminant industries.
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Statement of Work

I conducted the evaluation framework literature review with input from Dr. Andria Jones-Bitton and Dr. Sherilee Harper. I conducted the framework screening and initial framework design and refined the design with assistance from Dr. Jones-Bitton, Dr. Harper and Dr. Paula Menzies. The framework was reviewed by a group of program evaluation and animal health surveillance experts (Dr. Cathy Bauman, Dr. David Kelton, Dr. Jan Sargeant, Dr. Anne LeBoeuf, Dr. Andrew Papadoupoulos, and Dr. Victoria Edge), and I incorporated their feedback into the final framework design.

I developed the plan for evaluation of the Small Ruminant Adult Mortality (SRAM) system in collaboration with the other project team members (Dr. Maria Spinato, Dr. Jocelyn Jansen, Dr. Jones-Bitton and Dr. Menzies). The diagnostic case data were gathered from the Animal Health Laboratory system by Dr. Spinato. I performed the statistical analyses for the case data. The pathologist survey was designed by me, with assistance from the SRAM team members (Dr. Spinato, Dr. Jansen, Dr. Jones-Bitton and Dr. Menzies). I performed the survey recruitment and analysis of the resulting data.

For the focus groups and interviews, the discussion guides were created by the SRAM project team (myself, Dr. Spinato, Dr. Jansen, Dr. Jones-Bitton and Dr. Menzies). I managed the recruitment of participants and conducted the data collection. Transcripts of the audio files were created by a professional transcriptionist. Analysis of the focus group and interview data was conducted by myself and Dr. Jones-Bitton.

I prepared the manuscript of this thesis with feedback and edits from Dr. Jones-Bitton, Dr. Menzies, Dr. Harper, Dr. Spinato, and Dr. Jansen. I created all of the tables and figures using
Microsoft Office™ programs. I presented some preliminary results from this thesis research at the Ontario Sheep Annual General Meeting in Alliston, Ontario, 2018. Each of the three research chapters in this thesis will be submitted to peer-reviewed scientific journals for publication.
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Chapter One: Introduction, Literature Review, and Thesis Objectives

The Canadian small ruminant industries have experienced substantial growth over the last ten years (Agriculture and Agri-food Canada, 2010, 2017, 2018a, Statistics Canada, 2017a, 2018a). Despite this growth, gaps in knowledge remain. For example, little research has been conducted regarding mortality in adult small ruminants and the research that does exist may not reflect the current industry (Dohoo, Curtis, & Finley, 1985). This research gap may hinder the ability of producers and veterinarians to promote the high-level flock or herd health necessary for the continued expansion of the industry. Possible reasons for inadequate investigation of adult small ruminant mortalities may include the poor quality of veterinarian-producer working relationships in the small ruminant industries and cost of postmortem services; however, these factors have not been investigated in Canada.

To fill these gaps in knowledge, the Small Ruminant Adult Mortality (SRAM) project involved development of a web-based distance support system for veterinarians to perform on-farm postmortems of adult small ruminants. The evaluation of the utility of this system to facilitate improved investigation of adult small ruminant mortalities and enhance disease surveillance was undertaken using an evaluation framework. To understand how use of veterinary services could be improved, including those services that contribute to improved animal health surveillance, focus group discussions and one-one-one interviews were used to explore small ruminant veterinarians’ and producers’ perceptions of health management and their working relationships.

The following literature review provides a brief overview of the small ruminant industries in Canada, as well as a review of current research on health management and veterinarian-producer working relationships in livestock industries worldwide. An overview of program
evaluation and evaluation frameworks, the qualitative research methods used in this thesis, and
the SRAM project will also be described. The chapter will conclude with the rationale and
objectives for this thesis.

1. Canadian Small Ruminant Industries

1.1 The Canadian Sheep Industry

As of January 2018, the Canadian sheep industry was comprised of approximately
825 400 head of sheep (Statistics Canada, 2018a). The largest proportion of these sheep resided
in Ontario (29%), followed by Quebec (24%) and Alberta (17%) (Statistics Canada, 2018).
Almost all sheep in Canada are farmed for meat production (Paibomesai, 2018). In Ontario, there
are approximately 12 000 dairy sheep representing only 5% of Ontario sheep flocks (Paibomesai,
2018). Fibre is not a large part of Canadian agriculture. It is generally considered to be a by-
product from meat or dairy flocks, sold by producers to recoup the costs of shearing sheep, to
promote healthy skin and reduce the impact of external parasites, fly strike, and wool blindness

In contrast to other Canadian meat industries (i.e. beef and pork), which have experienced
a decline in consumer demand since the early 2000s, demand for mutton and lamb has continued
to grow, increasing 48% in the last 20 years (Agriculture and Agri-food Canada, 2018a). It is
expected that demand will continue to increase, in part due to large numbers of people
immigrating to Canada from top lamb consuming countries (Expansion Working Group Under
the Sheep Value Chain Roundtable, 2015). Despite a clear demand for sheep and lamb products
in Canada, the domestic sheep industry currently only fills 45 - 50% of domestic demand
(Expansion Working Group Under the Sheep Value Chain Roundtable, 2015). In 2016, the
Canadian industry produced 16.4 million kilograms of mutton and lamb, and an additional 18.8 million kilograms were imported to meet demand (Agriculture and Agri-food Canada, 2018b, 2018c). This demand suggests that there is opportunity for the industry to nearly double the $179.2 million in cash receipts earned by producers in 2016 (Statistics Canada, 2017b).

1.2 Sheep Mortality in North America

There is little published information regarding the mortality risk and causes of mortality in adult sheep in Canada. One published study investigated causes of ewe and lamb mortality on 116 Canadian sheep farms registered with the Records of Performance program (Dohoo et al., 1985). The average ewe mortality risk across these farms was 4.9%. Top causes of ewe mortality included pneumonia (0.8%), and predation (0.7%), followed by unknown causes (0.5%) (Dohoo et al., 1985). However, this study was conducted in 1983 and may not be representative of ewe mortality today, particularly when considering the increase in number of sheep per farm (Expansion Working Group Under the Sheep Value Chain Roundtable, 2015), change in breed composition of the industry (Fahmy, 1990; Kennedy, 2012), and changes in endemic diseases due to climate change (Summers, 2009).

Current surveillance of Canadian sheep populations is mostly conducted through cases submitted to provincial veterinary diagnostic laboratories for analysis. In Ontario, the Animal Health Laboratory examined 168 histopathology and 112 postmortem submissions in 2017. Of these cases, which included both adult sheep and lambs, the most common diagnoses were abortion (48), parasitism (38), and pneumonia (36) (Animal Health Laboratory, 2017). In Quebec, the Ministry of Agriculture, Fisheries and Food (MAPAQ) laboratory performed only 5 postmortems on adult sheep between May and November 2017. Diagnoses included: nasal
adenocarcinoma, liver lipidosis, Johne’s disease, listerial encephalitis, and hepatitis (MAPAQ, 2017).

More data are available regarding sheep mortality in the United States than for Canada. The United States Department of Agriculture (USDA)’s National Animal Health Monitoring System (NAHMS) conducted a study in 2011 and reported similar mortality rates to that of the study conducted by Dohoo et al. (1985), described above. The 2011 study reported an overall death loss risk of 4.9% in adult sheep, with a non-predator death loss risk of 3.8%. Of those non-predator death losses, 14% (i.e. 0.5% overall) had an undetermined cause of death (USDA, 2012).

The level of mortality in adult sheep is quite high when compared to other meat producing livestock industries. For example, death losses for beef cattle are reported to be only 1.6% for cattle in feedlots (USDA, 2013) and 1.5% for adult cattle in cow-calf operations (USDA, 2010) in the United States. A reduction in mortality in the sheep industry, could help improve production performance in a flock through increased culling pressure (Scott, Sargison, & Wilson, 2007). This opportunity to reduce mortality is particularly important in the sheep industry, where profit margins per individual animal may be only a few dollars (Hosford, Stolz, & Cook, 2012).

1.3 The Canadian Goat Industry

The Canadian goat industry has grown substantially over the last 20 years, with the national herd currently consisting of approximately 230,000 goats (Statistics Canada, 2017a). The largest provincial herd is in Ontario (56.6%), followed by Quebec (15.6%) (McGonegal, 2017). Milk, produced for both fluid milk sales and cheese, represents the largest proportion of
the Ontario industry (64%), with the rest of the industry comprised of goats raised for meat or fibre (McGonegal, 2017).

The goat industry is a small livestock industry in Canada with a total of $41.7 million in cash receipts in 2016 (Statistics Canada, 2017b). In comparison, the Canadian dairy cattle and pork industries had a total of $2.4 billion and $4.1 billion in cash receipts, respectively, in 2016 (Statistics Canada, 2017b).

Though the goat industry is small, there is opportunity for growth. Production of goat meat has increased over the last ten years with 68,709 head slaughtered in Canada in 2017 (Agriculture and Agri-food Canada, 2010, 2017). With an average slaughter weight of 14.4 kg, this suggests an annual production of approximately 989,410 kilograms of meat (Agriculture and Agri-food Canada, 2017). This supply was only enough to meet approximately one-third of consumer demand, with imports of goat meat in 2017 totalling 2.9 million kilograms (Agriculture and Agri-food Canada, 2017). Additionally, the production of goat milk in Canada has grown rapidly over the last 10 years, with over 57 million litres produced in 2016 (Canadian Dairy Information Centre, 2017). Although there is greater fluctuation in imports of goat dairy products than in goat meat, over 111,000 kilograms of goat cheese were imported in 2016 to fulfill Canadian consumer demand (Agriculture and Agri-food Canada, 2017). These imports again suggest that there is opportunity for expansion of the Canadian industry, with demand likely to continue to grow as immigration from top goat-producing countries makes up almost 30% of all immigration to Canada (Food and Agriculture Organization of the United Nations, 2017; Statistics Canada, 2017c).
1.4 Goat Mortality in North America

There is little published information available on mortality levels and causes of mortality in the Canadian goat industry. One study, conducted in Quebec in 2009/2010, collected a convenience sample of adult goats and post-weaned kids that died or were euthanized on 13 farms (Debien et al., 2013). The researchers performed postmortems on 152 submitted goats and kids and found the most common causes of death included *Clostridium perfringens* Type D enterotoxaemia (17.1%), pneumonia (13.8%), and paratuberculosis (10.5%). The investigators were unable to make a diagnosis in 5.3% of cases (Debien et al., 2013).

Similar to the situation in the Canadian sheep industry, disease surveillance in the goat industry is primarily conducted through submissions to provincial veterinary diagnostic laboratories. The Animal Health Laboratory at the University of Guelph in Ontario examined 113 postmortems and 182 histopathology submissions from goats in 2017, with common diagnoses including parasites (63), abortions (43), and pneumonia (41) (Animal Health Laboratory, 2017). It should be noted that these diagnoses are not separated by age and therefore include both adults and juveniles. Quebec’s MAPAQ laboratory examined 4 adult goat postmortems between May and November 2017. Diagnoses included listerial encephalitis, diarrhoea, and pneumonia (MAPAQ, 2017).

There is more information available regarding goat mortality in the United States than in Canada. A 2015 NAHMS study found a death loss risk of 9% for adult goats, with type specific risks of 8% (dairy) and 10.7% (meat or other) (USDA 2017). Adult losses due to non-predator causes were 78% of all losses, and 37.4% of those losses (i.e. 29% overall) were due to an unknown cause (USDA, 2017). In comparison to goats, NAHMS estimates death loss in dairy
cattle to be lower: 5.7% in dairy cows and 1.8% in dairy heifers, with death loss due to unknown cause being 15% and 14.6% respectively (USDA, 2007). A reduction of mortality levels in North American goat populations could improve both animal welfare and producer profits (Scott et al., 2007), and help better meet consumer demand for goat products.


The practice of veterinary medicine requires a veterinary-client-patient relationship (VCPR) for a veterinarian to prescribe or dispense medications to that client (College of Veterinarians of Ontario, 2018). A VCPR is defined by the College of Veterinarians of Ontario (CVO) as, “a formal, long-term relationship between client and veterinarian centered around [the client’s] animals” (CVO, 2018). A valid VCPR relies on three factors: (1) the veterinarian assuming the responsibility of providing veterinary care to the client’s animal(s); (2) the veterinarian maintaining enough knowledge of the client’s animals to provide appropriate treatment as required; and (3) the client being willing to accept the advice provided by the veterinarian (CVO, 2018).

In livestock production, animal health and productivity are closely linked. Hence, livestock veterinarians may offer health management services to their livestock clients designed to protect or enhance the health of the group as a whole, in addition to providing treatment for sick animals (Radostits, 2001). There are a range of options for providing health management services, from basic veterinary visits designed to evaluate health and performance of animals and to recommend improvements to reduce disease and increase production, to more comprehensive herd management including advising on additional areas of livestock management such as nutrition, housing, and genetic improvement (Radostits, 2001). There is some thought amongst
veterinarians that improvements could be made to the veterinary-client relationship with respect to offering health management services to small ruminant clients, but little understanding of how this relationship can be improved (P. Menzies, personal communication, July 4th, 2018).

In Canada, no published research exists on the perceptions of farmers and veterinarians regarding the provision of health management services or veterinarian-producer working relationships in small ruminants or other livestock species; however, some research on these topics has been conducted in the United Kingdom (UK) and New Zealand. This research has been summarized below.

2.1 Perceptions of Health Management

2.1.1 Veterinarians’ Perceptions of Health Management

A study conducted in 2012 in the UK investigated veterinarians’ opinions on the delivery of flock health services to their sheep clients. The study used face-to-face interviews with sheep veterinarians with discussion topics including expertise in sheep, contact with sheep farm clients, and provision of services (Bellet, Woodnutt, Green, & Kaler, 2015). Veterinarians discussed several factors that limited their ability to provide flock health services to their sheep clients. First, veterinarians reported that it was difficult to offer preventative advice to their sheep clients because veterinarians often do not develop a strong knowledge base in sheep. They also reported having little opportunity to use their knowledge in practice with sheep clients, which further prevented them from building their skills (Bellet et al., 2015). Additionally, they reported that they are often unable to determine “where things are going wrong” on a farm, due to a lack of record keeping, which hindered them in offering value-added preventative advice to their clients.
(Bellet et al., 2015). Finally, the veterinarians also perceived that that their sheep clients would be unwilling to pay for flock health services, if they were offered (Bellet et al., 2015).

Another study conducted in the UK investigated the challenges cattle veterinarians faced in offering herd health-based services to their clients. These veterinarians identified a shift in their practice from individual to herd health-based medicine; however, they reported a number of difficulties associated with this shift (Ruston et al., 2016). The presence of other, non-veterinary consultants (e.g. nutritionists) providing preventative advice was perceived to prevent farmers from consulting their veterinarians for animal health advice (Ruston et al., 2016). Additionally, veterinarians reported feeling ill-equipped to promote preventative, herd health-based services to their clients, due to a lack of training in how to market their services. They also perceived that attempting to sell clients services they were not seeking would reduce their credibility (Ruston et al., 2016). Veterinarians also reported being unsure how to develop a payment scheme for health management services that would function for both their clients and their own businesses (Ruston et al., 2016). These challenges are in line with those reported for sheep veterinarians described above, and highlight the challenges that exist for veterinarians in the UK offering herd health services to their livestock clients (Bellet et al., 2015; Ruston et al., 2016).

2.1.2 Livestock Producers’ Perceptions of Health Management

Studies of the perceptions of sheep producers regarding flock health services show similarities to the perceptions of veterinarians. In one study that used focus group discussions with male sheep producers in England, producers described veterinary services as a resource to be used in an emergency, such as when a sheep had difficulty lambing or when many sheep were dying due to an unknown cause (Kaler & Green, 2013). Outside of this use, most producers reported that their knowledge of sheep farming practices and of their own flock, made their
expertise superior to that of veterinarian, and that a veterinarian was therefore not a useful resource in flock management planning (Kaler & Green, 2013). Some producers expressed their interest in a flock health model for veterinary services, but there was little clarity on what a useful model might look like (Kaler & Green, 2013).

Studies with other livestock farmers have also looked at perceptions of herd health planning. One study, conducted in England in 2011, examined the attitudes of both swine and sheep producers regarding a number of disease-related topics using semi-structured one-on-one interviews. When asked about flock health planning, sheep producers reported having a flock health plan drawn up by their vet; however, they also reported that they did not consider it a useful resource, and only kept it because it was required by their farm assurance scheme (Garforth, Bailey, & Tranter, 2013). In contrast, swine producers reported having a herd health plan created with their veterinarian because they found value in “having a systematic…way of addressing health issues” (Garforth et al., 2013).

Costs of veterinary care were also a factor in producers’ perceptions of health management. Sheep producers reported that the expense of a veterinary visit was often too great when considering the price of a single animal. They were usually unwilling to have veterinarians visit their farm specifically for their sheep, but they reported seeking free advice regarding their sheep from their veterinarians, either over the phone or when veterinarians were on farm for other species (Kaler & Green, 2013).

Investigation into the perception of veterinary services amongst dairy consultants (i.e. non-veterinary professionals who advise producers on a number of topics such as dairy herd management, nutrition, and budgeting) in New Zealand reported results similar to those of producers in the United Kingdom. Dairy consultants suggested that the role of a veterinarian
should be focused on treatment of disease on farm and that they had little to contribute in terms of other aspects of maximizing farm efficiency, such as reproduction (Bates, Wapenaar, Campbell, & Eggleton, 2016). They also expressed the opinion that veterinary advice should be taken cautiously because they perceived veterinarians as having something to gain from the advice they give to their clients (Bates et al., 2016). These consultants also expressed the opinion that costs associated with animal health, such as those for veterinary care, were an expense that should be controlled and minimized wherever possible, rather than an investment in future animal health and productivity (Bates et al., 2016).

2.2 Perceptions of the Veterinarian-Producer Working Relationships

2.2.1 Veterinarians’ Perceptions of Veterinarian-Producer Working Relationships

In a study published in 2016, English cattle veterinarians expressed the perception that trust between veterinarians and their clients is a central feature of a good working relationship (Ruston et al., 2016). They also reported that trust needed to be earned and built over time, so as to develop a strong working relationship with their clients (Ruston et al., 2016).

Another study conducted with sheep veterinarians from England and Wales explored the relationship between veterinarians and their clients. Sheep veterinarians perceived that they did not have a strong working relationship with their sheep clients because their sheep clients did not trust that their veterinarian’s expertise was greater than their own where their sheep were concerned. These veterinarians also expressed that they believed sheep farmers are not interested in putting effort into developing a strong working relationship (Bellet et al., 2015).
2.2.2 Livestock Producers’ Perceptions of the Veterinarian-Producer Working Relationship

Perceptions of veterinarian-producer working relationships have also been explored in producer populations. One study conducted in England in 2010 with sheep producers explored the role they perceived for veterinarians on farm. Sheep producers felt that a lack of time spent with a single veterinarian, (both in a single farm visit and over time due to high turnover rate), was a major contributor to an inability to build trust, and therefore a strong relationship, between the two parties (Kaler & Green, 2013). Additionally, although sheep producers reported that they considered veterinarians to be useful sources of information and advice (Garforth et al., 2013; Kaler & Green, 2013), they were skeptical of any information provided as they felt that veterinarians often had a financial interest in selling them additional services or products, such as pharmaceuticals, that were not truly required (Garforth et al., 2013; Kaler & Green, 2013).

Qualitative research methods were used to collect and analyse data regarding veterinarians’ and producers’ perceptions of veterinary care in the preceding studies. Similarly, qualitative methods were used for part of the research described in this thesis. These methods are briefly described in the following section.

3. Qualitative Research Methods

Qualitative research methods have gained popularity in health research in recent years (Doyle, Brady, & Byrne, 2016). Some researchers use qualitative methods as a complement to quantitative methods, to provide additional corroboration of findings, to explore unexpected outcomes, and to provide context or illustration for quantitative analyses (Doyle et al., 2016). Others use qualitative research as an avenue of investigation in its own right, or as an initial exploration of a little-known topic from which to build a larger quantitative study (Doyle et al.,
There are many methods for data collection in qualitative research, each with its own benefits and drawbacks. This review will concentrate on the use of focus group discussions and one-on-one interviews, as these were employed in the research described in this thesis.

3.1 One-on-One Interviews and Focus Group Discussions

Interviews are one of the most common methods of data collection used for qualitative research (Green & Thorogood, 2004). There are multiple styles of in-depth interview ranging from fully structured, which often produces quantitative data designed to test an *a priori* hypothesis, to completely unstructured, informal interviews which are often conducted in conjunction with observational data (DiCicco-Bloom & Crabtree, 2006; Green & Thorogood, 2004). Most commonly used is the semi-structured interview. This type of interview can be used one-on-one or in a group setting and is focussed around a set of pre-determined questions with the opportunity to ask additional questions at the discretion of the interviewer (DiCicco-Bloom & Crabtree, 2006).

One-on-one interviews are used in health research to gather data for a wide range of research topics, such as understanding patients experiences with pain, and doctors’ attitudes towards antibiotic prescription (DiCicco-Bloom & Crabtree, 2006). One-on-one interviews allow researchers to gain detailed information about a single individual’s experience with, or perceptions of, a topic of interest and are generally more useful than group interviews for discussing experiences that are considered by the participant to be highly personal or sensitive (DiCicco-Bloom & Crabtree, 2006; Guest, Namey, & Mitchell, 2013).

