

Understanding drivers of how to improve producer-led passive surveillance among smallholder livestock producers in Australia

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Abstract

Smallholder livestock producers are believed to pose higher risks for disease introduction and spread than commercial producers. One of the main reasons for this is an assumption that smallholders do not possess adequate level of knowledge of diseases, disease management and reporting. Knowledge is a key driver in influencing behaviour and is also a primary feature of passive disease surveillance. A cross-sectional study, using a postal survey (n=1140) and focus group discussions (n=28), was conducted to understand the animal health management and communication practices of smallholders keeping sheep, cattle, pigs, dairy goats and alpacas in Australia; practices that could influence the effectiveness of producer-led passive surveillance. Findings indicate that animal health management practices, such as contact with veterinarians and attitudes towards reporting could be improved, although over 80% of smallholders actively seek information on the health of their livestock. Private veterinarians have a vital role in improving passive surveillance among these producers, given they are the first point of contact in the event of unusual signs of disease and are considered trusted sources of information. In addition, most smallholders would also contact other producers for disease advice, and are less likely to contact government agencies. Among smallholders, emergency animal diseases are not a priority; however, these producers are concerned about the health of their animals. Strategies for improving awareness of disease and disease reporting responsibilities, using private veterinarians and producers as key stakeholders of a producer-led system, could improve the effectiveness of on-farm passive surveillance.

Keywords: *smallholder livestock producers, producer-led surveillance, communication networks*

Introduction

Biosecurity and animal health management practices of smallholder livestock producers are perceived as posing a higher risk for disease introduction and spread than those of commercial producers. Key components and drivers of these practices are awareness and knowledge of diseases and attitudes towards disease reporting. The effectiveness of passive surveillance systems for early detection of disease introductions rely on these practices. The smallholder sector of livestock producers encompasses a broad range of livestock keepers, in relation to species and number of animals kept, land size and motivations for keeping livestock (1,2). It has been reported that a proportion of

smallholders are not registered within government and industry registers, emphasising the role of producer-led reporting of disease events (3).

Recent studies focusing on pig producers have found that attitudes towards disease reporting differed according to herd size and the severity of perceived impact of the disease, with small scale producers being less likely to keep health records and have recent contact with veterinarians (3-5). An additional issue identified was the lack of adequate communication networks between smallholders and industry and government stakeholders (1,4,6). Better extension and communication networks could increase producers' active engagement and participation within their industry, and as a consequence potentially decrease the risk of disease introduction and spread (7).

Limited studies have investigated smallholder animal health management practices that define producers' abilities to recognise and report diseases. These practices will influence the effectiveness of passive surveillance systems in the country. The current study aims to understand these practices and influences among smallholder livestock producers in Australia.

Materials and methods

A cross-sectional study, using a survey and focus group discussions among smallholder livestock producers, was conducted over a three year period. Smallholders included in this study were those keeping less than or equal to 50 head of: (i) cattle and/or sheep, (ii) pigs, (iii) dairy goats and, (iv) alpacas.

Cross-sectional survey

A questionnaire was developed to gather information on demographics and general husbandry, biosecurity, animal health management and communication networks of smallholders. The questionnaire, which included 37 short closed, semi-closed and open questions in a simple, clear format (8), was available in hard copy for postal administration and online via the SurveyMonkey® platform. For the purposes of this paper, eight questions related to passive surveillance are presented. Questionnaires were distributed to smallholders through stakeholder organisations using their existing contact lists. A cohort of 700 cattle and/or sheep smallholders was targeted in each state of Australia (with the exception of the Northern Territory), with a total of 5164 questionnaires distributed. Sample size for each state was calculated, assuming 20% of producers

would conduct a specific practice, 95% confidence level, 5% precision and 30-35% response rate. Questionnaires for alpaca (n=1370), dairy goat (n=476) and pig (n=897) producers were distributed using a census approach.

Data from the returned questionnaires were entered in Excel (PC/Windows XP, 2007) and descriptive and statistical analysis was conducted using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. Associations of a list of explanatory variables (gender, animal species kept and biosecurity knowledge) with animal health management practices, were investigated using univariable and multivariable logistic regression analysis, with significant associations defined at $P < 0.05$.

Focus groups

From identified regions of smallholder population in South-Eastern Australia (1, 9, 10), three representative areas were selected for inclusion - Riverina region (NSW), South Coast region (NSW) and Euroa/Benalla region (Victoria). Eight to ten smallholder producers were recruited in each region through advertisement sent by government stakeholders. Each focus group, which had 2-3 hours duration, was facilitated by two researchers. The focus groups comprised structured activities and open discussions in relation to diseases of importance and communication networks. All discussions were recorded via a tape-recorder for subsequent transcription. Descriptive and categorical data from the structured activities was recorded and analysed in Microsoft® Excel (Windows XP, 2006) and qualitative data was analysed using thematic content analysis (11).