Focus group discussions are used by researchers to gather a broad range of viewpoints on a particular topic in a short period of time (Green & Thorogood, 2004; Krueger & Casey, 2009).
In health research, they are often used to: evaluate health programs; assess public understanding of and experience with disease; and gather information regarding public perception of health risks (Green & Thorogood, 2004; Wong, 2008).

Focus group discussions are a useful tool for researchers because they take advantage of interaction between participants that does not exist with other data collection methods, such as one-on-one interviews (Green & Thorogood, 2004; Krueger & Casey, 2009; Wong, 2008). This interaction can elicit additional information from participants because it allows participants to build on each other’s comments and experiences. Additionally, focus group discussions often provide a more natural social setting than one-on-one interviews, which allows for greater discussion of negative viewpoints, particularly toward provision of services (Green & Thorogood, 2004).

In veterinary medicine, qualitative interviews have been used to study perceptions of veterinarians regarding a wide range of topics, including: finances (Coe, Adams, & Bonnett, 2007); communication with clients (Coe, Adams, & Bonnett, 2008); and veterinary education (Dale, Nasir, & Sullivan, 2005; Moore, Klingborg, Brenner, & Gotz, 2000). Interviews have also been used with livestock veterinary clients to explore other topics, including: health management of livestock (Kaler & Green, 2013; Morgan-Davies, Waterhouse, Milne, & Stott, 2006); use of antibiotics (Friedman et al., 2007); biosecurity (Gunn, Heffernan, Hall, McLeod, & Hovi, 2008); and animal welfare (Horseman et al., 2017).

3.1.1 Online Focus Group Discussions

Traditionally, focus group discussions were conducted in person; however, with the development of high speed internet, researchers in many fields, including those in health
research, have begun to conduct focus group discussions online, through moderated discussion boards and real-time voice or video based software (Stewart & Shamdasani, 2017). Online focus group discussions are often logistically easier to conduct as they are less costly; require less time commitment by participants by eliminating travel time; eliminate the need to secure an appropriate location to hold an in-person discussion; and allow for participation of geographically-dispersed individuals in a single group discussion (Stewart & Shamdasani, 2017).

There are two general types of online focus group discussions commonly used in research: asynchronous and synchronous. Asynchronous groups differ considerably from traditional in-person focus group discussions. They are generally text-based, and are often conducted through the use of discussion board software, which allows participants to log on at any time to see and respond to posts from the moderator or other participants (Stewart & Shamdasani, 2017). In contrast, synchronous groups are similar to traditional focus group discussions, in that they require participants to conduct a discussion in real time; however, they connect participants through an online text-based, audio-based or video-based format, eliminating the need for participants to travel to a single location (Stewart & Shamdasani, 2017).

Synchronous online focus group discussions are reported to have participation rates equal to or greater than those found in traditional in-person focus group discussions (Stewart & Shamdasani, 2017) and have been shown to elicit greater personal disclosure and honesty from participants, particularly regarding sensitive topics (Smith, John Sullivan, & David Baxter, 2009; Stewart & Shamdasani, 2017; Wilkerson, Iantaffi, Grey, Bockting, & Rosser, 2014; Woodyatt, Finneran, & Stephenson, 2016). The latter is likely due to participants’ perceptions of increased anonymity and group homogeneity (i.e. the participants’ perception that the other members of the group are more similar to themselves), as well as perceptions of less formality and reduced
There are some drawbacks to the use of synchronous online focus group discussions when compared to an in-person format. Online focus group discussions generally require some level of technological literacy, and access to a high-speed internet connection; as such, they can exclude participants who are not comfortable with the use of online conferencing software or do not have access to reliable high-speed internet service (Wilkerson et al., 2014). Additionally, online focus group discussions, particularly those that are not video-based, do not provide the option for moderators to respond to non-verbal cues such as eye-contact or body language (Smith et al., 2009).

3.2 Qualitative Data Analysis

There are a range of approaches available for analysing qualitative data, depending on the goal of the study being undertaken (Green & Thorogood, 2004). For example, some studies aim to simply ‘give a voice’ to their participants, in which case there is little interpretation involved in analysis beyond basic editing for clarity (Green & Thorogood, 2004). Other studies are interested in describing and explaining complex phenomena, which involves a more thorough analysis to discover and describe underlying meaning and patterns in the data (Green & Thorogood, 2004).

Some commonly used methods of analysis include: thematic analysis, grounded theory, and framework analysis (Green & Thorogood, 2004). This review will focus on thematic analysis, as this was the method of analysis used for the research reported in this thesis.
3.2.1 Thematic Analysis

One of the most common methods of qualitative analysis is thematic analysis, which is used by a researcher to look for, describe, and interpret patterns found throughout a data set as themes. These themes are generally defined with some consideration of their importance to the research question, and can be used to provide a general picture of an under-researched area or to delve deeply in a specific aspect of a topic (Braun & Clarke, 2006).

Braun and Clarke (2006) describe six steps in performing a thematic analysis. First is familiarization with the data. Here the researcher will read through the data and make note of initial ideas for codes that describe the lines of transcript. Next, the researcher will generate codes and apply them across the whole data set. The third step involves the creation of themes by grouping codes of similar topics. Themes are then reviewed to check for similarities between themes, divergences from the theme in grouped codes, and for the existence of adequate supporting evidence for the theme. Once themes are reviewed, they are named and defined. Finally, a report is produced that describes themes with supporting evidence from the data (e.g. via the use of direct quotations) and relates these themes to both the research question and any applicable literature (Braun & Clarke, 2006).

Part of the work comprising this thesis used the methods described above. Additional work involved program evaluation and use of program evaluation frameworks which are reviewed in the following section.

4. Program Evaluation

Program evaluation is defined by the World Health Organization (WHO) as the “periodic assessment of the relevance, effectiveness and impact of activities in light of the objectives of a
program” (World Health Organization (WHO), 2006). These assessments can be varied in scope and in timing. An evaluation may assess a single activity within a larger program, or address the program as a whole (Bowen, 2012; Health Surveillance Coordinating Committee, 2004; Porteous, 1997). Some program evaluations may be conducted during program planning stages to assess need or feasibility, while others may be conducted for an existing program to evaluate the implementation or impact of activities (Porteous, 1997). Program evaluations may also have different end goals, such as illuminating gaps in program function, explaining benefits and drawbacks to program activities, and identifying areas for improvement (Bowen, 2012; Porteous, 1997; WHO, 2006). While all these elements may vary, evaluations have a common purpose in providing evidence about a program for decision-makers. This evidence may help determine whether a program is fulfilling its objective, provide information for resource planning, help explain any successes and failures the program may achieve, and provide decision-makers with impartial recommendations for modifications to the program (WHO, 2006).

4.1 Evaluation Frameworks for Program Evaluation

There are a variety of published frameworks to guide program evaluations. These frameworks usually contain a set of steps designed to assist evaluators in the development and execution of an evaluation and to provide consistency in evaluators’ approaches (Bowen, 2012; Health Surveillance Coordinating Committee, 2004; Porteous, 1997; Centers for Disease Control (CDC), 2008; WHO, 2006).

Although most frameworks have similarity in their construction, their content and application can vary. For example, some frameworks are general and are designed to be applied to a variety of health-based programming, (e.g. Public Health Agency of Canada (PHAC)’s Program Evaluation Toolkit (Porteous, 1997) and the Canadian Institute of Health Research
(CIHR)’s Guide to Evaluation in Health Research (Bowen, 2012)). Others, such as the frameworks available from the United States Centers for Disease Control and Prevention (CDC) (CDC, 2008), Health Canada (Health Surveillance Coordinating Committee, 2004), and the WHO (2006), are designed to be applied to a specific kind of program, such as disease surveillance programs. Some frameworks may be designed for application to even more specific types of programs: programs using a specific type of surveillance (e.g. syndromic surveillance (Sosin, 2003)); that provide surveillance for a single disease (e.g. diabetes (Paquette-Warren, Hayward, Tompkins, & Harris, 2014) or HIV-AIDS (Boerma, Pisani, Schwartländer, & Mertens, 2000)); or that are operated under a specific project or provided funding by a specific agency such as the Enhanced Comprehensive HIV Prevention Planning project (Fisher et al., 2016).

Frameworks can also vary in flexibility of application. Some frameworks are rigid, providing specific criteria designed to give a program an overall score, such as the analysis tool for surveillance systems (OASIS) tool used for assessing surveillance in animal health and food safety (Hendrikx et al., 2011), or the World Organisation for Animal Health (OIE) tool for assessing performance of veterinary services (World Organisation For Animal Health, 2013). Other frameworks may be semi-flexible, providing a number of options to select from when designing elements of an evaluation, (e.g. the Surveillance Evaluation (SERVAL) framework (Drewe et al., 2015)). Other frameworks, such as those from the CDC, PHAC, CIHR and the WHO are designed to be very flexible, by providing basic guidance that can be applied to a wide range of programming or program components, as required by evaluators (Bowen, 2012; Porteous, 1997; CDC, 2008; WHO, 2006).

While differences exist, there are commonalties among many frameworks. Frameworks are often designed in steps, with each step encompassing a task in the evaluation process
Evaluation frameworks can be used to evaluate many different surveillance and public health programs, including the one that underlies the work of this thesis, described in the following section.

5. The Small Ruminant Adult Mortality (SRAM) Project

As demand for Canadian small ruminant products continues to grow (Agriculture and Agri-food Canada, 2018a), there remains a gap in research and surveillance with regard to causes of mortality in adult sheep and goats. The Small Ruminant Adult Mortality (SRAM) project aimed to improve disease surveillance capacity by supporting veterinarians in providing the service of on-farm postmortems of adult small ruminants.

It is believed that the lack of information available regarding causes of adult small ruminant mortalities is at least partially due to a lack of investigation into deaths of adult animals that occur on farm, and a lack of quality investigative technique when postmortems do take place (P. Menzies, personal communication, July 4th, 2018). With this in mind, the SRAM project
involved creation of a web-based tool designed to assist veterinarians with performance and submission of high quality postmortem samples to the University of Guelph Animal Health Laboratory (AHL) by providing instructions, including a training video, for performing a postmortem and an online medium through which to submit complete case histories and photographs. Using the developed online tool, the SRAM project aimed to improve diagnostic outcomes for submitted adult small ruminant postmortems and therefore, enhance disease surveillance in Ontario’s adult small ruminant populations.

6. Thesis Rationale and Objectives

Research in other small ruminant-producing countries has identified challenges with uptake of veterinary health management services and development of strong working relationships between small ruminant veterinarians and producers (Bates et al., 2016; Bellet et al., 2015; Garforth et al., 2013; Kaler & Green, 2013; Ruston et al., 2016). Though a strong working relationship, including provisions of health management services, is an important factor in successful livestock production (Radostits 2001; CVO 2018), no research regarding health management or working relationships has been conducted with Canadian small ruminant producers and veterinarians. As the Canadian small ruminant industries continue to grow, addressing this gap in knowledge is important, to promote future sustainability of the industry.

Mortality, particularly of adult animals, is another important factor to address, to support the continued growth and sustainability of the Canadian small ruminant industries. The SRAM project has created a system with the aim of enhancing surveillance for disease in adult small ruminant populations through improved postmortem performance and submission techniques.
Evaluation of surveillance activities and systems, such as the SRAM system, is important to ensure the system is meeting its objectives and to discover opportunities for system improvement (WHO 2006). Though many frameworks are available to guide evaluation of surveillance or public health programs (Porteous 1997; Health Surveillance Coordinating Committee 2004; WHO 2006; CDC 2008; Bowen 2012), few are targeted specifically to address evaluation of animal health surveillance programs (Drewe et al., 2015). Hence, a framework for evaluation of animal health surveillance programs was created as part of this thesis, and was used to evaluate the SRAM system as a test case.

The specific objectives of this thesis were to:

1. Create an evaluation framework designed to guide the evaluation of animal health surveillance programs (Chapter Two);

2. Apply the framework to the evaluation of a web-based system designed to assist veterinarians in conducting quality postmortems on-farm for adult small ruminants (Chapter Three); and

3. Investigate veterinarians’ and producers’ attitudes towards flock/herd health management and working relationships on Ontario small ruminant farms (Chapter Four).
7. References


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Chapter Two: A New Framework for the Evaluation of Animal Health Surveillance Programs

Abstract

Systematic evaluation is an important component of health surveillance programs. To support evaluation in an animal health setting, a framework for the evaluation of animal health surveillance systems, the Animal Health Surveillance Evaluation Framework (AHSEF), was designed. Guidance from published evaluation frameworks and animal health surveillance experts was incorporated into the final design of the framework, which was completed over the period of May 2017 to September 2018. The framework is comprised of 35 guiding questions divided into four sections. Use of this framework will help users to perform systematic evaluations of animal health surveillance systems that can assist in maximizing the benefits of surveillance activities.

Key Words: Program evaluation, surveillance, animal health

1. Introduction

Animal health surveillance is an important component of the international food system (Hoinville et al., 2013). Defined as “the systematic measurement, collection, collation, analysis, interpretation, and timely dissemination of animal health and welfare data from defined populations” (Hoinville et al., 2013, pg. 4), animal health surveillance is used in a variety of contexts and for numerous purposes around the world. Objectives of animal health surveillance systems often include: detection of specific disease cases; tracking of disease trends; monitoring the efficacy of disease control measures; elimination of disease; and substantiation of freedom
from disease claims (Hoinville et al., 2013; World Health Organization, 2006). Animal health surveillance systems can therefore have important practical outcomes. For example, data from such systems can be used to support the growth of animal industries by providing evidence of freedom from disease, thus facilitating international trade, and by informing policy designed to reduce the impact of disease on animal production, health, and welfare (Hoinville et al., 2013; Mariner, Hendrickx, Pfeiffer, Costard, & Knopf, 2011). Animal health surveillance systems can also be used to protect human public health, for example, by reducing the impact of zoonotic disease in human populations through early detection of potential diseases of concern and informed response to disease outbreaks (Hoinville et al., 2013; Mariner et al., 2011).

Evaluation of surveillance systems, defined by the World Health Organization (WHO) as the “assessment of the relevance, effectiveness and impact of activities in light of the objectives of the surveillance and response systems”, is an important component of surveillance activities (World Health Organization, 2006, pg. 5). Evaluation can provide explanations for problems with surveillance activities, provide evidence for modifications to system objectives or activities, and highlight areas for system improvements (World Health Organization, 2006). Evaluation is also crucial in an international context, to maintain the credibility of a surveillance system for trade partners (Drewe, Hoinville, Cook, Floyd, & Stärk, 2012).

Evaluation frameworks are tools designed to provide guidance for evaluation design; as such, they are important tools for anyone designing, operating, or evaluating health programs, including animal health surveillance researchers (Drewe et al., 2012). There are a number of published frameworks for the evaluation of human public health programming, including disease surveillance systems (e.g. Bowen, 2012; El Allaki, Bigras-Poulin, & Ravel, 2013; Hässler, Howe, & Stärk, 2011; Public Health Ontario, 2015; Waller, 2008; World Health Organization, 2006);
however, very few frameworks have been designed specifically for an animal health surveillance context (Drewe et al., 2015; Hendrikx et al., 2011; World Organisation for Animal Health (OIE), 2013). It may be difficult to apply frameworks designed for human surveillance systems to animal surveillance systems, because the framework guidance may not be easily adaptable to the differences between these contexts, such as the inclusion of multiple species. This can hinder the systematic evaluation of animal health surveillance systems.

In addition to the use of systematic frameworks, evaluation of health programs, including surveillance programs, can also be strengthened via the use of participatory methods. The participation of end-users in research can increase the effectiveness of conventional research methods by better designing and targeting research in populations (Johnson, Lilja, Ashby, & Garcia, 2004). Participatory methods can also reveal differences between what researchers and end-users each identify as problems to be addressed, and can improve research practices to better suit target populations (Johnson et al., 2004). Use of participatory methods is also reported to strengthen relationships between researchers and stakeholder groups, as well as result in faster, more wide-spread adoption of research-based programs (Johnson et al., 2004). When applied to a surveillance context, participatory disease surveillance can help create policy that prioritizes the needs of all surveillance stakeholders by thorough need identification, and increased commitment of all stakeholders to surveillance programs via a heightened sense of ownership (Mariner et al., 2011). In an evaluation setting, the participation of all stakeholder groups can provide a greater understanding of the context of surveillance system operations and of the limitations of surveillance activities (Calba et al., 2015).

The lack of published evaluation frameworks designed for application to animal health surveillance programs that specifically include guidance for the participation of program
stakeholder groups in the evaluation process presents an important gap between research and practice. Addressing this deficiency will help provide evaluators with systematic guidance in evaluating animal health surveillance programs using participatory methods. Therefore, the objective of this study was to create an evaluation framework for animal health surveillance that includes a participatory component.

2. Methods

2.1 Identification of Evaluation Frameworks

A literature review (Grant & Booth, 2009) was conducted in May and June 2017 to identify published frameworks for the evaluation of public health programming and/or human or animal disease surveillance systems. This search was meant to be informative rather than exhaustive. Searches were conducted in the Web of Science™ and Google Scholar™ databases, using the following search string: (“disease surveillance” OR “public health program”) AND (“evaluation framework”).

Titles and abstracts of identified articles were screened using the exclusion criteria found in Table 2.1, column A. Articles meeting one or more of the exclusion criteria were removed. The remaining articles were screened using the full text, and reference lists were examined to identify evaluation frameworks.

2.2 Screening of Evaluation Frameworks

The articles identified from the literature search were screened using the exclusion criteria listed in Table 2.1, column B to select evaluation frameworks to guide the construction of the new animal health surveillance evaluation framework.
2.3 New Framework Design

The frameworks selected during the screening process were examined and compared to identify elements that were common to at least two frameworks. Elements that were common to more than one framework were deemed more likely to be necessary to perform an evaluation and therefore, were the elements used to build the new animal health surveillance framework. The elements were grouped by topic (e.g. used to describe the program or engagement of stakeholders), refined into a series of guidance questions, and organized into a chronological order to create a functional evaluation guide.

To inform the participatory methods component, Web of Science™ and Google Scholar™ were searched using a search string ("participatory evaluation") AND (animal disease surveillance), to identify good exemplars of participatory evaluation of animal disease surveillance. This search was meant to be informative rather than exhaustive. Animal disease surveillance was specified as it was assumed that animal-specific research would have a greater similarity to the context and stakeholder structure of the animal health surveillance programs that the new evaluation framework was intended to target than would research evaluating other programs (e.g. human health surveillance). The selected literature was used to assess the rationale for inclusion of participatory methods in identified framework elements.

2.4 Revision of Framework Design

The initial draft of the new animal health surveillance evaluation framework was reviewed by experts involved with public health (n=2) or animal health (n=4) surveillance. The experts were initially contacted by email between April and July 2018. Each was provided a copy of the current draft of the framework and asked to provide feedback on the structure and
clarity of the framework, as well as any suggestions they had for additions, removals, or changes to the elements of the framework. The feedback from each expert was reviewed, synthesized and incorporated to produce a second draft of the framework. The same experts were contacted again in September 2018 and asked to provide comments on any other changes to the structure or elements of the new framework that they felt would be beneficial.

3. Results

3.1 Identification and Screening of Evaluation Frameworks

The initial title and abstract screening of the searched literature yielded 5 papers from Web of Science™ and 27 papers from Google Scholar™ that were suitable for further screening, (i.e. did not meet the exclusion criteria listed in Table 2.1, column A). Full text screening identified 29 frameworks for framework screening (Figure 2.1). Full review of the 29 frameworks left 6 frameworks for use in the framework design phase (Bowen, 2012; Centers for Disease Control and Prevention, 2008; Drewe et al., 2015; Health Surveillance Coordinating Committee, 2004; Porteous, 1997; World Health Organization, 2006) (Figure 2.1).

3.2 Framework Design and Revision

Initial comparison of the 6 frameworks identified 33 elements common to at least 2 frameworks. These elements were categorized into three major guidance steps, each with a series of sub-steps. The three major steps were: (1) describe the surveillance program; (2) develop the evaluation plan; and (3) evaluate, recommend, and report (Table 2.2).

The search of the literature on participatory methods in animal health surveillance provided insight into inclusion of participatory methods in multiple elements of the new
framework. Most notably, participatory components were used heavily in the design of elements related to identifying stakeholder groups, and engaging stakeholder groups in the evaluation process. Two additional elements not found in any of the six identified frameworks, choosing user engagement methods, and identifying which questions user engagement can assist in answering, were also included based on guidance from this literature (Table 2.2).

Revision of the framework by experts yielded modifications to section and question design to produce the final framework, i.e. the framework was revised to include four major steps rather than three and the wording of some questions and guidance notes was updated. No expert had additional comments or suggestions after two rounds of editing.


The final Animal Health Surveillance Evaluation Framework (AHSEF) consists of four sections as shown in Figure 2.2. Each section is divided into a series of subsections, each with a set of questions designed to guide the evaluator through the evaluation process (Figures 2.3-2.6). Section 1: Gathering Preliminary Information, contains guidance questions for initial preparation of the evaluation (Figure 2.3). Section 2: Describe the Surveillance Program, guides the evaluator in compiling a full description of the surveillance program design and operation (Figure 2.4). Section 3: Develop the Evaluation Plan, guides the evaluator through developing evaluation questions, choosing data collection methods and creating a data analysis plan specific to their program, and provides guidance questions for ensuring adequate resources are available to conduct the evaluation (Figure 2.5). Section 4: Evaluate, Recommend and Report, guides evaluators through the final activities of an evaluation, including making evidence-based
recommendations for the program, developing a plan of action based on the recommendations, and disseminating the evaluation results to the target audiences (Figure 2.6).

The participatory elements of the framework are incorporated into Sections 1 and 3 of the AHSEF. Section 1, Steps B and C require the evaluator to identify all surveillance program stakeholders and engage any appropriate groups in the development of the evaluation purpose. To facilitate this, the AHSEF provides an example of the suggested stakeholder mapping and grouping activities. The example is based on Canada’s National Scrapie Eradication Program (Canadian Food Inspection Agency, 2018), and includes a program stakeholder map (Figure 2.7), and a table detailing the stakeholder groupings and explanations for those groupings (Table 2.3). Section 3, Step C, guides the evaluator through the inclusion of the stakeholder groups identified in Section 1 of the evaluation process.

The complete AHSEF also contains comments on choosing the right evaluator and using the results of the evaluation, as well as additional notes to assist in fully answering the framework guidance questions. The complete AHSEF can be found in Appendix C.

4. Discussion

Evaluation of animal health surveillance systems is important for identification of issues with surveillance activities in practice, and for identifying needed modifications and improvements to program components (WHO, 2006). Evaluation can occur before or after implementation of a program, may be performed for a whole program or a portion of it, and can occur a single time or on a routine basis, depending on the needs of the program and its stakeholders (Bowen, 2012; Health Surveillance Coordinating Committee, 2004; Porteous, 1997). Systematic evaluation is also an important component of international trade relationships,
as it provides evidence for the credibility of the program to international trade partners (Drewe et al., 2012). To assist in the evaluation of animal health surveillance systems, the aim of this study was to create a framework tailored to the evaluation of animal health surveillance programs that incorporated participatory methods and was flexible enough to be applied to the evaluation of any animal health surveillance program or subset of program activities.

The comparison of frameworks to identify common elements highlighted some interesting areas of difference. Most notable were the differences in the level of detail required in the description of the surveillance programs being evaluated. Some frameworks had few or no elements involved in describing the program (e.g. WHO, 2006) and others had many (e.g. Drewe et al., 2015). Despite this, it was deemed important to include program description elements in the new AHSEF, because of the role understanding the program may play in highlighting issues with the program, particularly where execution of program activities may differ from their original design (Calba et al., 2015; Johnson et al., 2004; Schulz, Calba, Peyre, Staubach, & Conraths, 2016).

Differences between human public health and animal health evaluation requirements for program description were also noted during the expert review phase of the new framework design. All the experts provided feedback that reworked the wording and overall order of questions leading to a framework with greater clarity for evaluators; however, the animal health surveillance experts provided much more feedback for the elements relating to program description than did the human health experts, often looking for greater detail in the questions and additional guidance notes than was originally included during framework construction. This difference was also noted in the published frameworks. For example the framework published by
Drewe et al. (2015) for evaluation of animal health surveillance programs contained more elements related to program description than any other framework used in this study.

Participation of stakeholders in evaluation activities was considered an important component of the AHSEF. Participatory approaches have been used in veterinary work since the 1980s, and particularly in low and middle income nations, to address a wide variety of livestock disease concerns (Catley, Alders, & Wood, 2012). Recently, these approaches have been applied to evaluation of animal health surveillance in high, middle and low income nations, including the surveillance of African swine fever in Corsica (Calba et al., 2015) and classical swine fever in Germany (Schulz et al., 2016). In both instances, participatory approaches allowed researchers to understand the contributions of stakeholders to the surveillance activities with greater context, and highlighted limitations to current surveillance activities, as well as barriers to implementation of alternative surveillance strategies that may not have been noted with more traditional evaluation approaches (Calba et al., 2015; Schulz et al., 2016). Participatory approaches were also used to investigate the acceptability of these surveillance systems to stakeholder groups, and to investigate potential alternative surveillance strategies for classical swine fever (Calba et al., 2015; Schulz et al., 2016). Though the advantages of participatory approaches are being increasingly recognized in the literature, none of the identified published frameworks provided specific guidance for their inclusion in surveillance evaluation. To fill this gap, participatory approaches were built into Section 1 (gathering preliminary information) and Section 3 (develop the evaluation plan) of the AHSEF.

Some limitations may exist in the design of the AHSEF. The use of a literature review, rather than a more extensive systematic review, may have excluded some evaluation frameworks from the element identification portion of the framework design. However, it is likely that
elements critically important to surveillance evaluation would be included in most evaluation frameworks, and would therefore have been identified during framework comparison or would have been identified later as a gap during the expert review process. Further, the AHSEF has not yet been formally applied to evaluate an animal health surveillance program. Next steps will include evaluating an animal health surveillance project on adult small ruminant mortality with the use of this framework.

5. Conclusion

The AHSEF is a flexible framework designed to assist evaluators in the evaluation of a wide range of animal health surveillance programs and activities. The systematic, tailored approach that the ASHEF provides in evaluating animal health surveillance activities will assist evaluators in carrying out a comprehensive evaluation of the target program. The inclusion of participatory approaches in the framework will allow users to benefit from the advantages afforded by these methods, such as improved commitment to the program by stakeholders and better understanding of program limitations in stakeholder context. Overall, use of the AHSEF may allow users to approach evaluation in a systematic way that will maximize the benefits to their animal health surveillance activities.
6. References


7. Acknowledgements

The authors would like to thank all the human public health and animal health surveillance experts who lent their time and expertise to the review of this framework.

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8. Tables

Table 2.1 Exclusion criteria used for identification of evaluation frameworks and the framework screening process.

<table>
<thead>
<tr>
<th>A. Exclusion Criteria – Title/Abstract Screening</th>
<th>B. Exclusion Criteria - Frameworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No mention of formal evaluation of a public health program or disease surveillance system</td>
<td></td>
</tr>
<tr>
<td>• No mention of public health program or disease surveillance system (human or animal)</td>
<td></td>
</tr>
<tr>
<td>• Article describes the evaluation/validation of a screening or diagnostic test</td>
<td></td>
</tr>
<tr>
<td>• Evaluation framework is not designed for a public health program or disease surveillance system (human or animal)</td>
<td></td>
</tr>
<tr>
<td>• Article is not available in English</td>
<td></td>
</tr>
<tr>
<td>• Framework was designed for a specific program or health/disease context only*</td>
<td></td>
</tr>
<tr>
<td>• Framework provides a rating scheme only</td>
<td></td>
</tr>
<tr>
<td>• Framework provides tools for use in an evaluation rather than a guide for design of an evaluation**</td>
<td></td>
</tr>
<tr>
<td>• Framework does not provide any steps/guidance for designing an evaluation</td>
<td></td>
</tr>
</tbody>
</table>

*Frameworks designed to be applied to a specific public health program or a specific disease under surveillance may have provided useful information, but could have also introduced evaluation elements useful for only a certain program or a specific health or disease issue. It was expected that any elements in these frameworks that were necessary for evaluation would be captured in frameworks designed for wider application. Hence, program or disease-specific frameworks were excluded for simplicity.

**Tools (such as a specific survey or scale) provide a greater level of detail than is required for a guiding framework, and were therefore excluded when determining common framework elements.
Table 2.2 Thirty-five design elements identified from the selected health program evaluation frameworks and participatory evaluation literature.

<table>
<thead>
<tr>
<th>Coded Major Steps (n=3) and Sub-Steps</th>
<th>Reference to Published Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Porteous, 1997</td>
</tr>
</tbody>
</table>

1. Describe the Program

<table>
<thead>
<tr>
<th>Why was the program created?</th>
<th>X</th>
<th>X</th>
<th>*</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is/are the target population(s) of the program?</td>
<td>X</td>
<td>X</td>
<td>*</td>
<td>X</td>
</tr>
<tr>
<td>What are the program objectives?</td>
<td>X</td>
<td>*</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>What resources does the program use?</td>
<td>X</td>
<td>X</td>
<td>*</td>
<td>X</td>
</tr>
<tr>
<td>How is the program intended to operate?</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>When does the program operate?</td>
<td>X</td>
<td>*</td>
<td>X</td>
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</tr>
<tr>
<td>Where does the program run?</td>
<td>X</td>
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<td>X</td>
<td>•</td>
</tr>
<tr>
<td>Who is in charge of the program?</td>
<td>X</td>
<td>*</td>
<td>X</td>
<td>•</td>
</tr>
<tr>
<td>What are the day-to-day program activities?</td>
<td>*</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Who are the program users?</td>
<td>X</td>
<td>X</td>
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</table>

2. Develop an Evaluation Plan

<p>| Determine what stakeholders want to know. | X | X | X | X | • |</p>
<table>
<thead>
<tr>
<th>Coded Major Steps (n=3) and Sub-Steps</th>
<th>Reference to Published Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Porteous, 1997</td>
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<tr>
<td>Determine who will conduct the evaluation.</td>
<td>X</td>
</tr>
<tr>
<td>What resources are available? Are there enough?</td>
<td>X</td>
</tr>
<tr>
<td>What is the purpose of the evaluation?</td>
<td>X</td>
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<tr>
<td>What are the specific evaluation questions?</td>
<td>X</td>
</tr>
<tr>
<td>What performance attributes should be assessed?</td>
<td>X</td>
</tr>
<tr>
<td>What method is the most appropriate for engaging system users?</td>
<td>X</td>
</tr>
<tr>
<td>What evaluation questions can user engagement assist in answering?</td>
<td>X</td>
</tr>
<tr>
<td>What methods should be employed to fully answer the evaluation questions?</td>
<td>X</td>
</tr>
<tr>
<td>How will existing data be accessed?</td>
<td>X</td>
</tr>
<tr>
<td>What existing tools could be used for each method?</td>
<td>X</td>
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<tr>
<td>What should be included in a new tool?</td>
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<tr>
<td>Who will collect the data?</td>
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<td>How will the data be organized?</td>
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<tr>
<td>Coded Major Steps (n=3) and Sub-Steps</td>
<td>Reference to Published Literature</td>
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<tr>
<td>How will the data be analyzed?</td>
<td>X</td>
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<tr>
<td>Are there any targets indicated by your evaluation questions?</td>
<td>X</td>
</tr>
</tbody>
</table>

3. Evaluate, Recommend and Report

| Who will oversee data collection and analysis? | X | X | X | X | X |
| Who should be involved in making final recommendations? | X | X |
| What are the recommendations for the program based on results? | X | X | X | X | X |
| What actions should be taken? | X | X | X | X | X |
| Who is in charge of implementation? | X | X | X |
| When should actions be completed by? | X | X | X |
| Who is in charge of following up on implementation of actions? | X | X |
| Who should results be communicated to? | X | X | X | X | X | X | X |
| How will results be communicated clearly and usefully to target audiences? | X | X | X | X | X |

X indicates the element was found in the specified framework

* Indicates the element was not specifically described, but would likely be incorporated in an evaluation using this framework

· Indicates participatory methods were incorporated into this element during design of the new framework, based on guidance from at least one of the listed references
Table 2.3 An example of the grouping of program stakeholders required in Section 1 of the Animal Health Surveillance Evaluation Framework based on Canada’s National Scrapie Eradication Program and explanations for those groupings.

<table>
<thead>
<tr>
<th>Group</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>These groups all work directly with the sheep and goats and are responsible for submitting a predetermined set of samples for testing (i.e. a random sample of all processed animals at abattoir, all deadstock for a producer enrolled in the Voluntary Scrapie Flock Certification Program) or for contacting their local veterinarian or the Canadian Food Inspection Agency (CFIA) to report suspected cases.</td>
</tr>
<tr>
<td>Group 2</td>
<td>This group is responsible for reporting all suspected scrapie cases either by submission of samples from a euthanized animal to a provincial laboratory or by contacting the area CFIA veterinarian to investigate live suspected cases.</td>
</tr>
<tr>
<td>Group 3</td>
<td>Both provincial and federal laboratories are responsible for conducting scrapie testing and reporting any positive results to the appropriate authority for follow-up (provincial laboratories send positive results to federal laboratories for confirmatory testing, federal laboratories report confirmed positive findings to the appropriate CFIA veterinarian).</td>
</tr>
<tr>
<td>Group 4</td>
<td>This organization is responsible for the investigation of potential cases and coordination of response activities in the event of a confirmed case.</td>
</tr>
</tbody>
</table>
9. Figures

Figure 2.1 Results of the literature review, including number of papers identified in each step and reasons for exclusion
Figure 2.2 Graphic representation of the Animal Health Surveillance Evaluation Framework
Figure 2.3 Graphic representation of Section 1 of the Animal Health Surveillance Evaluation Framework including subsections and guiding questions.
Figure 2.4 Graphic description of Section 2 of the Animal Health Surveillance Evaluation Framework including subsections and guiding questions.
Figure 2.5 Graphic representation of Section 3 of the Animal Health Surveillance Evaluation Framework, including subsections and guiding questions.
Figure 2.6 Graphic representation of Section 4 of the Animal Health Surveillance Evaluation Framework, including subsections and guiding questions.

- **D. Report**
  - Who should receive the results of the evaluation?
  - How will the results be communicated to the target audience(s) in a clear and useful manner?

- **A. Conduct the Evaluation**

- **C. Develop an Action Plan**
  - What actions should be taken, based on the evaluation recommendations?

- **B. Make Recommendations**
  - Who should be involved in making the final recommendations?
  - What are the recommendations for the program, based on the results of the evaluation?
Figure 2.7 Stakeholder identification and grouping depicting the program stakeholders and structure of Canada’s National Scrapie Eradication Program. Used as an example for requirements in Section 1 of the Animal Health Surveillance Evaluation Framework.
Chapter Three: Evaluation of a System to Enhance Surveillance of Small Ruminant Adult Mortalities in Ontario, Canada

Abstract

The Small Ruminant Adult Mortality (SRAM) system was designed to support small ruminant veterinarians in the performance of on-farm postmortems of adult small ruminants. The purpose of the present study was to evaluate the SRAM system, and to determine its value to small ruminant veterinarians and producers.

The Animal Health Surveillance Evaluation Framework (Chapter Two) was used to design an evaluation plan which included an assessment of the diagnostic success of system cases, assessment of the usefulness of the submission components to pathologists, and an assessment of the impacts the system had on postmortem practices and working relationships for veterinarians and their small ruminant producer clients.

The evaluation, conducted in 2018, found that the SRAM system greatly improved the value of on-farm postmortems of adult small ruminants. Cases processed through the SRAM system had a high proportion of diagnostic success and significantly higher odds of diagnosis than historical small ruminant postmortem cases submitted to the same laboratory (OR=7.9, 95% CI: 4.1 – 15.2). Pathologists found all components of the submissions useful in making a diagnosis and found the requirement of a standardized set of tissues to be the most useful aspect. Both veterinarians and producers identified many strengths associated with the system: on-farm postmortem practices were improved and the system provided opportunities for relationship building between the two groups.
Overall, the evaluation suggests that continued use of the system, with some revision to enhance its utility, could be used for enhanced disease surveillance and to provide support for health management activities for small ruminant producers and their veterinarians.

**Key Words:** small ruminants, postmortems, surveillance, program evaluation

### 1. Introduction

The Canadian small ruminant industries have experienced growth in production over the last ten years (Agriculture and Agri-food Canada, 2010, 2017, 2018a, Statistics Canada, 2017, 2018). Despite this growth, demand for the products from the small ruminant industries in Canada still outstrips supply. In 2016, Canada imported 18.8 million kilograms of mutton and lamb, and 110 000 kilograms of goat cheese to meet demand, and in 2017, 2.9 million kilograms of goat meat products were imported into the country (Agriculture and Agri-food Canada, 2017, 2018b, 2018c). This demand suggests that opportunity exists for further growth of these industries.

Currently, little knowledge exists on causes of mortality of adult small ruminants in Canada and the published information that does exist may not reflect the current situation (Dohoo, Curtis, & Finley, 1985). Addressing mortality issues that negatively impact a livestock sector is an important part of mitigating disease risk, which can assist in improving performance and increasing production (Scott, Sargison, & Wilson, 2007). This is therefore a critical research gap to fill.

As such, a system was developed to enhance surveillance of diseases responsible for unexplained mortality of adult small ruminants in Ontario. This system, called the Small Ruminant Adult Mortality (SRAM) system, sought to increase the number of postmortems
performed, and to improve the diagnostic outcomes of these postmortems. To accomplish this, an online tool was designed to support veterinarians in the submission of high-quality adult small ruminant postmortems to the Animal Health Laboratory (AHL) at the University of Guelph (Guelph, Ontario, Canada). The tool provides training resources for postmortem technique, including text instructions and a video example of a complete postmortem, in addition to an online form designed to achieve optimal submission of case history details and standardized postmortem photographs.

An important element of any surveillance system is formal evaluation, to determine if the system met its goals (Centers for Disease Control and Prevention, 2008). The specific objectives of this study were to evaluate the SRAM system to determine the value of the online support tool for postmortems in the small ruminant industries, and to explore what improvements could help ensure its uptake and success in the future.

2. Methods

2.1 Evaluation Plan Development

The evaluation of the SRAM system was facilitated through use of the Animal Health Surveillance Evaluation Framework (AHSEF) (Chapter Two). The AHSEF is comprised of a series of questions, grouped into four sections, that guide the user through the development and execution of an animal health-based program evaluation. To evaluate the SRAM system, we applied all sections of the AHSEF, as described below.
2.2 Diagnostic Cases

To submit a case to the AHL through the SRAM system, the veterinarians performed a postmortem on a client’s farm, following the system protocol. Samples were shipped to the AHL using the kit provided, and case histories and standard photographs were submitted through the system website. Every case submitted correctly through the SRAM system between the start of collection in April 2017 and end of collection in November 2018 was included for analysis. Information on species (i.e. sheep or goat), commodity (i.e. meat or dairy) and diagnostic outcome were recorded.

The 124 SRAM system cases were compared with 124 cases submitted through the regular AHL postmortem submission system. These cases were all historical (i.e. were submitted prior to the first case submission through the SRAM system). Historical cases were chosen to ensure no comparison cases would have been submitted by veterinarians using the SRAM resources outside of the SRAM system. To be selected, the case must have been an on-farm postmortem of an adult animal (>1 year of age) in the same species as the SRAM case, and it must not have been previously selected as a comparison case (i.e. each case could only be selected once). Cases were selected in order of submission, from newest to oldest. An odds ratio and confidence interval were calculated to determine if a difference in diagnostic success existed between the two groups (Thrusfield, 1996).

In addition, to determine if the opportunity for pathologists to improve their adult small ruminant postmortem skills may have played a role in any improvement in diagnostic success seen when comparing SRAM cases to historical AHL cases, odds ratios were also calculated to
determine if a difference in diagnostic success existed between the first 50% of cases submitted through the SRAM system and the last 50% of cases submitted through the SRAM system.

2.3 Animal Health Laboratory Pathologist Survey

Pathologists at the University of Guelph’s AHL who worked on SRAM system cases were contacted and invited to participate in a short survey to seek feedback on the SRAM system. The survey was administered online through Qualtrics© software (Qualtrics©, 2019). The survey included questions on the usefulness of the SRAM system components (i.e. the set of standard photographs, the case history form, the full set of submitted tissues, the intact head submission) in making a diagnosis, and asked for recommendations for improvements to the system. A 10-point ratings scale was used to indicate usefulness, where 1 was “not at all useful” and 10 was “very useful” (Appendix D).

2.4 Focus Group Discussions and Interviews

A phenomenological approach was used to explore veterinarians’ and producers’ experiences with the SRAM system (Creswell, Hanson, Clark, & Morales, 2007). Data collection methods for each group are described further below.

2.4.1 Veterinarians

Veterinarians who submitted at least one case through the SRAM system between April 2017 and August 2018 were contacted by email and/or telephone and asked to participate in focus group discussions.

Due to logistical demands associated with widespread geographical distribution of participating veterinarians, the focus group discussions were conducted as conference calls, using
Cisco’s WebEx Meetings (Cisco WebEx, 2018). The University of Guelph Research Ethics Board reviewed and approved the study protocol (REB #17-06-023) and informed consent was obtained from each participating veterinarian.

A semi-structured discussion guide developed by the authors was used by the moderator (JC) during the focus group discussions to guide the overall discussion (Appendix A). The guide centered on two main topics: the use of the online tool; and the impact of using the SRAM program on their postmortem practices and their relationships with small ruminant clients.

2.4.2 Producers

Producers who had at least one animal submitted to the SRAM system between April 2017 and August 2018 were eligible to participate in a focus group discussions or one-on-one interview discussions, at their preference.

Participating veterinarians were asked to request permission from the producers to share their contact information with the study team. Producers who agreed were then asked if they would participate in our study. Producers consenting to participate in a focus group discussion or a one-on-one interview, did so between September and November 2018. These were conducted using either Cisco’s WebEx software or a telephone call, depending on the preference of the participant. Consent was obtained as described above. A semi-structured interview guide (Appendix B) was used to guide the discussion and included questions on the producer’s use of postmortems, their working relationship with their veterinarian, and the effects of their veterinarian’s use of the SRAM system.
2.5 Analysis of Focus Group and Interview Data

Verbatim text transcripts of the focus group discussion and interview audio recordings were produced by a professional transcriptionist. Analysis of the focus group discussion and interview data was conducted using theoretical thematic analysis as described by Braun and Clarke (2006) and a constant comparative method (Green & Thorogood, 2005). Briefly, the thematic analysis involved six main steps: familiarization with the data; generation of codes describing sections of the transcripts; creation of themes through grouping of codes with similar topics; reviewing of themes to check for similarities, differences, and adequate supporting evidence; naming and defining of themes; and production of a report that describes the defined themes and links them to any applicable literature (Braun & Clarke, 2006).