Results

Cross-sectional survey

A total of 1140 smallholders participated in the survey, including 746 cattle/sheep smallholders, 198 pig smallholders, 103 dairy goat producers and 93 alpaca producers. In relation to demographic characteristics, most respondent smallholders were over 45 years of age, with the majority of cattle/sheep and pig smallholders being males (67.5 and 68.1%, respectively) and for alpaca and dairy goat producers, the majority being female (78.1 and 73.3%, respectively). A summary of the animal health management and communication practices is shown in Table 1 and 2, respectively.

Only a third of smallholders keeping cattle, sheep and pigs had contacted a veterinarian in the past 12 months, whilst most dairy goats and alpaca smallholders reporting this practice ($P < 0.05$). Keeping animal health records was also higher ($P < 0.05$) among dairy goat and alpaca smallholders.

Despite these differences, most respondents indicated that they would contact a private veterinarian if they saw unusual symptoms of illness or disease (88.4%-97.6%), compared to a lower proportion of smallholders who would contact government agencies. Most smallholders (67.5%-80.3%), except those keeping pigs (36.2%), would also contact other producers when facing unusual signs of disease. Daily inspection of stock occurred less frequently in those keeping ruminants when compared to pigs, alpaca and dairy goats. Among smallholders

keeping ruminants, more ($P < 0.01$) producers keeping cattle would record diseases (60.7%) and contact veterinarians (46.2%) than those keeping sheep (35.5 and 29.8%, respectively). Furthermore, for all smallholders, females were more likely than males to contact a veterinarian and keep animal health records ($P < 0.01$). Interestingly, ruminant smallholders who had a moderate to high understanding of biosecurity were also more likely ($P < 0.01$) to have contacted a veterinarian (45.2%) than those with lower understanding (31.5%).

Table 1. Animal health and management practices of smallholder livestock producers participating in cross-sectional study during 2013-2016.

Practice	Species, n(%)			
	Ruminants	Pigs	Dairy Goats	Alpacas
Frequency of livestock inspection				
Daily	Cattle 375(62.3) ^b Sheep 184(66.9) ^b	190(97.4) ^a	96(97.0) ^a	72(81.8) ^a
Weekly	Cattle 200(33.2) ^b Sheep 76(27.6) ^b	4(2.1) ^a	3(3.0) ^a	12(13.6) ^a
Fortnightly	Cattle 21(3.5) Sheep 6(2.2)	1(0.5)	0	2(2.3)
Monthly	Cattle 6(1.0) Sheep 9(3.3)	0 (0.0)	0	2(2.3)
Record the number of animals with disease				
	351(54.8) ^b	75(45.2) ^b	83(89.2) ^a	76(88.4) ^a
Record the number of animals that died or were euthanased				
	416(63.5) ^b	91(54.8) ^b	93(96.9) ^a	78(90.7) ^a
Record treatment routine				
	425(66.3) ^b	114(68.7) ^b	76(77.6) ^b	80(93.0) ^a
Contacted a vet in the last 12mths				
	257(35.2) ^b	64(32.7) ^b	72(72.7) ^a	70(79.5) ^a
If no, last time veterinarian contacted				
Never	116(27.0) ^{ab}	50(43.5) ^a	4(14.8) ^b	6(33.3) ^{ab}
1-2 yrs ago	119(27.7) ^b	34(29.6) ^b	12(44.4) ^{ab}	11(61.1) ^a
3-5yrs ago	108(25.1) ^a	16(13.9) ^b	10(37.0) ^a	1(5.6) ^b
>5yrs ago	87(20.2)	15(13.0)	1(3.7)	0
What would you do if you saw symptoms of disease or unusual behaviour in your livestock?				
Do nothing	14(4.1)	6(5.5)	4(6.3)	1(1.7)
Treat myself				
	134(79.8)	49(84.5)	75(91.5)	65(84.4)
Call other producer				
	135 (67.5) ^a	25(36.2) ^b	46(67.6) ^a	53(80.3) ^a
Call veterinarian				
	237(88.4)	78(94.0)	90(94.7)	80(97.6)
Call livestock agent / saleyard				
	27(7.1)	4(3.1)	2(3.4)	3(5.6)
Call Government agency				
	43(14.3) ^b	23(25.6) ^a	22(34.4) ^a	14(24.6) ^a
Call the Emergency Animal Disease Watch Hotline				
	29(7.9) ^a	15(14.7) ^a	0	1(1.1) ^b

^{a,b,c}: For each row, different superscripts differ $P < 0.05$

Table 2. Main sources of information on livestock management and health reported by smallholders participating in cross-sectional study during 2013-2016.