Several methods were also employed to ensure rigour, including: use of multiple coders (Barbour, 2001); searching for disconfirming evidence; maintaining an audit trail; and providing thick, rich description of results (Creswell & Miller, 2000).

Quotations have been selected from the transcripts and used in the results to illustrate themes. Where applicable, square brackets have been used to indicate words added by the authors and ‘…’ has been used to indicate that some words have been omitted by the authors to clarify a quotation.

3. Results

3.1 Evaluation Plan Development

The authors developed an evaluation plan, including evaluation questions and methods of data collection, using the AHSEF (the full evaluation plan can be found in Appendix E). The
developed plan included five main evaluation questions: (1) were postmortems submitted through the SRAM system associated with higher diagnostic success than historical cases not submitted through the SRAM system; (2) did use of the SRAM system change the way veterinarians reported performing a postmortem on-farm; (3) what changes to the SRAM system would improve the utility of the system for veterinarians; (4) did producers find value in the postmortems submitted through the SRAM system by their veterinarians; and (5) after their experience with the SRAM system, are producers more likely to have their veterinarians perform and submit on-farm postmortems to the AHL in the future?

To fully answer the identified evaluation questions, three data collection and analysis methods were required, including: (1) a comparison of the diagnostic success of SRAM system cases compared to historically similar AHL cases; (2) a survey of AHL pathologists who assessed SRAM system submitted cases on the utility of the submission components in case diagnosis; and (3) focus group and interview discussions with participating veterinarians and producers on the utility and value of the SRAM system. A more detailed discussion of each of these methods is found below.

3.2 Diagnostic Cases

There were 124 cases submitted to the SRAM project between April 2017 and November 2018; 66 (53.0%) were sheep cases and 58 (47.0%) were goat cases. Diagnostic proportions were high, with 61/66 (92.4%) sheep and 49/58 (84.5%) goat cases, receiving a conclusive postmortem diagnosis. A total of 124 historical cases (66 sheep submitted between 2012 and 2017 and 58 goats submitted between 2013 and 2017) from the AHL data files were selected for comparison. For this
set of cases, 32/66 (48.5%) of sheep submissions and 30/58 (51.7%) of goat submissions had a conclusive diagnosis.

A diagnostic odds ratio (OR) was calculated for all cases combined, and separately for each species. Overall, the odds of a conclusive diagnosis were 7.9 times greater (95% CI: 4.1-15.2) through the SRAM system, compared to historical cases. By species, the odds of diagnosis were 13.0 times greater (95% CI: 4.6 – 36.4) in sheep and 5.1 times greater (95% CI: 2.1 – 12.2) in goats, compared to historical cases for each species.

Odds ratios were also calculated to compare diagnostic success between the first 62 SRAM system cases submitted (30/32 diagnostically successful sheep cases and 24/30 diagnostically successful goat cases) and the last 62 SRAM cases submitted (31/34 diagnostically successful sheep cases and 25/28 diagnostically successful goat cases). Overall, the odds of diagnostic success were not significantly different (OR=1.38; 95% CI: 0.45-4.25) in cases submitted in the second half of SRAM case collection compared to the first half. By species, the odds of diagnosis were not significantly different for sheep cases (OR=0.69; 95% CI: 0.11 – 4.42) or for goats cases (OR=2.08; 95% CI: 0.47 – 9.29) submitted in the latter half of SRAM system case collection compared to the first half of case collection.

3.3 Animal Health Laboratory Pathologist Survey

All seven pathologists that worked on SRAM system cases were invited to participate; six responded to the survey. Overall, the pathologists found all components of the SRAM system to be useful in making a diagnosis. They found the standardized set of fresh and formalin-fixed tissues submitted by the veterinarians to be the most useful component, with an average score of 9.5/10 (range 8-10). The detailed clinical and animal management information included in the
case submission form, the sheep head submission, and goat head submission were all considered to be useful components, with average scores of 8.7/10 (range 7-10), 8.7/10 (range 7-10), and 8.5/10 (range 7-10), respectively. The set of standard photographs was rated the least useful of all the components by the pathologists, with an average score of 7.3/10 (3-10); however, most pathologists found the photographs to be a useful component of the SRAM system.

The pathologists reported that the submissions made through the SRAM system were much improved over typical small ruminant postmortem submissions made outside of the system. In particular, they noted improvements in the tissue set submissions and the clinical and management details provided via the case submission form.

3.4 Focus Group Discussions and Interviews

3.4.1 Veterinarians

The 36 veterinarians who submitted at least one postmortem using the SRAM system between April 2017 and August 2018 were invited to participate in the focus group discussions; of these, 10 agreed to participate in one of three focus group discussions. Of these veterinarians, 9 identified as female and 1 identified as male (n=10), and their reported ages ranged from 26-58 years (n=8). Their years in veterinary practice ranged from 2-35 (n=8) and small ruminant work comprised between 3% and 75% of their total clinical practice (n=8). The focus group discussions were conducted in April and May 2018 as no contacted veterinarian agreed to participate after these dates.

Five key themes were identified via coding of the veterinarian focus group discussion data: (1) strengths of the SRAM program, (2) weaknesses of the SRAM program, (3) impacts of the SRAM program on postmortem practices, (4) recommendations for future use of the system, and
impacts on relationships with their small ruminant clients. These themes, and their related sub-themes and codes, are shown in Figure 3.1 and are further described below.

3.4.1.1 Strengths of the SRAM Program

The veterinarians described several features of the SRAM program as strengths. They reported that the program, and in particular the online tool, “was very easy to use” and “everything worked very well”.

Veterinarians also found the set of standardized photographs required by the program to be of value. They discussed the ease with which they were able to include the photographs in their submission as being a good feature of the online tool, and discussed the benefits the photographs had as a part of their overall postmortem process. As these veterinarians explained, “I loved the pictures and I know that sounds kind of basic, but it made me stop and think and take pictures of everything” and “[before the program] I took a random picture that seemed crystal clear at the time [but wasn’t] and then this way it’s a little bit more focussed, like you know what you’re taking pictures of.”

Veterinarians described the benefits of the full postmortem protocol in two ways. First, they described how useful they found the clear instructions provided by the protocol, in ensuring their submission had the best chance of receiving a diagnosis, as described by these veterinarians: “because of all the clear instructions…I submitted everything correctly” and “having that really good guidance on the postmortem was very beneficial in going forward and making sure you have a better chance of getting a diagnosis for the problem.” Second, veterinarians commented on the benefits of being required to follow the thorough “start-to-finish” protocol. Several veterinarians commented that they found value in going “back to basics” and in being required to take the time to go through the full postmortem, rather than investigating only the point where they think the
animal’s problem occurred. One veterinarian in particular, highlighted the benefits of this thorough procedure when they said, “in our heads we had an idea of what one goat had died from, but certainly we would have missed – had we not followed the protocol – … we would have missed something fairly key.”

In addition to the online tool, the SRAM program also provided veterinarians with a postmortem kit containing the supplies needed to conduct the project postmortem on farm. Veterinarians reported that this kit “was incredibly useful, incredibly handy, and to have everything all in one spot like that was just – it made my life so much easier.”

Of the resources provided in the kit, the laminated tissue mats were highlighted by veterinarians as a particularly useful tool. Veterinarians described often forgetting which tissues they needed to collect for a postmortem submission and which they may have already collected through the course of a postmortem, an issue they found was corrected by the tissue mats. As one veterinarian commented:

“I really, really, really like the laminated sheets with the pictures and stuff of what you had to submit. The ability to cut the piece and put it on top of the laminated sheet so you’ve got all of the puzzle pieces covered was really good.”

3.4.1.2 Weaknesses of the SRAM Program

The veterinarians identified three areas of the system that they considered to be weaknesses. Two of these areas were related to the online tool, while the third was related to other aspects of the program execution.

In using the online tool, the participating veterinarians identified three problems when using the submission form to provide case history to the AHL. First, they noted the length of the
history as an area of concern. Many of the veterinarians found they did not have enough space to fill in all of the history they wanted to communicate with the pathologists. Additionally, they found that the segmented nature of the submission form left gaps where they had information they wanted to share, but could not find an appropriate place to share that information. As this veterinarian described, “there were a few more things I wanted to put in there, but once I submitted it, I realised ah, I didn’t really see a place to put it in there.”

Participants also discussed some difficulty they had with the “must-fill” feature of the form, which requires all fields be filled before submission can be processed. Some participants discussed feeling as though they were being forced to fill in boxes for which they “either didn’t really know or was completely unimportant to the case”. Other participants discussed having issues when they tried to submit their form, in finding boxes they may have missed filling out:

“It wouldn’t submit, and it wasn’t entirely clear what I had missed. I had to go through like three times […] to see where I had forgot to click like one checkmark and it doesn’t flag what you missed.”

The other area of the online tool participants mentioned having difficulty with was the invoicing feature, which allowed veterinarians to invoice the project for the postmortem visit. While some participants had no trouble using the feature, others found it difficult to use and it described it taking “a while to figure out how that was supposed to work.”

In terms of program execution, veterinarians identified two weaknesses, both related to the time involved in program components. Some veterinarians noted that the travel time required to get to some farms could make the requirements for fresh tissue submissions difficult to adhere to. As this participant noted, “the time of year would be a key factor…it was winter so if I wasn’t able
to get there that day it wasn’t the end of the world, but certainly yes that was a summertime issue.”
Another participant also discussed this issue:

“One of the ones that was an acute death for me, that was one of my clients that was an hour away and I wouldn’t have been able to get there in time so actually they brought that goat in… it just happened to work that the clients lived close enough that we could get the goat in.”

Another timing aspect of the program that veterinarians found difficult was the variable time it took to get laboratory test results back from the AHL. They found it difficult when speaking to clients to not know when they would receive their results.

3.4.1.3 Impacts of the SRAM Program on Postmortem Practices

Veterinarians discussed three components of the SRAM system that they will continue to use even after study closure. Several participants noted that they would continue to use the postmortem procedure and samples that the program recommended or required, as this veterinarian suggested, “I think what I would try is to follow that protocol and perhaps be a little bit more thorough and think about perhaps sending more samples than what I have in the past.”

The standardized set of photographs the project required was also valued by the veterinarians, as explained by this veterinarian, “I could go back and look at [the photographs] later and I found that really helpful and I’ve actually been doing it with other postmortems as well.”

Finally, they noted that they would continue to use the provided tissue mats in future postmortems they conduct, for both small ruminants and other species, to ensure they were collecting the right sample set from their postmortems.
3.4.1.4 Recommendations for the Future

The veterinarians provided a number of recommendations both to improve the system’s online tool and to improve future use of postmortems in the small ruminant industry. For example, veterinarians suggested providing more space for “a bit more history and background” and for “more picture slots because when I had cool things, I ran out of places to put the pictures.”

Additionally, they suggested that providing automatic invoicing would improve the overall experience of using the system’s online tool.

The veterinarians also provided recommendations for increasing the use of adult small ruminant postmortems in the future. The veterinarians felt that the authors providing the general results of the project to producers, through articles and presentations at industry meetings, could help producers understand the value of performing a postmortem. They also suggested producing a case series from the cases submitted through the SRAM system to provide opportunities for veterinarians to learn from other cases:

“If you could share details of some cases that would be really, really helpful. Like have a repository of interesting cases or just cases or common cases, that sort of thing I think would be very, very helpful.”

The veterinarians also reported that a subsidy on the costs of postmortems for small ruminants would enable more producers to make use of the service.

3.4.1.5 Impacts on Relationships with Small Ruminant Clients

One of the biggest advantages to the program that veterinarians discussed was the ability to use the program to build relationships with their small ruminant clients in several ways. First, they noted that the program allowed them to “re-engage” clients with whom they had previously
lost contact. As these veterinarians commented, “I have had one or two clients that we hadn’t seen in a while who did participate in the program and we’ve kind of re-engaged with them, so it’s been helpful on that aspect” and “several people kind of came out of the woodwork [to take advantage of the program] and I thoroughly believe they never would have called me about this dead animal if there hadn’t been a program in place.”

Second, they discussed that the program provided them opportunities to be on farm with their clients. Once on farm, they felt they were able to show these clients the value of their expertise and get a sense of ongoing health problems their clients might have in their flock or herd. As this veterinarian explained:

“I really, really enjoyed being able to do this on the farm. I know the farmers really appreciate it too. I got way more involved with certain problems they had going on. Things that I probably wouldn’t have known about…since then I’ve been back on multiple farms for follow up things…and it’s really helped strengthen the relationship.”

Once they were on farm, veterinarians also described the opportunities that the program created for them to educate their clients, about the specific problem they are experiencing, how they may manage that problem, and how they might manage their animal husbandry to prevent future problems. This was well illustrated by this participant who explained, “if something comes up that you can apply to the rest of the herd, there’s that opportunity right there for education.” Another participant also explained this impact:

“It was a huge thing for [the producer and I] to look at nutrition, hoof trimming and sub-acute rumen acidosis and then how do we treat these [animals] that have
laminitis, and do we ever get them to be a productive goat again? And so that was interesting for us to tie those facets together with nutrition and medicine and the role of the producer in animal care husbandry.”

Another benefit of the program that veterinarians highlighted was its use in building trust between themselves and their clients. As one veterinarian explained:

“It already started a trust situation that they were learning about a program that I was involved in…They already were so appreciative that way, that they found somebody [involved in the program] and it just started off the whole relationship a lot better.”

Veterinarians also explained that it helped build clients’ trust in their postmortem skills, as they had them return to perform additional postmortems after completion of the SRAM project. Finally, veterinarians found that using the SRAM program had clients recognize the value of the postmortem process, both for investigating acute issues in their flock/herd and for investigating underlying issues in cull animals. As these veterinarians commented:

“I think it improved their view of the value of a postmortem. Sometimes I don’t think even when we tell them this is what we want to do and why, I don’t think they always agree with it because it does cost money in not just having you out, but then running the samples. But I think the majority of the information I got back they’re very grateful for and like I said, it may make them do more in the future.”
“I think now that they’ve seen the value … they find value and information in these postmortems to do better in the rest of the herd when before they’d just be a cull goat with no good reason.”

3.4.2. Producer Interviews

Of the 89 producers who submitted cases to the SRAM project, 19 agreed to be contacted regarding participation in focus groups or interviews. Of those 19, 9 actually participated (5 males and 4 females): 2 producers in a focus group and 7 producers in one-on-one interviews. Their reported ages ranged from 24-58 (n=7) and the size of their operations ranged from 125-570 breeding ewes or does (n=7). The focus groups and interviews were conducted between September and November, 2018.

Four key themes arose from the analysis of the producers interviews and focus group, related to: (1) communication of SRAM postmortem results between veterinarians and producers; (2) use of SRAM postmortem results; (3) strengths of the SRAM program; and (4) barriers to postmortem use. Each of these themes and their related codes are shown in Figure 3.2 and are further described in detail below.

3.4.2.1 Communication of SRAM Postmortem Results Between Veterinarians and Producers

Producers discussed two major forms of communication veterinarians used to inform them of the results of their SRAM postmortem. The first method involved veterinarians forwarding the AHL report to the producers. Several producers who received their results in this manner reported feeling “confused” by the results and wished they had a more concise summary of what they needed to know, as illustrated by this producer:
“I kept getting all of those emails from [my veterinarian] that felt confusing and I didn’t want to read them, and I didn’t really pay attention to them…I know on some of those reports there is an answer or a diagnosis, like way at the bottom, but even that uses very technical terms sometimes that can be confusing.”

Several other producers also reported feeling confused by the language used in the written reports, that prevented them from understanding the results. As these participants described, “there was some terminology which I’m ignorant to I guess, words that I possibly don’t understand…or not good enough anyway” and “I’m not a major in biology or anything, so a good portion of those results were Greek to me.”

In contrast to producers who received written feedback in the form of AHL reports, producers who received their postmortem feedback verbally from their veterinarians highlighted the value of these follow-up conversations both as a learning opportunity and an opportunity to involve their veterinarian in management decisions, as exemplified by these comments:

“[The veterinarian] explained to me what she found at my level of understanding…she told me what she suggested I watch for, and what she suggested I do…she spent the time to explain it to me so that I understood what we were up against and what happened.”

“The follow up conversation…is really vital I think because that’s the part that helps you learn, like decide on what you can change in your management to prevent further issues…With [the SRAM program] that time is really put in to communicating everything back to the farmer…the effort is put in to really helping the farmer translate the results into actions.”
Several producers also gave suggestions they felt could help improve future communication of postmortem results between veterinarians and producers. Producers who had received the AHL report from their veterinarian indicated that they would like the opportunity to discuss the results with their veterinarian or at minimum to have received a written summary from their veterinarian, rather than just the AHL report. As this producer explained:

“A more concise [report] from the vet, ‘this is why your sheep died’ [would be useful] so you don’t have to worry about reading through the whole report…because…[the report] uses very technical terms sometimes that can make it confusing.”

Additionally, one producer who discussed the results with their veterinarian indicated that having a written summary would have also been useful to refer back to later. Overall, producers appeared to stress the importance of receiving plain language feedback, ideally in both written and verbal format, regarding the postmortem results.

3.4.2.2 Use of SRAM Postmortem Results

Producers discussed several ways in which they used the results they received from their SRAM postmortem. Some producers discussed using the results to guide treatment of their flock or herd, either by confirming treatment protocols already in place or by informing what treatment should be given, as illustrated by these comments: “We were treating the goats already…so [the veterinarian] confirmed our treatment protocol…was right” and “we treated [our animals] right away and we had good results. We lost a couple more, but I think we saved a lot more than we lost.”
Another producer discussed their use of the postmortem results to inform additional investigation into disease issues on farm. As this producer explained:

“When the results came back, the vet said she wasn’t sick with anything, then we looked into other stuff…we got in contact with the nutritionist and then when all the information came back, they concluded it was to do with nutrition.”

A few other producers also described using the results of the SRAM postmortems to make changes to their management practices, in cooperation with their veterinarian. One participant explained that, “it was more helpful for me because [the postmortems] have led us down a new better management style…so that helped change part of what we do.” Another participant also explained how they used the postmortem results:

“[The postmortems have] been good in kind of drilling down to see what the actual cause of the problem is and then to start looking for solutions…if we know what the root cause of things are, we can try different things and re-evaluate each time, and if that doesn’t work retry again in cooperation with our vet.”

3.4.2.3 Strengths of the SRAM Program

Producers identified several strengths in the postmortem process required by the SRAM program, in addition to the strength they found in discussing the results with their veterinarians as described above. Several producers discussed the education they received in participating in the postmortem process with their veterinarian. As these producers commented, “[the veterinarian] went systematically through the whole thing, why they did what they did, what they were looking for. I had a real biology lesson, that was very valuable and interesting” and “we kind of did
everything and I learned a lot along the way as far as different things he was picking up or seeing 
himself while we were doing the autopsy.”

Another advantage to the SRAM postmortem process that producers noted was the detailed 
postmortem protocol that was required for the program. They discussed that the information they 
received from the postmortem contained details in addition to the animal’s cause of death that they 
were able to use to improve the overall health of their animals. This was well illustrated by these 
producers:

“Some of the things like…the liver sample…can figure out some nutrient levels 
in the sheep that they can’t get if they’re alive. So, I mean even getting some 
numbers back like that can be helpful…you just get a lot more information back 
[from the SRAM postmortem].”

“It was way, way more thorough and I mean when an animal isn’t doing well it’s 
not always just one cause, it can be multiple things, so in a more thorough case 
like [the SRAM postmortem], you’ll find the actual cause of death might be one 
thing but other factors you might find were influencing its ability to thrive.”

Producers also noted another advantage afforded by the detailed nature of the postmortem 
protocol, in providing clarity to the process for the producers. As one producer explained:

“I thought the process was a lot clearer…the only other time I’ve done a 
postmortem was actually this year and…it was actually kind of confusing…when 
I went through this program everything was very streamlined and very clearly 
explained to me.”
Finally, the producers found an advantage in the program’s cost subsidies which covered both the AHL testing and the veterinarian’s farm visit fee. Most notably, producers expressed that the cost subsidy allowed them to use the postmortem service their veterinarian provided, or it allowed them to take greater advantage of the testing options available to them. As these producers commented, “[my veterinarian] informed me that there was funding available…but there is always of course a cost factor, so that part of it was appealing to me” and “it’s a lot of testing, right? I would never be able to afford that kind of testing normally.”

3.4.2.4 Barriers to Postmortem Use

Producers identified two major barriers to use of postmortems for small ruminants. The first was the consideration of cost versus value of the postmortem. Producers reported that when considering the cost of the postmortem, both veterinary fees and testing expenses against the worth of an individual animal, they often do not find enough value in investigating unexplained deaths, unless they feel the problem may be affecting a larger portion of the flock or herd. As this producer explains:

“Normally with sheep you don’t really have a sick sheep. It’s they’re either fine or they’re dead. And if one of them dies for no particular reason, you don’t typically do much about it, but if there’s a bigger problem, that’s when something like [the postmortems] might be more useful…because the cost of getting a vet, by the time you pay for everything, that’s more money than what [one sheep] is worth.”

The other barrier to use of postmortems that producers identified was the time involved in multiple aspects of the process. They identified challenges in the time it may take the veterinarian
to arrive at the farm after the death of an animal, and in the time it takes to receive results back from the laboratory.

4. Discussion

The purpose of this evaluation was to determine the value of the online support tool and to explore what improvements could help ensure its uptake and future success in the Ontario small ruminant industries. Diagnostic success of on-farm postmortems has not been well researched in food animals; however, the high proportion of cases with diagnostic success submitted through the SRAM system was comparable to those reported in sheep and goats by Wäsle et al. (2017), who looked at diagnoses in small ruminant postmortems conducted at the veterinary teaching hospital at the University of Zurich. In addition, the odds of diagnostic success from postmortems submitted through the SRAM system were notably greater than those from historically similar AHL submissions, both overall and by species. One likely explanation, supported by the results presented here, is that the system’s thorough guidance in postmortem procedure helped improve diagnostic success for adult small ruminant postmortems. This improved diagnostic success likely assisted in the improved view many producer participants had of on-farm postmortems. It is also possible that some of the improvement in diagnostic success could be due to the increased opportunity for pathologists to work on adult small ruminant postmortem submissions; however the lack of statistically significant difference in the odds of diagnostic success between the first half and second half of SRAM case collection suggests that the impact of this factor is likely minimal in this study. Detection bias may also have had some impact on the diagnostic success of SRAM system cases. Pathologists were not blinded to the submission stream of the adult small ruminant postmortems, so it is possible that they may have conducted their diagnostic process differently based on the knowledge that cases were submitted
through the SRAM system, than they would have if the cases had been submitted in the traditional manner. It would be preferable in future studies to blind pathologists to the submission stream of cases to ensure the impact of this bias is minimized.

Other unmeasured factors, such as changes in postmortem procedures or available laboratory tests over time, may also help explain results, but were not explored here.

Nevertheless, this study provides good evidence in support of improved diagnostic outcomes as a result of using the SRAM system.

Veterinarians in this study reported that use of the SRAM system affected improvements to their normal small ruminant postmortem procedure. Future work to determine if these improvements last beyond the end of SRAM system use could be a useful addition to the small ruminant research base.

Small ruminant producers, in this study and others (Kaler & Green, 2013), identified the costs of veterinary services, as a barrier to their use, when measured against their perceived value. Veterinarians in this study reported that use of the SRAM system allowed them to spend time on their small ruminant clients’ farms and build trust. Veterinarians reported they could show producers the value of their services, through the education they could provide to producers on-farm during the postmortem and through discussion of results from the postmortem. This kind of relationship building was also identified as important in studies conducted in the United Kingdom with sheep (Bellet, Woodnutt, Green, & Kaler, 2015), and other livestock (Ruston et al., 2016) veterinarians. It may be valuable for Ontario’s small ruminant veterinarians to use other opportunities, such as the recent change in Canada’s veterinary drug prescription legislation (Canadian Veterinary Medical Association, 2017), to
visit their small ruminant clients’ farms, build relationships, and reduce barriers to use of veterinary services.

In addition to costs, time was also identified by producers as a barrier to use of veterinary services, as has been reported by sheep producers in the United Kingdom (Kaler & Green, 2013) and as barriers to use of postmortems by veterinarians in this study. Further work exploring opportunities to reduce these barriers may be needed to improve the use of veterinary services in the small ruminant industries. Based on feedback from veterinarians and producers there are several recommendations that can be made for enhancing future use of postmortems in the small ruminant industries including: (1) creating and distributing a producer-oriented project summary highlighting important project outcomes; (2) providing opportunities for further education in small ruminant postmortems for veterinarians through the creation of a case series, using postmortems submitted to the AHL through the SRAM program; and (3) highlighting to veterinarians the importance of discussing the results of a postmortem with producers, through written materials and presentations at veterinarian-attended events, such as conferences and education days.

Several changes could also be made to improve the utility of the SRAM system for any future use. These changes include: (1) increasing the space available for submission of case histories and pictures; (2) creating a feature that highlights missed sections when attempting to submit an incomplete case history form; and (3) providing estimates for the time to receive laboratory test results to assist veterinarians in creating treatment or management plans in the interim.

Veterinarians also identified the invoicing feature as a weakness in the SRAM system; however, it should be noted that the invoicing feature was only to be used to reimburse
veterinarians contributing to the project and would not be a feature of the SRAM system if it were adopted by the AHL at the completion of the project. Therefore, this feature does not need to be modified to improve the utility of the system in the future.

There were some limitations in this evaluation. One was related to the recruitment method used for the producer interviews. Contact information was obtained from veterinarians with permission from their producer clients, which made it much less likely that we were able to interview producers who may have little contact with their veterinarian or who do not utilize the services of a veterinarian on a regular basis outside of the SRAM system. As such, extrapolation of the project results to other groups may be limited.

The other limitation was related to the limited sample size of our veterinarian and producer groups. Theoretical saturation is the point at which no new information is obtained from continued data collection with additional participants in a study (Green & Thorogood, 2004). Little new information was noted during later focus groups and interviews with our veterinarian and producer participants; however it is possible that saturation was not reached in our data collection, due to our limited sample size.

5. Conclusion

In conclusion, this evaluation has shown that the SRAM system was of great value to veterinarians and producers in the small ruminant industries when performing adult postmortems on farm. The program improved the odds of diagnostic success for adult small ruminant postmortems submitted to the AHL, assisted veterinarians in enhancing their small ruminant postmortem skills, provided opportunities to build stronger relationships between small ruminant veterinarians and producers and, provided valuable information to veterinarians and producers
that could improve the overall health of the producer’s flock or herd. Dissemination of the results of this pilot program and continued use of the SRAM system, with revision based on the recommendations from veterinarians could continue to benefit the growing Ontario small ruminant sector in the future.
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Figure 3.1 Thematic map displaying the themes, sub-themes, and codes from analysis of 3 veterinarian focus group discussions (Ontario, Canada, April – May 2018)
Figure 3.2 Thematic map displaying the themes, sub-themes, and codes for 7 producer interviews and 1 producer focus group discussion (Ontario, Canada, September – November 2018)
Chapter Four: Perceptions of Health Management and the Working Relationship Between Ontario Veterinarians and their Small Ruminant Clients

Abstract

Reducing morbidity and mortality of livestock is important for continued industry growth. Use of veterinary services is a critical component of accomplishing that goal; however, anecdotal evidence suggests that use of veterinary services, and in particular health management services, has remained low in the Canadian small ruminant industries. The purpose of this study was to investigate the perceptions of small ruminant producers and veterinarians in Ontario regarding their working relationships, health management, and use of veterinary services.

Focus group discussions and interview discussions were conducted between April and November 2018, with veterinarians and producers who participated in the Small Ruminant Adult Mortality project. Transcripts of the discussions were used to perform a thematic analysis.

Veterinarians and producers identified several features of a good working relationship, including: good record keeping and goal setting by producers; using a proactive approach to flock or herd health; availability and consistency of veterinary personnel; honest communication between veterinarians and producers; and veterinarians being willing to teach producers skills.

Several barriers to the use of veterinary services and building strong relationships were also discussed, including: veterinarians’ lack of specific small ruminant knowledge, particularly in the area of veterinary drugs for small ruminants; the perception of high costs versus the value of
services; a perceived lack of available small ruminant research; competition from other agriculture support personnel; and producers’ reliance on telephone versus on farm consultations.

The use of health management services was also briefly discussed by producers. A variety of reasons for using these services were described, including: maximizing productivity of their flock or herd; preventing disease outbreaks; and for its contribution to their financial success.

Overall, this study suggested that veterinary services, particularly health management services, are underused by small ruminant producers. While there is some interest by small ruminant producers in the use of health management services, a number of barriers exist to use of these services. Addressing these barriers through investment in further research and in education programs for veterinarians and producers could assist in improving working relationships and increasing uptake of veterinary services by small ruminant producers.

**Key Words:** health management, working relationships, small ruminants, veterinarian-client relationship

1. Introduction

Demand for agricultural products from sheep and goats has grown considerably in Canada over the last ten years (Agriculture and Agri-food Canada, 2010, 2017, 2018, Statistics Canada, 2017, 2018). This increase in demand continues to provide significant opportunity for growth in the Canadian small ruminant sectors, as demand continues to outstrip supply (Agriculture and Agri-food Canada, 2017, 2018; Expansion Working Group Under the Sheep Value Chain Roundtable, 2015).
Reducing morbidity and mortality in livestock populations is important for continued industry growth. Lower animal morbidity and mortality rates and greater longevity of superior livestock are linked with better overall health and welfare for animals, which can result in greater overall productivity of the flock or herd (Scott, Sargison, & Wilson, 2007). To lower animal morbidity and mortality rates, veterinarians and producers often employ the use of health management services, in addition to treating individual sick animals and other emergent conditions (Radostits, 2001). These services can range from basic evaluation of a livestock group’s overall health to a more comprehensive set of services, including pregnancy diagnosis, animal health diagnostics, and consultation with livestock support personnel to support disease control protocols (Radostits, 2001).

Although use of health management services offered by veterinarians can provide significant advantages to a livestock operation, anecdotal evidence suggests that use of these types of services by Canadian small ruminant producers is low. Studies in other small ruminant producing countries have identified barriers to uptake of health management services (Bellet, Woodnutt, Green, & Kaler, 2015; Kaler & Green, 2013; Ruston et al., 2016), including cost of services and a veterinarian’s lack of species specific knowledge; however, no results of studies conducted in a Canadian setting are available. As there is significant variation in animal health challenges by country and region, it is valuable to examine this topic in a Canadian context.

Therefore, the objectives of this study were to: (1) investigate the attitudes of producers and veterinarians towards health management services, and (2) determine what barriers to, and features of, good working relationships and use of veterinary services, are perceived by veterinarians and producers in the small ruminant industries.
2. Methods

A phenomenological approach (Creswell, Hanson, Clark, & Morales, 2007) was used to explore the attitudes of small ruminant producers and veterinarians towards health management and their working relationships. The methods used for both groups are described in detail below.

2.1 Veterinarian Focus Group Discussions

Veterinarians who submitted at least one postmortem case using the Small Ruminant Adult Mortality (SRAM) system (Chapter Three) between April 2017 and August 2018 were identified as potential participants for this study. The 36 veterinarians who used the SRAM system in this time frame were contacted by email and/or telephone and were invited to participate in focus group discussions of health management services and their perceptions of working relationships between veterinarians and their small ruminant producer clients. Of the 36 veterinarians contacted, 10 (28%) agreed to participate in a focus group discussion.

Between April and May 2018, three focus group discussions were conducted via conference call, using Cisco’s WebEx software (Cisco, 2018). No veterinarians contacted agreed to participate after May 2018. A semi-structured interview guide developed by the researchers was used by the moderator (author) to facilitate the discussion (Appendix A).

2.2 Producer Focus Group Discussions and Interviews

Small ruminant producers who had at least one animal postmortem submitted to the AHL through the SRAM system between April 2017 and August 2018 were identified as potential participants for this study. To obtain contact information for these producers, the veterinarians who submitted the animals to the project were contacted and, with the producer’s permission, were
asked to provide the producer’s contact information to the study team. We received contact details from 19 of the 83 producers (23%) who had an animal submitted through the SRAM system. These producers were contacted by email and/or telephone and were invited to participate in a focus group discussion or one-on-one interview, depending on their availability and preference. Two producers agreed to participate in one focus group discussion and seven producers agreed to one-on-one interviews between September and November 2018 (n=9). The focus group was conducted by conference call through Cisco’s WebEx software (Cisco, 2018) and the one-on-one interviews were conducted by telephone call. The interviewer (author) used a semi-structured interview guide (Appendix B) to facilitate the discussion. Questions focused on their use of veterinary services, including health management services and their perception of their working relationship with their veterinarian.

2.3 Ethics Approval

The University of Guelph Research Ethics Board approved the study protocol (REB #17-06-023) and informed consent was obtained from each participant. The discussions were audio-recorded with permission from participants.

2.4 Analysis of Focus Group Discussions and Interviews

Audio recordings of the focus group discussions and one-on-one interviews were transcribed verbatim by a professional transcriptionist. A combination of inductive and theoretical thematic analysis, as described by Braun and Clarke (2006) with a constant comparative method (Green & Thorogood, 2004), was used to analyse these transcripts. Briefly, this involved six steps: familiarization with the transcripts; generation of codes to describe sections of transcript; creation of themes through grouping of similar codes; reviewing of themes
to check for similarities, differences, and available supporting evidence; naming and defining of themes; and production of a report that describes the themes and places them in context of relevant literature (Braun & Clarke, 2006). Additional methods employed to ensure rigour included using multiple coders (Barbour, 2001); searching for disconfirming evidence; maintaining an audit trail; and providing thick, rich description of results (Creswell & Miller, 2000).

Quotations from the focus group discussions and interviews were used to illustrate the themes in the results presented below. Square brackets were used to indicate words added by the authors to clarify meaning. A ‘…’ was used to indicate places were some words were omitted by the authors to enhance clarity.

3. Results

There were three themes described by the veterinarians (Figure 4.1) and four themes described by the producers (Figure 4.2). These themes, and their related sub-themes and codes are described below.

3.1 Working Relationships

Producers described several uses of veterinary services, ranging from minimal (e.g. basic emergency work and access to animal health drugs only available by veterinary prescription) to more extensive involvement of the veterinarian (e.g. disease prevention programs and further education in small ruminant health). Use of all these services requires a relationship to exist between veterinarians and producers. The barriers to, and features of, good working relationships
and use of veterinary services were a major focus of this study and the themes relating to this
topic are discussed below.

3.1.1 Barriers to Use of Veterinary Services and Good Working Relationships

Veterinarians and producers described several barriers to use of veterinary services and
building strong working relationships. Producers found costs to be a barrier to use of veterinary
services. Some producers described situations in which they chose to forgo services or took on
doing them on their own to “save…money…on the veterinary bill”. Others mentioned they
would use veterinary services more often if they were more affordable.

Veterinarians also identified costs as a barrier to providing services to their small
ruminant clients. However, they suggested that costs were a barrier because producers were
looking at “the individual value of calling a vet out for one animal”, rather than recognizing the
value that the services might have to the producer’s entire flock or herd. The veterinarians
indicated that the producers instead ought to compare the cost of services against the greater
value of the flock or herd.

Another barrier identified by veterinarians was the use of telephone-only consultations.
Veterinarians described these as “frustrating” because they “feel like [they] are missing things”
by not being physically present on-farm, which could prevent them from providing good service
and building a good relationship. Producers also described use of telephone consultations with
their veterinarian, to answer questions or provide advice; however, in contrast to veterinarians,
they identified these as an important part of a good relationship. For example, one producer
explained that what they “appreciated more than anything” is that “a lot of things [their
veterinarian] will answer over the phone”.
Veterinarians described producers’ use of veterinary services only for emergency work as another barrier to a strong working relationship. They noted that producers who called them for emergency work only, often called too late for veterinary services to be effective in preventing more animal losses which leads to frustration for the producers. As these veterinarians described:

“One of the challenges is that when they call you for the first time in the middle of a disaster…we often can’t do much to help fix the disaster at the time, but the deaths keep piling up after we are there right? And they want an instant cure for something that’s beyond instantly curing.”

“The clients that don’t call until things are at a fifty-percent mortality rate…then you’re coming in when they are very stressed and very frustrated with the problem and you’re really behind the eight ball and then it’s much harder to help them.”

The lack of veterinarians practicing small ruminant medicine was discussed by producers as another major barrier to veterinary service use. As this producer explained:

“There’s a lot of herds out there that don’t have a proper vet. They struggle to find a good [small ruminant] vet. There’s not really enough small ruminant vets out there to service the industry…I bet you there’s half the producers out there that are either without [a vet] or have a cow vet who doesn’t really know much about small ruminants.”

Producers described how this lack of small ruminant knowledge can create frustrating experiences and created a barrier to building strong working relationships between veterinarians and producers. As this producer explained, “[it’s] frustrating that like if you need a vet you want to have answers and yeah, she cannot give always the answer because she knows she has the same knowledge or less knowledge than I have for goats.”
Along similar lines, veterinarians noted that producers were often frustrated with their veterinarian’s lack of knowledge surrounding small ruminants as compared to their knowledge of other species, as illustrated by this veterinarian:

“Some of those [producers] they have cows too, or they have horses…they’re like well whenever I ask you a question about that you just have an answer unless it’s really complicated, but every other thing I ask you about sheep or the goats you’re like, ‘I don’t know, I have to go look that up, I have to phone a friend or I have to do something’.”

As with producers, veterinarians also discussed how this perceived lack of knowledge can lead to bad experiences and make producers less likely to continue to seek veterinary services in the future because “they’ve had one bad experience or maybe two and they just aren’t willing to keep trying.”

Both veterinarians and producers also described a perceived lack of small ruminant research that could be used to build veterinary knowledge. For example, producers discussed their perception that little research exists to support the treatment of small ruminants, particularly when compared to other livestock groups, such as dairy cattle. They noted that this lack of research often meant that they had to “reinvent the wheel” to treat small ruminants, leading to frustration.

Veterinarians described how a perceived lack of small ruminant research prevents them from providing good service to their producer clients:

“There are some things where the least resources exist out there to help us, right…I’m trying to talk a guy into doing [fecal examinations], but he’s got 300 sheep in his field - how many fecals do I tell him to do? When do I start? What is the threat? How many of
them have to be over 500 [fecal egg count] in a group before we run the whole group in and do something?”

Some veterinarians suggested that addressing this lack of resources could assist in removing barriers to good working relationships because it would “encourage [veterinarians]…to take on sheep clients because it would give them at least an idea of where to start”. Related to this, some veterinarians also discussed creating mentorship opportunities for new small ruminant veterinarians so they “feel like they’ve got support and resources” to learn from when entering small ruminant practice.

Finally, veterinarians discussed the competition they find from employees in agricultural support industries, (e.g. animal feed representatives), in terms of giving advice to producers, as a barrier to building strong working relationships with small ruminant producers. As this veterinarian described:

“I find because there’s not as many vets that are doing small ruminant work then a lot of people, say like feed reps, do work that I would consider very veterinary… having to insert yourself in that direct competition for giving advice can be very daunting.”

This competition was also discussed by one producer who described not accessing veterinary services because they felt they could get the same information from other sources available on the internet or through email contact with veterinarians outside of Ontario.

3.1.2 Features of a Good Working Relationship

There were many features of a good working relationship discussed by both producers and veterinarians. One producer discussed needing to “find the right person” to be their
veterinarian and that finding that person was often “partly luck and partly willingness from the producer to go out there and hunt them down.”

Another producer highlighted the importance of having the same veterinarian visit their farm, to ensure they have the best working knowledge of the farm possible.

Willingness to pay for veterinary services was described by producers as another important factor in having good working relationship with their veterinarians. Several producers noted that many producers are not willing to pay for veterinary services, but that “If a farm wants to have a good vet, they have to be willing to pay the professional costs of having that and in building a relationship.” Producers noted that this willingness to pay for services also resulted in better outcomes because “all of a sudden you have live lambs instead of dead lambs out the door”.

Veterinarians and producers both discussed the value of including a veterinarian in a producer’s operation for more than just emergency work. Veterinarians described their best working relationships as the ones where producers involve their veterinarian “as opposed to talking to their nutritionist and their eight friends that also have goats”. Some producers discussed the importance they placed on having a veterinarian involved in their operation. As this producer explained:

“I’ve learned to have [my vet] more involved as far as not just call him when I have trouble, like try and get him out two or three times a year if I can or more and have him see the flock, know what’s going on…it’s definitely important to have your vet on your side, not just call him when you need him.”
Nevertheless, other producers described only wanting to involve their veterinarian only “if necessary”, usually for ordering medication or for treating disease outbreaks on-farm.

Despite frustrations some veterinarians described in terms of “competing” with other industry personnel, they also discussed the importance of a “team approach”, that allows veterinarians to work with not only the producer, but with these other professionals who do work on the farm as well (e.g. nutritionists). This collaboration was described as a feature of a good working relationship because “it’s easier to get everybody talking in the same direction and then…work on the solution from the same approach.”

Honest communication was also discussed by veterinarians and producers as a part of a good working relationship. Veterinarians discussed this honesty as an important part of being able to help the producer problem solve and producers found honest communication to be important because, “[A vet is] coming on the farm and taking one hour look at your animals, it’s not really fair to anybody if they don’t know what you’re doing or what you already did two or three days prior.”

Another important factor described by producers was trust in their veterinarian’s advice. This was well described by this producer:

“You need to trust your vet…sometimes [producers] think we’re smarter than we are and sometimes you need to realise…you should trust [your vet]…they usually know what’s going on and if they don’t they have other people they can bounce ideas off of so I think trust is one of the factors you could use to have a good relationship with your vet.”

Veterinarians described producers who were “progressive” and “proactive” as “quite encouraging” in that they “try to do preventive medicine” and “focus on the solution to prevent
[a problem] from spreading”. Along these lines, veterinarians described goal setting as helpful in fostering their strongest relationships with small ruminant clients. They talked about goal setting as a method to “get that first foot in the door” and said it gets producers “thinking about where they are and where they’d like to be”. Some veterinarians discuss the difficulties of implementing goal setting when producers do not have full records. As one veterinarian explained, “I don’t know how you prove to [producers] how much our disease surveillance and testing is of value on the farm if they aren’t monitoring anything because how do you compare trends over time without writing things down?”