Practice	Species n(%)			
	Ruminants	Pigs	Dairy Goats	Alpacas
Seek information on management and health of livestock?				
	597(82.9)	163(82.3)	89(92.7)	82(95.3)
Most useful sources of information				
Government	311(52.1) ^a	98(60.1) ^a	36(37.5) ^b	31(36.0) ^b
Veterinarian	402(67.3) ^a	109(66.9) ^a	76(79.2) ^b	70(46.5) ^c
Rural supplier	227(38.0) ^a	44(27.0) ^b	28(29.2) ^b	21(24.4) ^b
Other producers	149(25.0) ^a	32(19.6) ^a	62(64.6) ^b	67(77.9) ^b
Industry breed groups	72(12.1) ^a	34(20.9) ^a	41(42.7) ^b	34(39.5) ^b

^{a,b,c}: For each row, different superscripts differ $P < 0.05$

The vast majority of smallholders indicated that they sought information on the management and health of their livestock, with veterinarians considered to be the most useful source of information by all smallholders, except for those keeping alpacas ($P < 0.05$), of which less than half of respondents considered veterinarians as useful sources of information. Information from other producers and industry breed groups was more likely ($P < 0.05$) to be considered useful among dairy goat and alpaca smallholders; whilst government sources were more likely to be considered useful information sources by ruminant and pig producers ($P < 0.05$).

Focus groups

A total of 28 ruminant smallholders, participated in the three focus groups. When asked to list the three diseases considered being of most importance to themselves or their livestock operations, endemic diseases, such as internal parasites and clostridial diseases, were listed most frequently. Some emergency animal diseases and exotic diseases, such as Foot and mouth disease, were listed by some producers; however, these were not considered a priority for smallholders. The reasons for participants considering a disease to be of importance in order of ranking was; animal welfare (39.7%) and loss of income (31.6%), followed by impact on livestock industries and the Australian economy (16.1%), with impact on neighbours (7.7%) and personal/family health (4.8%) receiving the lowest rank.

The communication networks of smallholders with regards to livestock health and management was further examined. Participants reported their most frequent contacts to be with neighbours, other producers, family, friends and veterinarians, with government sources and producer associations being considered infrequent contacts.

Discussion

The aim of this study was to develop an understanding of the factors that may influence smallholder livestock producer's engagement with disease management and disease reporting, key practices of the on-farm component of a passive surveillance system. Regular observation of livestock is essential for the early detection of disease, with delays having potential financial and eradication implications (12). The current study finding that over 95% of smallholders inspected their livestock at a minimum weekly interval, suggests that smallholders are engaging at some level in passive surveillance. The extent to which this practice is effective is, however, dependent on the level of knowledge of clinical signs of disease and the subsequent action taken once such signs are observed (12-14). Results from this study suggest that although smallholders are concerned about the health of their animals, do not consider emergency animal diseases to be a priority and as such, the effectiveness of animal inspection for early detection of diseases could be compromised.

Behaviour is influenced by a complex combination of factors; with knowledge, beliefs, attitudes and trust all playing an important role (15,16). For producer-led passive surveillance to be effective, producers, in this case smallholders, must trust both those from whom they receive information and those to whom they provide information (17). Recent studies have shown that whilst veterinarians are considered to be a trusted stakeholder, thereby placing them in a strong position to influence the behaviour of smallholders, there is a considerable level of mistrust of government sources (7,16).

The role of other producers in disease management must not be underestimated as was found to be the case in the current study; this group is one of the primary contacts in the event of the observation of unusual symptoms of disease. It is important that the correct health related information is shared between producers, leading to the suggestion that well informed "champion" producers could be included as part an overall producer-led passive surveillance strategy.

There is a need for a coordinated approach among all those involved with smallholder producers to develop appropriate channels and communication strategies to ensure that the efficacy of producer-led passive surveillance is maximised.

References

1. **Hollier and Reid.** RIRDC, Victoria, 2007
2. **Hernández-Jover et al.** (Unpublished results)
3. **Schembri et al.** *Prev Vet Med* 118(1): p104-116, 2015
4. **Schembri.** Faculty of Veterinary Science, University of Sydney: Camden, 2009
5. **Schembri et al.** *Animal Production Science* 50(9), 852-862, 2010
6. **Hernández-Jover et al.** *Prev Vet Med* 110(3-4), 497-509, 2013
7. **Hernández-Jover et al.** *Prev Vet Med* 104(3-4), 258-270, 2012

8. **Dillman.** Wiley: New York, 2000
9. **Aslin et al.** Bureau of Rural Sciences: Canberra, 2004
10. **Hollier et al.** RIRDC: ACT, 2008
11. **Silverman.** SAGE Publications Limited, 2013
12. **East et al.** *Prev Vet Med* 123, 1-11, 2016
13. **Martin et al.** *Prev Vet Med* 121(3), 215-230, 2015
14. **Hadorn, Stärk.** *Veterinary Research* 39(6), 1, 2008
15. **Fishbein, Ajzen.** Reading, MA.: Addison-Wesley, 1975
16. **Palmer et al.** *Sociologia Ruralis* 49(4), 360-374, 2009
17. **Garner et al.** *Prev Vet Med* 128, 78-86, 2016

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