Finally, producers discussed the willingness of the veterinarian to teach producers as being important to a strong working relationship. The producers who had good relationships with their veterinarians often described learning from their veterinarian as an important part of that relationship, as illustrated by this producer, “they’ve taught me so much…I wasn’t raised on a sheep farm and so I learned on my own but then maybe once a year there’s one thing I can’t handle and then the vet comes out and then the next year I can handle whatever it is she taught me.” Veterinarians also highlighted this area as an opportunity to build strong relationships with producers by “arming them with the technique and knowledge to start treating [sick] animals” and then following up with those producers to “evaluate together”.

3.1.3 Ideas to Improve Working Relationships

Veterinarians discussed a few ways in which they could improve their working relationships with small ruminant clients. One idea discussed was finding opportunities to get producers interested in the services that veterinarians can provide, to create opportunities for veterinarians to engage with producers, and build good working relationships. Some
veterinarians suggested this could be accomplished by holding meetings on a health topic, such as lambing or breeding at a time when that topic is most relevant to producers.

Veterinarians also described the importance of managing producers’ expectations of veterinary services in improving relationships. As this veterinarian explained:

“"I tell some clients, sometimes you are going to lose 10 more of these but what we need to focus on here is a strategy to prevent any more from happening, not on the next 10 dead ones because they’re already dead, we just don’t know which ones they are yet. Because otherwise they get a bill a few weeks later in the mail and all they had was ‘deadness’.”

3.2 Health Management

Understanding how producers perceive and use health management and health management services in the small ruminant industries was another objective of this study. The theme ‘health management’ was used to describe responses related to this objective, and its sub-themes are described below.

3.2.1 Definitions of Health Management

When asked what health management meant to them, producers discussed monitoring the health of their animals on a day-to-day basis, and keeping records of health concerns. As this producer explained:

“I record who I treat, what I treat them with, why I treated them, what the symptoms were, how long of a treatment and…then it’s just overall observation of animal health, check your goats two or three times a day and then when you feed them.”
3.2.2 Health Management Services

Producers discussed using many different health management services including: vaccination programs; reproductive services; nutritional counselling; and disease testing, which included laboratory testing of samples from live animals and postmortems for dead animals. Some producers mentioned using all of these services, while others used only one or two of these services on an as-needed basis.

3.2.3 Reasons to Use Health Management Services

Producers discussed several reasons for using health management services. Financial success was one such reason. Some producers felt that health management were an integral part of the profitability of their operation because “if you don’t manage the health end of your flock then you’re not going to make any money.”

Producers also discussed using health management services to maximize productivity of their flock or herd. This producer described this when discussing their use of reproductive services from their veterinarian, “our breeding program…[the vet is] helping me with the management…to get the optimum lambings per ewe without jeopardizing the health of the ewe.”

Finally, producers discussed using health management as a means to prevent disease in their flock or herd.

Although some producers discussed these reasons for using health management services, others did not use veterinary health management services. Some discussed choosing to carry out some health management activities, such as pregnancy scanning, themselves because it was “way cheaper” and “more convenient”, while others noted they “just haven’t found…any reason to be doing more”.
4. Discussion

The purpose of this study was to explore the working relationships of small ruminant producers and veterinarians from each group’s perspective, and producers’ understanding and use of health management and its related veterinary services. This is the first study to explore this topic in small ruminant industries in a Canadian context.

Many areas of agreement were noted, both between the Ontario producers and veterinarians interviewed in this study, and between participants in this study and in similar studies conducted in the United Kingdom (UK). For example, many small ruminant producers in Ontario and sheep producers in the UK reported using veterinary services primarily for emergency work, rather than using more preventive focussed services (Kaler & Green, 2013). Veterinarians in the current study highlighted this reactive approach to veterinary service use as a barrier to fostering strong working relationships with their small ruminant clients, a view which was shared by UK sheep veterinarians in a study conducted by Bellet, et al. (2015).

The lack of specific small ruminant knowledge amongst veterinarians highlighted in this study is also similar to what has been reported by sheep producers (Kaler & Green, 2013) and sheep veterinarians (Bellet et al., 2015) in the UK. Several strategies could be used to address this lack of knowledge, such as increasing access to small ruminant continuing education opportunities for veterinarians, creating mentorship opportunities for new veterinary graduates interested in small ruminant practice, and ensuring research and resources are disseminated to practicing veterinarians in a useful and timely manner. Implementing these strategies could help improve veterinarian-producer working relationships in the small ruminant industries, by
decreasing the frustration producers often experience during interactions with their veterinarian due to this real or perceived lack of knowledge.

Economic factors were another area where barriers were identified, although perspectives differed between producers and veterinarians. Producers in this study, as well as sheep producers and veterinarians in the UK, identified the costs of veterinary services as a major barrier to their use on farm (Bellet et al., 2015; Kaler & Green, 2013). The cost of a veterinary service was often considered too great when compared to the worth of an individual animal (Bellet et al., 2015; Kaler & Green, 2013). Small ruminant veterinarians in this study also noted this as a reason why small ruminant producers are hesitant to access veterinary services; however, they also felt that producers did not recognize the value that services often have to their entire operation and that producers should be weighing the costs of veterinary care against the value of their entire flock or herd, rather than against the value of a single animal. Creating opportunities for producers to access veterinary services at a reduced cost, through research projects or subsidy programs (like this one) could provide veterinarians with the opportunity to showcase the value of their services to producers. Other factors, such as record keeping practices may also need to be addressed to provide evidence of successful outcomes, both health-based and financial for producers.

Another barrier to use of veterinary services discussed by both veterinarians and producers in this study, was the lack of research available to veterinarians to support their choice of protocols and treatments. One particular area of concern was in the lack of pharmaceuticals approved for use in Canadian small ruminants. Addressing this shortage, through increased funding for safety and efficacy research, which could be used to support science-based recommendations on use in sheep and goats, would prevent veterinarians from having to “reinvent the wheel” to treat health problems in small ruminants and could reduce the frustration
producers often encounter when seeking assistance from their veterinarian, allowing for better working relationships to be established.

The limited sample size of our veterinarian and producer groups may have introduced some limitations to our data. Theoretical saturation is the point at which no new information is being obtained from data collection with additional participants (Green & Thorogood, 2004). While little new information was noted from later interviews in the veterinarian and producer data sets during data collection, it is possible that saturation was not reached due to our limited sample size.

The nature of the sampling method chosen for this study also resulted in some limitations. First, the collection of producers’ contact information was facilitated through the veterinarian. Producers who had a poor relationship with their veterinarian may have been less likely to give their veterinarian permission to share their contact details with the research team. Additionally, participants were selected through their participation in the SRAM system. To participate, producers had to request a postmortem from their veterinarian when a suitable candidate adult sheep or goat was available on their farm. Producers who did not already have a relationship with an Ontario veterinarian were therefore less likely to have been included in our source population. The SRAM system also required fresh tissue submissions, so our choice of source population may have excluded producers who were geographically distant from their veterinarian, as they may not have been able to get their veterinarian out to their farm in time to submit fresh samples to the system. A broader sampling strategy could prove useful in future work. Nevertheless, this study is an important first step in exploring the relationship between small ruminant producers and veterinarians in Ontario and has helped identify areas where interventions could be applied to improve these relationships.
5. Conclusion

In conclusion, this study suggests there are a number of barriers to use of veterinary services and building strong working relationships with their veterinarians for small ruminant producers, including: a perceived lack of veterinarians offering services to small ruminant producers; perceived lack of sufficient small ruminant knowledge in those veterinarians who do offer services to these clients; a lack of small ruminant research available to support veterinarians in treating small ruminant patients; and a perception of the costs of veterinary services being greater than the value they provide for a small ruminant operation. Addressing these barriers could assist in improving the relationship between veterinarians and small ruminant producers and increase the overall uptake in use of preventive veterinary services.
6. References


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7. Acknowledgements

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8. Figures

Figure 4.1 Map depicting the themes, sub-themes and codes from analysis of 3 veterinarian focus groups (Ontario, Canada, April – May 2018). ‘SR’ is defined as small ruminant in this figure
Figure 4.2 Map depicting the themes, sub-themes and codes from analysis of the 7 producer interviews and 1 producer focus group (Ontario, Canada, September – November 2018). ‘SR’ is defined as ‘small ruminant’ in this figure.
Chapter Five: Summary, Recommendations, and Conclusions

1. Summary of Research

This thesis evaluated the efficacy of a program designed to improve use of on-farm postmortems for adult small ruminants (Chapter Three) using a novel animal health surveillance evaluation framework (Chapter Two). It also explored perceptions of the working relationships between veterinarians and their small ruminant producer clients, and use of health management practices in the small ruminant industries (Chapter Four), with an emphasis on postmortem services. The present chapter summarizes the results and limitations of this research and presents recommendations for future research, education, and interventions dedicated to improving veterinarian-client working relationships and animal health surveillance activities in the Canadian small ruminant industries.

1.1 The Animal Health Surveillance Evaluation Framework

Systematic evaluation is an important part of health surveillance programs. Although several published frameworks tailored to the evaluation of human health surveillance programs are available (Bowen, 2012; Centers for Disease Control and Prevention, 2008; Health Surveillance Coordinating Committee, 2004; Porteous, 1997; World Health Organization, 2006), few frameworks exist for evaluation of animal health surveillance programs specifically (Drewe et al., 2015). To address this gap, a new framework was developed for the evaluation of animal health surveillance programs by collating elements from existing frameworks, expanding areas of perceived deficiency (e.g. including participatory research elements), and via consultations with experts in public health program evaluation and animal health surveillance.
The developed framework, termed the Animal Health Surveillance Evaluation Framework (AHSEF), consists of four sections and thirty-five questions designed to guide the development of an evaluation plan for animal health surveillance programs. This framework can be used by investigators seeking to formally assess animal health surveillance.

1.2 Evaluation of the Small Ruminant Adult Mortality (SRAM) System

The Small Ruminant Adult Mortality (SRAM) system was designed to assist veterinarians in performing and submitting on-farm postmortems of adult small ruminants to the Animal Health Laboratory (AHL) at the University of Guelph. The system aimed to improve the quality of postmortems submitted to the laboratory, to enhance disease surveillance in the adult small ruminant population, and to assist veterinarians in developing strong relationships with their small ruminant clients.

Evaluation of the SRAM system to determine its value as a support tool for postmortems in the Ontario small ruminant industries was a major objective of this thesis. The Animal Health Surveillance Evaluation Framework (Chapter Two) was used to develop the evaluation plan. Evaluation involved comparing the diagnostic success of the SRAM submissions with similar historical AHL submissions, a survey of the pathologists that worked on SRAM cases to determine the utility of the system components in making a conclusive diagnosis and focus group and interview discussions with participating veterinarians and producers to explore the utility and value of the system.

Diagnostic proportions for both sheep and goats were higher for SRAM cases compared to historically similar AHL cases, and comparable to diagnostic proportions reported for sheep and goat postmortems conducted at the University of Zurich (Wäsle, Pospischil, Hässig, Gerspach, &
Hilbe, 2017). The odds of diagnosis were significantly greater for SRAM cases, both overall (7.9, 95% CI: 4.1 – 15.2) and separately in sheep (13.0, 95% CI: 4.6 – 36.4) and goats (5.1, 95% CI: 2.1 – 12.2). This suggests that the SRAM system was useful for improving the diagnostic success of on-farm postmortems.

In the pathologist survey on the usefulness of the program elements, pathologists found all of the SRAM system elements to be useful in successfully making a diagnosis, with the complete set of fresh and formalin-fixed tissues being rated the most useful component and photographs the least useful.

Veterinarians and producers both valued the SRAM system. Veterinarians noted that use of the program gave them opportunities to re-engage with their small ruminant clients, building trust, and showing producers the value veterinary services can provide to their flock or herd. Producers also found value in the system, from the education they received from their veterinarian during the on-farm postmortems, and from the discussion of the postmortem results with their veterinarian. The results from this chapter suggest that continued use of the SRAM system or similar programs could provide a valuable opportunity to improve working relationships between veterinarians and their small ruminant clients.

1.3 Perceptions of Working Relationships and Health Management

Veterinarians and producers identified several important features of a good working relationship during focus group and interview discussions. Their willingness to search for “the right [veterinarian]” for them and to pay for the cost of services seen to have financial value, were factors identified by small ruminant producers as important to the development of a good working relationship, along with honest communication with their veterinarian and trust in their
Veterinarian’s advice. Veterinarians identified features of a good working relationship with their small ruminant clients, including: producers setting goals and keeping good records for their flock or herd, and using a team approach that allows a veterinarian to work with the producer and other herd advisors, such as nutritionists when developing health management plans. Both groups identified veterinarians teaching producers the skills needed to treat basic animal health conditions as an important feature of a good relationship.

Veterinarians and producers identified several barriers to use of veterinary services, and by extension, to good working relationships. Both groups discussed the relative lack of knowledge of the diseases of small ruminants in many veterinarians. They also identified lack of research or access to research into small ruminant health in general, as barriers to use of veterinary services by small ruminant producers. Veterinarians also discussed the use of veterinary services only for emergency work on-farm as being a barrier to developing good working relationships with their small ruminant clients.

Veterinarians and producers discussed the costs of veterinary services as a barrier to their use; however, their opinions differed on the role these factors played in developing relationships. Producers found the cost of veterinary services to be a barrier to their use, when compared to the cost of an individual animal. Veterinarians suggested that producers perceived veterinary costs as prohibitive because they were not comparing the cost of veterinary services with that value of their entire flock or herd, where veterinarians felt the costs of services should be weighed.

Both groups also discussed the use of phone consultations in place of a farm visit. Producers discussed phone consultations as an important feature of a good working relationship, for the role they could play in saving them time and money; however, veterinarians discussed
phone consultations as barrier to developing good working relationships because not being present on-farm prevented them from delivering the best service to their small ruminant clients.

The barriers described by veterinarians and producers in this study were consistent with barriers to use of veterinary services described by sheep producers (Kaler & Green, 2013), sheep veterinarians (Bellet, Woodnutt, Green, & Kaler, 2015) and livestock veterinarians (Ruston et al., 2016) in the United Kingdom, which suggests that future interventions designed to alleviate these barriers could have impacts for veterinary practice both locally and internationally.

Overall, this chapter indicated that veterinarians are often used for remote advice and for treating emergent conditions in small ruminants, but less frequently for proactive health management services. It also illustrates the paths and barriers to developing a good working relationship between veterinarians and small ruminant producers that promotes delivery of beneficial health management services.

2. Limitations

Several limitations of the studies presented in this thesis should be noted. The main limitation stemmed from the recruitment of the small ruminant producers for the focus group discussions and interviews conducted in Chapters Three and Four. To be eligible, producers must have had at least one animal postmortem submitted to the SRAM project. This meant that producers who had little to no contact with a veterinarian or whose farms were too geographically distant from their veterinarian to make the fresh tissue requirements of the project feasible, were less likely to be included in our source population. As such, their perceptions may not have been represented in the results. Additionally, contact information for eligible producers was provided to the research team by veterinarians, with permission. Producers who had a poor
relationship with their veterinarian may have been less likely to give their veterinarian permission to pass on their information to the researchers, meaning their views may not have been represented in the research. Nevertheless, these results still provide important insights into the value of the SRAM system and the perceptions of working relationships between veterinarians and their clients in the small ruminant industries.

Another limitation should be noted in the design of the AHSEF. In the selection of the published frameworks used to identify elements from which to build the AHSEF, a literature review was chosen rather than a more extensive systematic review (Grant & Booth, 2009). It is possible that this method may have excluded some published frameworks from the identification process; however, it is likely that elements essential to the evaluation process would have been identified from the frameworks that were identified from the literature review.

3. Recommendations

3.1 The SRAM System

Evaluation of the SRAM system suggested that it was a valuable tool for improving the diagnostic rate of adult small ruminant postmortems and for building relationships between veterinarians and their small ruminant clients. It is therefore recommended that use of this system continue to be available to small ruminant veterinarians, in some capacity, although it is likely some changes will have to be made to meet funding constraints (i.e. here, the study covered the costs of the postmortems but, in the future producers will need to pay fees for the services).

Several changes should be made to the SRAM system, based on the results of Chapter Four, to enhance its utility for veterinarians and producers. For example, to improve the utility of
the online form for veterinarians, additional space for case history details and postmortem pictures should be made available. In addition, to improve the overall experience of using the SRAM system for veterinarians and producers, ensuring that veterinarians are aware of the turnaround times for submitted tests could assist veterinarians and producers in planning interim treatment and management activities. The AHL publishes the approximate turnaround times for all tests in their fee schedule and on their website. Providing links to this resource upon submission of a case will ensure veterinarians have access to this information.

Communication of the postmortem results was an important piece of the SRAM system. Further use of the system should include education for veterinarians on ways to communicate results effectively with producers. These could include providing a brief lay summary on the main findings from the laboratory testing via email, if no follow-up action is required, or a conversation, either by phone or in-person that includes an explanation of the findings and planning for management if further actions are required based on the results.

3.2 For Relationship Building

There are many opportunities available to assist veterinarians and producers in addressing the barriers that they identified as hindering good working relationships in the small ruminant industries.

3.2.1 Increasing Access to Small Ruminant Education Opportunities for Practicing Veterinarians

The lack of specific small ruminant knowledge held by some practicing veterinarians was identified as a barrier to use of veterinary services and the building of good working relationships between veterinarians and their small ruminant clients. Many opportunities already exist for veterinarians to access continuing education, through the Ontario Ministry of
Agriculture, Food and Rural Affairs, Small Ruminant Veterinarians of Ontario and other small ruminant industry groups. To ensure veterinarians have access to these education opportunities, efforts could be made to hold in-person education sessions in a variety of locations, to ensure geographic accessibility and where possible, provide online education opportunities. Developing new research into educational materials for veterinarians could also be useful for further education of veterinarians. For example, the diagnostic results from the SRAM project could be developed into a case series for veterinarians to learn more about the conditions diagnosed in Ontario small ruminants through this project.

A survey of veterinarians, to determine which areas they would like to see more education in and in what format they would prefer to access this information could also be useful in developing future education programs.

3.2.2 Address the Perceived Lack of Small Ruminant Research

Veterinarians and producers identified a perceived lack of research available for the treatment of Canadian small ruminants as a barrier to use of veterinary services. In particular, the lack of drugs labelled for use in small ruminants was identified as a source of frustration in use of veterinary services by producers, likely because veterinarians did not have easy access to the research information they need to make good, science-based recommendations for drugs being used in small ruminants. Providing funding for research on drugs used in small ruminants could address this issue and could reduce producers’ frustrations with veterinary services, especially as Canada shifts to a prescription-only format for accessing veterinary drugs (Canadian Veterinary Medical Association, 2017).
In addition to providing funding for needed research, it will be important to ensure research useful for treatment of small ruminants is disseminated to veterinarians in a format that is likely to be received and used. This will help to ensure that veterinarians have both knowledge of, and access to, the research they need to provide excellent service to their small ruminant clients. To accomplish this, summaries of new research could be placed in written communications distributed to veterinarians, such as email newsletters, and researchers could be invited to present their findings at meetings that are attended by small ruminant veterinarians, such as the Small Ruminant Veterinarians of Ontario Annual General Meetings.

3.2.3 Create Mentorship Opportunities for New Small Ruminant Veterinary Practitioners

Veterinarians in Chapter Four suggested that providing opportunities for new small ruminant veterinarians to be mentored by more experienced practitioners could help provide them with the resources and experience needed to be successful in their small ruminant practice. In turn, this could help them build good working relationships with their small ruminant clients. A network of small ruminant veterinarians, the Small Ruminant Veterinarians of Ontario, already exists and may be able to assist in the creation of a formal mentorship program to provide access to these opportunities for new graduates of veterinary programs.

3.2.4 Create Opportunities for Lower Cost Access to Veterinary Services

One important advantage of the SRAM project identified by veterinarians and producers was the cost subsidy the project provided for producers. This allowed producers more freedom to access postmortem services, allowed veterinarians the opportunity to connect with their small ruminant clients, and helped highlight the value veterinary services such as postmortems can provide to small ruminant operations. Creating additional opportunities for producers to access
veterinary services at lower cost, through the use of subsidies, could assist in further improving working relationships, use of veterinary services, and animal health surveillance in the small ruminant industries.

3.3 Future Research

There are two additional areas where further research may be valuable, in addition to those already identified above. First, additional research into the perceptions of working relationships and veterinary services amongst producers who did not participate in the SRAM system would greatly compliment the research presented in this thesis. This would help determine if additional barriers exist for this group that may prevent them from engaging in animal health surveillance, using veterinary services, and developing good working relationships with their veterinarians.

Second, additional research on the future diagnostic success of adult small ruminant postmortems may be of value, to determine if the use of the SRAM system provides lasting improvements to the diagnostic success of adult small ruminant postmortems, or if ongoing use is required to maintain high levels of diagnosis observed here.

4. Conclusions

This thesis presents novel research into the perceptions of working relationships and use of veterinary services in the Canadian small ruminant industries. Additionally, it evaluated the value of the SRAM system, as a tool to assist in the improvement of diagnostic success for adult small ruminant postmortems and as a resource for improving the working relationships of veterinarians and their small ruminant clients. To assist in this evaluation, a novel framework for
the evaluation of animal health surveillance systems, the Animal Health Surveillance Evaluation Framework was developed.

Results suggest that veterinary services are not currently used to their fullest extent in the small ruminant industries and several barriers prevented producers from accessing veterinary services. Evaluation of the SRAM system indicated that it was of great value to veterinarians and producers, both in improving the diagnostic success of postmortems for adult small ruminants and in reducing some of the barriers to use of veterinary services in the small ruminant industries. Future research should continue to build on this work by developing interventions to reduce barriers to use of veterinary service use for small ruminant producers and support the continued growth of these industries.
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Appendix A: Question Guide – Veterinary Focus Groups

Preamble (This is intended as a guide to ensure the moderator will cover all important points and will not be read verbatim)

- Welcome! Thank you all for joining us today! My name is XX and I’ll be guiding our conversation.
  - My role is to ask questions, keep our conversation moving, remain neutral, and encourage the free sharing of your thoughts and ideas.
- Describe SRAM project [participants will already have completed the consent form, and the researcher will have discussed any questions and concerns they may have]
- You are here because you are all small ruminant veterinarians who have participated in the small ruminant adult mortality project run by the AHL
- We want to hear your thoughts and experiences regarding:
  - Health Management on your clients’ farms
  - Use of veterinary services by your clients
  - Your experience with the use of the tool developed by the SRAM project
  - Your ideas for improvement of the SRAM project
- We are doing this study:
  - To understand use of veterinary services in the small ruminant industries
  - To inform improvements to the SRAM Program
- Microphone
  - Please try to speak clearly
- Identity protection – you won’t be named or have your name associated with what you say
- In keeping with that last point,
  - Please protect the identity of other people you might discuss by not using their names during our discussion – but know that if you do, we will simply remove them in the transcripts
  - We may use verbatim quotes of something you say in reports or papers arising from this work, but we can assure you that you will not be identified in any way
- Please don’t worry about saying something you think may not be a common belief or one not shared by myself; we are interested in hearing your unique perspectives
- On time – we will finish no later than x
- Please know that you have the option of withdrawing from this study at any time, or to skip any questions you are not comfortable with.
- If you want or need to leave for any reason, please just let XX know and you will be free to leave at any time.
- [Silence Phones]
- We will be providing you with your honorarium at the end of the interview
- What questions do you have before we continue?
**Introductions**

Before we get started I’d like us all to introduce ourselves to the group. Please share your first name, what area your practice is in, and your favourite thing to do outside of work. I’ll go first

<share introduction…>

**Warm Up Question**

To get us started, what’s the first thing that comes to your mind when you think about the online support tool you used for the adult small ruminant postmortem submission?

**Website Functionality**

Okay, let’s explore that further. Think back to your use of the online support tool.

- What did you like about the tool? (Probes: What worked well? What was an improvement over your usual postmortem procedure?)
- What didn’t you like about the tool? (Probes: What issues did you have with the function of the website?)
- How would you improve the tool? (Probes: What would you change? What features would you add?)

Extra Question (if needed and there is extra time):

- How would you describe your experience using the case submission form? (Probes: Were there entry fields missing? What fields were most useful/least useful?)
Working Relationships with Clients

Switching gears now, I’d like to know more about your interactions and working relationships with your small ruminant clients.

- Think about your best working relationship with a small ruminant client. What makes that relationship good?
- Now, think about your worst working relationship with a small ruminant client. What makes that relationship that way?
- How do you feel your relationship with your small ruminant clients could be improved?
- What prevents you from improving those relationships?
- What are the differences in the working relationships you have with clients in different small ruminant commodity groups? (Possible clarification: i.e. how do your relationships with dairy goat clients differ with meat sheep clients…)

Health Management¹

One of the areas we are interested in exploring is health management practices in the small ruminant industries.

- What health management services do you currently offer to your small ruminant clients? What makes you able to deliver those services effectively?
- What health management services would you like to offer, ideally? What makes you unable to currently provide these services?

¹ Those services that are planned with the goal of preventing or controlling disease and improving health and productivity of the flock / herd
How do you think producers view health management services? Why? Extra Question (if needed and there is extra time)

- What could be done to address areas of concern in how producers view health management services?

Impact of the distance support program:

Before we finish up we have just a few more questions to bring together everything we’ve talked about today. I’d like you to think about your practice with your small ruminant clients before and after your use of our online support tool.

- How has your use of the distance support program influenced your **working relationship(s)** with your small ruminant client(s)? (Probe: how did it facilitate communication with your client(s)?)

- How did your use of the distance support program influence your routine **practices** on your small ruminant client’s farm? (Probe: did it make a difference in how you approached your practice on that farm? How so?)

- How did your use of the distance support program impact your **delivery of health management** services to your small ruminant clients? (Probe: Did it impact your clients’ views of postmortems? Did it impact your view of postmortems?)

**Cool-Down**

Is there anything else that anyone would like to share about the veterinarian-small ruminant client relationship, or the distance support tool?
Thank you for sharing your thoughts on all of these issues – your input is very much appreciated.

I’d now like to provide a summary of what you shared today. Please feel free to correct me, or to add in anything you think we missed. <Provide summary of discussion…>

Is that accurate? Is there anything we missed?

Closing

Thank you all again for joining us today. The insights you’ve provided today will be very valuable in accomplishing our research objectives. Should you have any further questions for us, please feel free to get in touch using the contact information we’ve provided. Thank you for your time – honorarium (*sign*)
Appendix B: Question Guide – Producer Focus Groups

Preamble (The following is a guide to ensure the moderator hits all the important points when outlining the focus group and will not be read verbatim)

- Welcome! Thank you for joining us today! My name is XX and I’ll be guiding our conversation.
  - My role is to ask questions, keep our conversation moving, remain neutral, and encourage the free sharing of your thoughts and ideas.
- Describe SRAM project [participants will already have completed the consent form, and the researcher will have discussed any questions and concerns they may have]
- You are here because you are all small ruminant producers who have participated in the small ruminant adult mortality project run by the AHL
- We want to hear your thoughts and experiences regarding:
  - Health Management on your farm
  - Use of veterinary services on your farm
  - Your experience with the SRAM project
  - Your ideas for improvement of the SRAM project
- We are doing this study:
  - To understand use of veterinary services in the small ruminant industries
  - To inform improvements to the SRAM Program
- Microphone
  - Please try to speak clearly
- Identity protection – you won’t be named or have your name associated with what you say
- In keeping with that last point,
  - Please protect the identity of other people you might discuss by not using their names during our discussion – but know that if you do, we will simply remove them in the transcripts
  - We may use verbatim quotes of something you say in reports or papers arising from this work, but we can assure you that you will not be identified in any way
- Please don’t worry about saying something you think may not be a common belief or one not shared by myself; we are interested in hearing your unique perspectives
- On time – we will finish no later than x
- Please know that you have the option of withdrawing from this study at any time, or to skip any questions you are not comfortable with.
- If you want or need to leave for any reason, please just let XX know and the interview will end.
- [Silence Phones]
- We will be providing you with your honorarium at the end of the interview
- What questions do you have before we continue?
Introduction

Let’s start with everyone introducing themselves to the group. Please share your first name, what kind of farm you operate, and something you like to do in your free time. I’ll go first, and then feel free to go in whatever order you like <share introduction…>.

Warm up question

- What’s the first thing that comes to mind in thinking about veterinary services for your sheep/goats?

Health Management Questions

- Please describe what flock or herd health management is to you.
- What veterinary health management services do you use on your farm? (Probes: services may include: advice on preventing or control important diseases, testing for disease including postmortems, pregnancy diagnosis or other reproductive management procedures, analyzing production records, etc.)
- Why do you choose to use those health management services? How are these services helpful?
- What aspects of health management services do you not find useful? What makes those aspects not useful to you?

Producer-Vet Relationship

- What’s the first thing that comes to mind when you think of herd / flock veterinarians?
- How would you describe your working relationship with your vet?
- What factors do you feel contribute to this?
- What might you change to improve your relationship with your vet?
Extra Questions:

- How is your veterinarian helpful to your operation?
- How is your veterinarian not helpful to your operation?

Impact of the Project

I’d like to switch gears a little now and talk specifically about the postmortem(s) your vet performed for submission to the Small ruminant adult mortality project.

- Please tell us about how your vet communicated the postmortem findings with you. [ moderator can prompt participants with the month of case submission to help with recall]
- How did you use the information from the postmortem(s)?
- How was that postmortem different from others your vet has previously performed for you? (Probes: What things were better than the last time you had a postmortem done?)
- What changes might make you more likely to continue to use postmortem services from your vet?

Cool Down

Is there anything else you would like to share about your relationship with their vets, health management on your farm, or the experience of having a postmortem completed through the small ruminant adult mortality project?

Thank you for sharing your thoughts on all of these topics – your input is very much appreciated. I’d now like to provide a summary of what you shared today. Please feel free to correct me, or to add in anything you think we missed. <Provide summary of discussion…>
Is that accurate? Is there anything we missed, or that you would like to add?

Closing

Thank you all again for joining us today. The insights you’ve provided today will be very valuable in accomplishing our research objectives. Should you have any further questions for us, please feel free to get in touch using the contact information we’ve provided. Thank you very much for your time. – honorarium (*sign*)
Appendix C: Animal Health Surveillance Evaluation Framework

Evaluation of surveillance activities is an important component of a successful animal health surveillance program (World Health Organization, 2006). Many groups have designed frameworks to assist evaluators in performing program evaluations in a systematic manner (e.g. Bowen, 2012; Health Surveillance Coordinating Committee, 2004; Porteous, 1997; Centers for Disease Control and Prevention (CDC), 2008; World Health Organization, 2006); however, very few frameworks have been designed to apply specifically to an animal health surveillance context (Drewe et al., 2015; Hendrikx et al., 2011; World Organisation For Animal Health, 2013). Additionally, though the usefulness of participatory methods in evaluation has been increasingly recognized in the literature (Calba et al., 2015; Calba et al., 2016; Johnson, Lilja, Ashby, & Garcia, 2004; Mariner, Hendrickx, Pfeiffer, Costard, & Knopf, 2011; Schulz, Calba, Peyre, Staubach, & Conraths, 2016), there are no animal health surveillance evaluation frameworks currently available that provide specific guidance for incorporation of participation of all stakeholders in evaluation of these systems. This framework was created to address that gap and is intended to be used to evaluate any animal health surveillance program, in any species and of any size.

Comments On Choosing An Evaluator

Though outside the scope of this framework, choosing an appropriate evaluator is an important component of a successful evaluation. Consideration should be given to the expertise of an individual when selecting an evaluator, as well as any potential biases that they may inadvertently introduce, particularly when considering the choice between internal or external personnel. The Canadian Institute of Health Research (CIHR)’s A Guide to Evaluation in Health Research provides an excellent discussion on selecting an evaluator, and the potential advantages
and disadvantages of internal versus external personnel to assist in the selection process (Bowen, 2012).

**How To Use This Document**

This framework is divided into several sections. Evaluators should follow the general flow of the document from section to section, in order; however, it is expected that evaluators will go back to previous sections to fill in further details as the evaluation plan takes shape.

**Framework**

<table>
<thead>
<tr>
<th>Framework Section/Question</th>
<th>Guidance Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section 1: Gather</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Preliminary Information</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Background Information</strong></td>
<td></td>
</tr>
<tr>
<td><em>What animal health surveillance program is being evaluated?</em></td>
<td>Give the name and a short description of the animal health surveillance system being evaluated.</td>
</tr>
<tr>
<td><em>What is the scope of the evaluation?</em></td>
<td>Describe in which animal or industry sector(s) the program is being evaluated (e.g. if the program operates in beef and dairy, are you evaluating its operation only in beef, only in dairy or in both?). Also describe the scope (are you evaluating the whole program or only a part) and timeframe (since the last evaluation? In the last year? Etc.) of the evaluation.</td>
</tr>
<tr>
<td><em>Why is the program being evaluated?</em></td>
<td>Describe the reason for the evaluation. Examples: the evaluation was requested by a stakeholder, periodic evaluations are a part of the program, evaluations are required as part of a funding agreement, etc.</td>
</tr>
<tr>
<td><strong>Identify and Engage Stakeholders</strong></td>
<td></td>
</tr>
<tr>
<td><em>Who are the program stakeholders?</em></td>
<td>Describe all stakeholder groups involved in program activities; this may include (but is not limited to): those who may report a suspected case, those who investigate a case, those who confirm a case, those who coordinate appropriate response activities, those who analyze surveillance data, and those who use surveillance data.</td>
</tr>
<tr>
<td>What is the role of each group in the surveillance system? Is there an organizational structure/hierarchy to the program that stakeholders may be grouped into? For an example based on the Canadian National Scrapie Eradication Program see pg. 7.</td>
<td>Identify which stakeholder groups will use the evaluation results (evaluation-user stakeholder group(s))</td>
</tr>
<tr>
<td>What do the evaluation-user stakeholder group(s) want to know?</td>
<td>What are the evaluation-user stakeholder group(s) interested in learning or determining from the evaluation? What decisions or changes will the results of the evaluation inform? Determine what stakeholder wants are of greatest importance and which are of least importance based on consultation with these stakeholders.</td>
</tr>
<tr>
<td>To what extent will stakeholders be involved in the development of evaluation purpose and plan?</td>
<td>Determine the level of involvement evaluation-user stakeholder group(s) should have with the evaluation. Some evaluations may be intended to provide an impartial evaluation of the program, in which case stakeholders may only be consulted by evaluation personnel to provide information. In other cases, an evaluation team may wish to have greater involvement from the program stakeholders by having them involved in co-developing the evaluation purpose and plan with the evaluation personnel.</td>
</tr>
</tbody>
</table>

**Identify the Evaluation Purpose**

| What is the main purpose of the evaluation? | Working with evaluation-user stakeholders in the determined capacity, develop the main purpose of the evaluation, meeting as many evaluation-user stakeholder knowledge requests as possible. The evaluation may not include every area identified by stakeholders in its scope but should make every effort to include those deemed to be the most important during consultation with the evaluation users |

**Section 2: Describe the Surveillance Program**

<p>| Why was the program created? | Describe why the program was created and why surveillance of the disease/health outcome/health indicator is important |
| What population(s) does the program encompass? | Describe which populations are at risk for the outcome under surveillance. |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail in which population(s) the surveillance program activities</td>
<td>Detail in which population(s) the surveillance program activities operate and why these populations were chosen</td>
</tr>
<tr>
<td>operate and why these populations were chosen</td>
<td>Describe how animals/samples etc. are selected for program activities. Who selects the animals/samples? What sampling method is used? How many are selected and why?</td>
</tr>
<tr>
<td>Describe how animals/samples etc. are selected for program activities.</td>
<td>Describe how animals/samples etc. are selected for program activities. Who selects the animals/samples? What sampling method is used? How many are selected and why?</td>
</tr>
<tr>
<td>What is the goal of the program?</td>
<td>Describe what the program intends to accomplish.</td>
</tr>
<tr>
<td>What are the program objectives?</td>
<td>Describe the objectives the program has set to accomplish its goal(s).</td>
</tr>
<tr>
<td>What are the program activities?</td>
<td>Describe the activities the program undertakes (e.g. collecting samples, analysing data) to accomplish its objectives. Pay particular attention to activities that function differently in practice than they are intended to in the program design. This may require consultation with those involved in all areas of program operation.</td>
</tr>
<tr>
<td>Where are program activities being conducted?</td>
<td>Detail the geographic areas the program encompasses, and any relevant physical locations where activities operate (e.g. specific farms or communities, laboratories, offices)</td>
</tr>
<tr>
<td>When does the program operate?</td>
<td>Describe the timing of the program operation. Does the program operate continuously or only at certain times? Does it operate on a calendar schedule or in-line with certain events?</td>
</tr>
<tr>
<td>Section 3: Design an Evaluation Plan</td>
<td></td>
</tr>
<tr>
<td>Assess Resources</td>
<td></td>
</tr>
<tr>
<td>What resources are available for evaluation?</td>
<td>Consider the budget, timeframe, personnel, and any other resources available, internally or externally, for the evaluation, in relation to those required. Determine if available resources are sufficient for the evaluation to be carried out. The Logistics worksheet (pg. B-9) from the Public Health Agency of Canada’s Program Evaluation Toolkit is a helpful tool to assist in this step (Porteous, 1997).</td>
</tr>
<tr>
<td>Develop questions</td>
<td></td>
</tr>
<tr>
<td>What evaluation questions should be asked to address the evaluation</td>
<td>Consider what specific questions need to be answered to fully explore the purpose of the evaluation.</td>
</tr>
<tr>
<td>purpose?</td>
<td>Example: If the evaluation purpose is to determine how a program could be altered to better fulfill its objectives, evaluation questions might include: What program activities are functioning well? Why is a certain program activity not functioning as expected?</td>
</tr>
</tbody>
</table>
What performance attributes should be assessed?

If an assessment of system performance is desired/useful, which attributes should be assessed to best support the evaluation goals? Attributes can be selected from the CDC’s list of 10 performance attributes (usefulness, simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, stability) (Centers for Disease Control and Prevention, 2008). Frequency of use in the literature makes these attributes ideal to select from to compare with other similar surveillance system evaluations (see (Centers for Disease Control and Prevention, 2008) for descriptions of each attribute). Any number of attributes can be chosen as best suits the specific evaluation needs. Additional attributes not included in the CDC’s list may be chosen if the evaluation requires (e.g. cost-benefit analysis, specificity).

Choose/Design Methods

<p>| What can each evaluation question be answered? | Determine what data needs to be collected to fully answer each evaluation question. |
| Which stakeholders should be engaged in the evaluation? | Determine which stakeholder groups should be engaged as a part of the evaluation. Efforts should be made to include participants from as many groups as possible, and at least one group from all “levels” identified in Section 1. |
| What evaluation questions can be answered with data collected from stakeholder engagement? What questions will require data from other sources? | Determine what questions can be answered with data collected through engagement with the identified stakeholders. Consider which questions may require data from other sources to fully answer. What other data sources will be required to fully answer the evaluation questions (e.g. laboratory reports, program documents, etc.)? |
| What methods should be used to engage stakeholders? What methods should be used to collect data from other sources? | Determine what methods are most appropriate to collect data from the stakeholder groups. Different methods (e.g. focus groups, surveys, one-on-one interviews, etc.) may be required to engage different groups. Determine what methods are needed to collect the data required from the other sources identified above. |
| How will the data be accessed? | If the data you need already exists, how will you obtain them? Consider what form the data are available in (e.g. electronic, paper etc.), how you will access them (e.g. what software might you require), what permissions you might need to access the data, what may be missing or what errors may exist in the data. Consider what permission you may need to collect new data using the methods you have identified (e.g. ethics approval). |</p>
<table>
<thead>
<tr>
<th><strong>What data collection tools are needed?</strong></th>
<th>Determine what data collection tools (e.g. a survey, a focus group question guide etc.) will be needed for each data collection method chosen. Consider how the tool will be used, what the appropriate format may be, if a tool already exists or if one will need to be designed and if any pre-testing may be required prior to data collection.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Create a Data Collection and Analysis Plan</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Who will collect the data for the evaluation?</strong></td>
<td>Determine what personnel are needed to conduct the data collection and analysis. How will the personnel be recruited/trained, if necessary?</td>
</tr>
<tr>
<td><strong>How will data be organized and stored?</strong></td>
<td>Decide how the data will be kept and organized during and after collection. How long will you keep collected data after the evaluation is complete? Consider any data security and confidentiality rules that may be applicable (i.e. does the data need to be de-identified or encrypted) and any approvals that may need to be obtained (e.g. ethics approval).</td>
</tr>
<tr>
<td><strong>How will data be analyzed?</strong></td>
<td>Determine what analytical methods will be used and who will conduct each analysis.</td>
</tr>
<tr>
<td><strong>Are there targets indicated by your evaluation question to compare to?</strong></td>
<td>Consider if your evaluation question seeks to determine if the program is meeting a specific numerical target goal (e.g. response rate). If so, determine what that target is prior to data analysis.</td>
</tr>
<tr>
<td><strong>Section 4: Conduct Evaluation, Recommend and Report</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Conduct the Evaluation</strong></td>
<td>Conduct the evaluation using the evaluation plan developed in Section 2.</td>
</tr>
<tr>
<td><strong>Make Final Recommendations</strong></td>
<td>Determine which stakeholders should be involved in making final recommendations to ensure the evaluation outcomes will be used and recommendations are feasible.</td>
</tr>
<tr>
<td><strong>Who should be involved in determining final recommendations?</strong></td>
<td>Determine the recommendations based on the results of the evaluation with the input of the stakeholders who have been identified as evaluation users. Where appropriate, the literature should be consulted to look for previously successful solutions.</td>
</tr>
<tr>
<td><strong>What are the recommendations for the program based on the results of the evaluation?</strong></td>
<td>Give consideration to priority of recommendations (i.e. which are of highest priority to complete? Which are not high priority but would be nice to do if resources are available?).</td>
</tr>
</tbody>
</table>
### Develop an Action Plan

<table>
<thead>
<tr>
<th>What actions should be taken, based on the evaluation recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a set of specific tasks that will be undertaken to implement the recommendations of the evaluation.</td>
</tr>
<tr>
<td>Example: If the evaluation recommendation was “Expand the surveillance program to include additional counties” an action plan might include tasks to develop the infrastructure to support that such as: 1) Hire additional personnel to support the expanded program, and 2) Hold information meetings for animal health professionals in the new counties.</td>
</tr>
</tbody>
</table>

### Report

<table>
<thead>
<tr>
<th>Who should receive the results of the evaluation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine who should see the results of the evaluation. This might include stakeholder groups, funders, animal health professionals, academic communities, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How will the results be communicated to the target audience in a clear and useful manner?</th>
</tr>
</thead>
</table>

### Post-Evaluation Considerations

Use of evaluation findings is an important component of successful program evaluation (CDC, 2008; Health Surveillance Coordinating Committee, 2004; Porteous, 1997). The framework described above provides guidance for designing an action plan based on the recommendations of the evaluation, and it is up to the evaluation users to ensure the action plan
is implemented. Careful consideration should be given to who will oversee the implementation of the action plan, who will be in charge of each specific task, and the timeline for the action plan. Following up to ensure full use of the evaluation findings will ensure the surveillance program benefits fully from the evaluation process.
Stakeholder Description Example

Consider Canada’s National Scrapie Eradication Program. This program involves multiple stakeholder groups and uses multiple pathways to conduct surveillance for scrapie in Canada. The basic functioning of the system is described in Figure 1 above. Stakeholders in this program can be organized into 4 groups based on similarity of roles and responsibilities within the system. These groups are shown in Table 1 below.

![Diagram showing the stakeholder groups and function of Canada's National Scrapie Eradication Program](image-url)
<table>
<thead>
<tr>
<th>Group</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| Group 1  
Sheep Producers  
Goat Producers  
Abbatoirs | Group 1’s stakeholders include sheep producers, goat producers, and abattoirs. These groups all work directly with the animals and are responsible for submitting a predetermined set of samples for testing (i.e. a random sample of all processed animals at abattoir, all deadstock for a producer enrolled in the Voluntary Scrapie Flock Certification Program) or for contacting their local veterinarian to examine possible cases. |
| Group 2  
Attending Veterinary Practitioners | Group 2 consists of the attending veterinary practitioner stakeholder group, which is responsible for reporting all suspected scrapie cases either by submission of samples from a euthanized animal to a provincial laboratory or by contacting the area Canadian Food Inspection Agency (CFIA) veterinarian to investigate live suspected cases further. |
| Group 3  
Provincial Laboratories  
Federal Laboratories | Group 3’s stakeholders are the provincial and federal laboratories. Both provincial and federal labs are responsible for conducting scrapie testing and reporting any positive result to the appropriate authority for follow-up (provincial labs send positive results to federal lab for further testing, federal labs report positive findings to the appropriate CFIA veterinarian). |
| Group 4  
Canadian Food Inspection Agency Veterinarians | Group 4 contains the CFIA veterinarians. Veterinarians are responsible for investigation of potential cases and coordination of response activities in the event of a confirmed case. |
For an additional example of stakeholder organization see (Calba et al., 2015).

See the CFIA for additional information on the National Scrapie Eradication Program -
(http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/reportable/scrapie/eng/1329723409732/1329723572482)

References


Appendix D: Animal Health Laboratory Pathologist Survey

ONTARIO VETERINARY COLLEGE

Department of Population Medicine

CONSENT TO PARTICIPATE IN RESEARCH

(REB# 17-06-023)

Distance Support for On-Farm Investigation of Adult Small Ruminant Mortalities

You are asked to participate in a survey for research study conducted by researchers at the Ontario Veterinary College, including Dr. Paula Menzies, Dr. Andria Jones-Bitton, and Jeanette Cooper. Financial support for this study has been provided by the Ontario Ministry of Food, Agriculture and Rural Affairs, the Gartshore Memorial Sheep Research Fund, the Ontario Animal Health Network, the Ontario Veterinary College, and via an Ontario Graduate Scholarship. If you have any questions or concerns, please feel free to contact Dr. Paula Menzies (519-824-4120 Ext. 54043) or Dr. Andria Jones-Bitton (519-824-4120 Ext. 54786).

PURPOSE OF THE STUDY – AHL PATHOLOGIST SURVEY

This survey is part of a larger study conducted with sheep and goat producers, and their veterinarians in Ontario to enhance disease surveillance through improved on-farm postmortems of adult small ruminants using an online support tool. Material and information from these small
ruminant postmortems were submitted by Ontario veterinary practitioners to the Animal Health Laboratory at the University of Guelph.

The purpose of this survey is:

1. To evaluate the use of an online distance support tool for investigation of small ruminant mortalites,

2. To determine the usefulness of the required submission components for determining a diagnosis of submitted on-farm postmortems

Information gathered during this study is being used for a MSc research project. It may also be used in directing future research projects.

PROCEDURES

Participants will fill out a short online survey relating to their diagnosis of adult small ruminant postmortem cases that were submitted using the distance support tool. The survey will be administered through Qualtrics software and will be anonymous. We expect this survey to take approximately 15 to 20 minutes to complete.

CONFIDENTIALITY

Your participation in this study is completely voluntary. Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. Your identity will remain confidential to the extent allowed by law. Additionally, please note confidentiality cannot be guaranteed while the data are in transit over the internet.

The data collected from this survey will be stored in a secure location. Following data collection, the data file will be stored on a dedicated USB key kept in a locked cabinet and office, at the
University of Guelph until the publication of the study results, after which, it will be destroyed. Any findings released from the outcome of this study will not be directly linked to any of the project participants.

**POTENTIAL RISKS**

We do not expect there to be any risk or negative consequence as a result of your participation. You are free withdraw from the study at any time, without penalty or explanation, and you may skip any questions you would prefer not to answer.

**POTENTIAL BENEFITS**

It is not known whether this study will directly benefit you. You may gain satisfaction from knowing that your participation may assist in improvement of health and disease monitoring in the small ruminant industries.

**PARTICIPATION AND WITHDRAWAL**

You can choose whether to participate in this study or not. If you volunteer to participate in this study, you may choose to withdraw at any time without any consequence. You may also refuse to answer any questions and still remain in the study. The survey data will be collected anonymously and therefore cannot be removed once it is submitted. The investigators may withdraw you from the study if they feel it is necessary.

**RIGHTS OF RESEARCH PARTICIPANTS**

This project has been reviewed by the University of Guelph Research Ethics Board for compliance with federal guidelines for research involving human participants. You do not waive any legal rights by agreeing to take part in this study.
If you have any questions regarding your rights and welfare as a research participant in this study (REB #17-06-023), please contact: Director, Research Ethics; University of Guelph; reb@uoguelph.ca; 519-824-4120 ext. 56606.

CONSENT OF RESEARCH PARTICIPANT

I have read the information provided for the study, “Distance Support for On-Farm Investigation of Adult Small Ruminant Mortalities” described herein. My questions have been answered to my satisfaction and I agree to participate in this study with the assurance that my identity will remain. However, I agree to the use of verbatim quotes in any published materials and presentations as long as my identity remains protected.

- I consent to participate in the study
- I do not consent to participate in the study

1. SHEEP AND GOATS: Please rate the usefulness of each of the following components of the SRAM postmortem submissions in making a diagnosis on a scale from 1-10, 1 being not at all useful in making a diagnosis, and 10 being very useful in making a diagnosis:

- Set of standard photographs

  1  2  3  4  5  6  7  8  9  10

- Complete clinical and animal management information from farm
2. **SHEEP:** Please indicate how useful for making a diagnosis having the intact head submitted for examination was on a scale from 1 to 10, 1 being not at all useful in making a diagnosis and 10 being very useful in making a diagnosis.

3. **GOATS:** Please indicate how useful for making a diagnosis having the intact head submitted for examination was on a scale from 1 to 10, 1 being not at all useful in making a diagnosis and 10 being very useful in making a diagnosis.

4. **SHEEP:** What components (examples: tissue set, intact head, case history etc.) of the SRAM postmortem submissions were most helpful to you in making a diagnosis? What components were least helpful? Please indicate why for both responses.
5. **GOATS:** What components of the SRAM postmortem submissions were most helpful to you in making a diagnosis? What components were least helpful? Please indicate why for both responses.

________________________________________________________________________

________________________________________________________________________

6. Was the quality of SRAM postmortem submissions improved compared to adult small ruminant postmortem submissions from outside of the program?

- Yes
- No
- Unable to determine

7. If you answered ‘YES’ to Question 6, please describe in what ways you felt the submissions were improved.

________________________________________________________________________

________________________________________________________________________

8. Was sufficient information provided in the required case history to assist with your diagnosis and interpretation?
9. If you answered ‘NO’ to Question 8, what other information would have assisted in your diagnosis?
________________________________________________________________________
________________________________________________________________________

10. Are there any changes you would make to components of the SRAM postmortem submissions to improve your ability to make a diagnosis?
________________________________________________________________________
________________________________________________________________________

11. Are there any components currently missing you would add to the SRAM postmortem submissions to assist you in making a diagnosis?
________________________________________________________________________
________________________________________________________________________

12. Are there any other comments you would like to share about your experience with the SRAM postmortem submissions for sheep and goats?
________________________________________________________________________
________________________________________________________________________
Appendix E: Evaluation of the Small Ruminant Adult Mortality System

Step One: Gather Preliminary Information

Background Information

*What animal health surveillance program is being evaluated?*

Distance Support for On-Farm Investigation of Adult Small Ruminant Mortalities.

The Distance Support for On-Farm Investigation of Adult Small Ruminant Mortalities program involves the use of an online tool to, support the on-farm performance of postmortems for sheep and goats in Ontario, and enhance postmortem sample submissions to the Animal Health Laboratory at the University of Guelph.

*What is the scope of the evaluation?*

The project collects adult sheep and goat postmortems from all commodity sectors (dairy, meat, fibre) in Ontario. Animals must be one year of age and be submitted from a farm that raises livestock for commercial purposes by a veterinarian licensed to practice in Ontario.

The evaluation will include the entirety of the surveillance program, including the webtool, submission kits and communication of case outcomes to producers, since its inception in April 2017.

*Why is the program being evaluated?*

The project is being evaluated as part of the grant requirements for the project and to investigate the potential for on-going use of the system. It is also being evaluated to test the application of a new framework for the evaluation of animal health surveillance programs.
**Identify and Engage Program Stakeholders**

*Who are the Program Stakeholders?*

See Figure 1 for the diagram describing the program stakeholders and operation of the program. See Table 1 for a grouping and description of program stakeholders.

*Identify which stakeholder groups will use the evaluation results*

The Small Ruminant Adult Mortality Project team will use the results of the evaluation.

*What do the evaluation users want to know?*

Did the project improve the diagnostic rate for adult small ruminant postmortems performed on-farm, submitted to the Animal Health Laboratory?

Did the project change the way veterinarians report doing postmortems?

What changes could improve the utility of the online tool for veterinarians?

Did participation in the project change producers’ views of postmortems and the likelihood that they will use postmortems in the future? Did this improved service change (improve) producers’ views of the value of their veterinarian to maintaining the health of the flock/herd?

To what extent will stakeholders be involved in the development of the evaluation purpose and plan?

The SRAM project team will develop the evaluation purpose and plan. No other stakeholder groups will be involved in this portion of the evaluation.

*Identify the evaluation purpose*

*What is the main purpose of the evaluation?*
To determine the value of the use of the online support tool for postmortems in the small ruminant industries and explore what improvements could ensure its uptake and success going forward.

**Step Two: Describe the Program**

**Why Does the Program Exist?**

_Why was the surveillance program created?_

The increased demand for small ruminant commodities provides opportunity for growth in the Ontario small ruminant industries; however, individual and flock/herd health and disease issues can limit the ability of production to grow with demand. Little information is available on the causes of unexpected or unexplained mortality in adult animals in Ontario. This is likely due to lack of investigation into on-farm deaths and a lack of high-quality investigative techniques when investigation does occur.

This program was designed to improve investigative techniques, thereby improving diagnostic outcomes and surveillance of diseases of importance in adult small ruminants in Ontario.

**What to Know About the Program**

_What populations does the program encompass?_

Sheep and goats from commercial (non-hobby) farms in Ontario that are at least one year of age are the population of interest.

This population was chosen for this program because no research has addressed mortality in Ontario’s adult small ruminant populations.
The sample population comes from postmortem cases from adult animals that have died or are euthanized on-farm due to unknown causes. These cases are submitted on a voluntary basis to the AHL through the project website by an Ontario small ruminant veterinarian, who perform the postmortem at the request of a small ruminant producer.

*What is the goal of the program?*

The goal of the project is to improve surveillance of diseases responsible for unexplained or unexpected mortality in Ontario’s adult small ruminants, by improving diagnostic outcomes and uptake in performance of on-farm postmortems.

*What are the program objectives?*

Improve the completeness of case history data including signalment, animal management and clinical findings, submitted to the AHL with tissues obtained from an on-farm postmortem.

Improve the quality of tissue submissions to the AHL from on-farm postmortems.

Provide high-quality diagnostic information for veterinarians and producers to use in health management planning for their flock or herd.

*What are the program activities?*

With kits and instructions provided by the project team, veterinarians gather data and perform postmortems on-farm on freshly deceased adult sheep and goats.

Veterinarians ship tissue samples to the AHL and fill in a comprehensive online form for submission of case history, including digital photographs.

AHL pathologists process the case and provide veterinarians with a diagnostic report.
Veterinarians share that diagnostic information with their clients. Though not an explicit part of the program, it is encouraged that veterinarians and producers use that information to develop flock/herd health programs.

**Where Does the Program Operate**

*Where are the program activities conducted?*

The program is open to all commercial small ruminant producers in Ontario. Postmortems are conducted on small ruminant farms or in their local veterinary clinic.

Diagnostic testing takes place at the University of Guelph Animal Health Laboratory in Guelph, Ontario.

**When Does the Program Operate**

*When does the program operate?*

Surveillance began in April 2017 and will continue until November 30th, 2018.

The program procedure begins when a producer notifies their veterinarian that they would like a postmortem performed on a suitable animal. The veterinarian performs that postmortem and submits samples and the online case form to the AHL through the project website.

**Step Three: Design an Evaluation Plan**

**Assess Resources**

*What resources are available for the evaluation?*
Budget: All required funds are available through the Ontario Ministry of Agriculture, Food and Rural Affairs – University of Guelph Partnership Knowledge Translation and Transfer project grant to support the evaluation of the project.

Timeframe: The preliminary evaluation should be completed by the deadline for reporting to the funding body (December 31st, 2018).

Personnel: The project team will conduct and report on the evaluation. Jeanette Cooper, the Masters student on the project will conduct the evaluation as part of her thesis research.

**Develop Questions**

*What evaluation questions should be asked to address the evaluation purpose?*

1. Were postmortems conducted under the SRAM system associated with higher diagnostic success than historical cases not submitted through the system?
2. Did the program change the way veterinarians perform postmortems on-farm?
3. What changes would enhance the utility of the online tool?
4. Did producers find value in the postmortems submitted by their veterinarians through the program?
5. Are producers more likely to have their veterinarian perform and submit on-farm postmortems in the future after their experience with this program?

*What performance attributes should be assessed?*

No specific attributes will be assessed as part of this evaluation

**Choose/Design Methods**

*How can each evaluation question be answered?*
1. To answer this question a comparison will need to be made between the diagnostic rate for on-farm sheep and goat postmortem cases submitted without the use of the online tool and the diagnostic rate for cases submitted with the use of the online tool.

2. To answer this question, we will need to determine if the veterinarians continue to use the postmortem procedures required for the project.

3. To answer this question, we will need to understand what parts of the online tool the veterinarians like and what parts of the tool they did not like or did not perform well. We should also determine which components were useful for pathologists when making diagnoses. We should also determine what changes they would like to see if they are going to continue using the tool going forward.

4. To answer this question, we should determine what the producers felt they were able to gain from the postmortem diagnostic information they received, both for that animal and relevant to the improved health of the herd/flock.

5. To answer this question, we will need to ascertain from producers if they are planning to perform further postmortems in the future and if this is a change from their previous use of postmortems on farm.

Which stakeholders should be engaged in the evaluation?

For this evaluation, the sheep and goat producers, the veterinarians and the AHL pathologists should be engaged as a part of this evaluation process.

What evaluation questions can be answered with data collected from stakeholder engagement and what questions will require data from other sources?
Question 1 will require diagnostic reports for cases of on-farm postmortems submitted to the Animal Health Laboratory both historically and throughout the program operation.

Questions 2, 3, 4 and 5 can be answered with data collected from veterinarians, producers and pathologists.

*What methods should be used to engage stakeholders? What methods should be used to collect data from other sources?*

Focus groups and interviews should be used to engage producers and veterinarians to collect data for Questions 2-4.

An online survey can be used to collect data from the AHL pathologists for Question 2.

Collection of diagnostic information from the AHL should be used to answer Question 1.

*How will the data be accessed?*

Dr. Maria Spinato is a part of the SRAM project team and has access to the diagnostic reports for adult sheep and goat postmortems in electronic form. She will access and summarize the diagnostic information needed to answer Question 1.

Focus groups and interviews will be used to engage producers and veterinarians for the data collection process for Questions 2-4 and a survey will be used to collect data from pathologists for Question 2. To conduct the focus groups, interviews, and survey, permission will need to be obtained from the University of Guelph’s Research Ethics Board. Participants can then be recruited by Jeanette Cooper

*What data collection tools are needed?*
No specific tool is needed to collect the diagnostic information, as it is already available in the form of diagnostic reports.

To collect the information necessary to answer Questions 2-4 a semi-structured interview guide will need to be developed for the focus groups/interviews with each of the two stakeholder groups (veterinarians and producers). A survey will need to be developed to be administered to the pathologists.

**Create a Data Collection and Analysis Plan**

*Who will collect the data for the evaluation?*

Data collection for Question 1 will be conducted by both Jeanette Cooper and Dr. Maria Spinato from the SRAM project team.

The evaluation will be conducted by Jeanette Cooper, the Masters student involved with the SRAM project team. Data collection for Questions 2-4 will be conducted by this student.

*How will the data be stored and organized?*

Data for Question 1 is stored in Animal Health Laboratory records. It will be accessed to create a spreadsheet that can be further analyzed.

Recordings of focus groups and interviews will be stored on an encrypted USB in a locked cabinet with the research team at the OVC. Transcripts, once created, will be similarly stored.

Data from the survey, once collected can be stored similarly to the focus group and interview data.

*How will the data be analyzed?*
The diagnostic data from Question 1 will be used to calculate an odds ratio for diagnostic success between the 2 groups and determine if this odds ratio is statistically significant. This analysis will be conducted by Jeanette Cooper.

The focus group/interview data for Questions 2-4 will be analyzed using thematic analysis that will be completed by Jeanette Cooper and Dr. Andria Jones-Bitton, another member of the SRAM project team.

Averages can be used to interpret the data from the survey, using any provided comments for added context.

Are there targets indicated by your evaluation questions?

No targets for comparison are indicated by the evaluation questions.

Step Four: Evaluate, Recommend and Report

Make Final Recommendations

Who should be involved in determining the final recommendations?

The SRAM project team will be involved in determining the final recommendations for the project based on the data.

What are the recommendations for the program?

The project team will use the data for each evaluation question to determine if the program should continue and what changes should be made to the program to ensure continued uptake and success for the project if it does continue.

Develop and Action Plan
What actions should be taken, based on the recommendations?

This will be developed in conjunction with the SRAM project team based on the recommendations.

Report

Who should receive the results of the evaluation?

The funding body, the Ontario Ministry of Agriculture Food and Rural Affairs – University of Guelph Partnership Knowledge Translation and Transfer program, should receive a full report of the evaluation findings.

Academics may be interested in the results as this evaluation will serve as a test case for the Animal Health Surveillance Evaluation Framework.

Ontario veterinarians, Ontario sheep and goat producers, and AHL staff may also be interested in the findings of the evaluation as they have been participants in the project.

How will the results be communicated to the target audience?

The funding body will receive the results of the evaluation as part of the final project report during the project wrap-up.

To communicate with academic audiences, the evaluation findings will be published in Jeanette Cooper’s thesis and in an academic journal focused on evaluation.

To communicate with veterinarians and producers, results can be published in the communications bulletins through which initial information about the project was disseminated, such as organization newsletters (Ontario Sheep Farmers, Ontario Goat, Small Ruminant...
Veterinarians of Ontario) and the OAHN’s veterinarian and producer reports. The results can also be communicated at producer and veterinary meetings through poster and oral presentations.
Figure 2. Program Map of the Small Ruminant Adult Mortality Project
<table>
<thead>
<tr>
<th>Group</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>These groups are responsible for requesting postmortems for unexplained or unexpected adult mortalities, including euthanasias, from their local veterinarian.</td>
</tr>
<tr>
<td></td>
<td>- Ontario Sheep Producers</td>
</tr>
<tr>
<td></td>
<td>- Ontario Goat Producers</td>
</tr>
<tr>
<td>Group 2</td>
<td>This group is responsible for performing postmortems on farm and submit them to the Animal Health Laboratory</td>
</tr>
<tr>
<td></td>
<td>- Ontario Small Ruminant Veterinarians</td>
</tr>
<tr>
<td>Group 3</td>
<td>This group receives the postmortem cases, performs the case testing and reports the diagnostic results</td>
</tr>
<tr>
<td></td>
<td>- University of Guelph Animal Health Laboratory Pathologists</td>
</tr>
<tr>
<td>Group 4</td>
<td>This group designed and administers the project</td>
</tr>
<tr>
<td></td>
<td>- SRAM Project Team</td>
</tr>
</tbody>
</table>