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ORIGINAL ARTICLE

Analysis of substantiated welfare investigations in extensive farming systems in Victoria, Australia

N Williams,[a*] L Hemsworth,[a] S Chaplin,[b] R Shephard[c] and A Fisher[a]

Substantiated incidents of poor welfare affecting cattle, sheep and goats (livestock) in non-dairy extensive farming systems continue to occur. This study sought to describe the common causes of poor welfare of livestock and the associated circumstances, by analysing 39 years of de-identified, livestock welfare investigation records. There were a total of 2179 alleged offenders (AOff), defined as individual/s that had an incident of poor welfare affecting livestock on at least one occasion. Approximately 27% of AOff were found to have poor welfare on more than one occasion. The majority of livestock welfare incidents were associated with neglect, more specifically, inadequate nutrition (56%), treatment (65%) and management/husbandry (83%). Records of malicious acts were rare (1%). In the analysis, cases were allocated to 10 animal welfare severity categories (AWSC) based on the number of incidents and visits, whether the AOff reoffended, or if the incident was ongoing and whether the welfare issue was likely to affect the whole herd. A significantly higher proportion of cases in the most severe AWSC had a failure to shear, mark, dip/drench, draft and wean/cull, were overstocked or were not providing proper and sufficient feed, compared to the least severe AWSC ($P \leq 0.05$). Reoffending was significantly more likely when animals were found to be injured/unwell, recumbent, stuck in mud/yard/pen or in poor body condition, or when there was a failure to wean/cull, mark, dip/drench and draft. Some of the issues identified here may be risk factors more commonly identified on farms with poor livestock welfare.

Keywords animal welfare; complaints; extensive farming; starvation; treatment

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The most common cause of reported poor welfare in livestock is neglect[1,2] while malicious acts are rare.[3,4] Extensive livestock farming tends to be considered better for animal welfare, with more freedom to express natural behaviours, compared with intensive systems,[5,6] although incidents of poor welfare still occur.[3,7]

Livestock welfare investigations in Australia are managed at the State and Territory level[8] and each jurisdiction has its own animal welfare legislation.[9] In the state of Victoria, through a Memorandum of Understanding,[10] the State Government (Agriculture Victoria) investigates livestock welfare complaints when there are at least 10 livestock present and the Royal Society for the Prevention of Cruelty to Animals (RSPCA) Victoria responds when there are less than 10 livestock or when the complaints refer to horses and other non-livestock species. In Victoria, the *Prevention of Cruelty to Animals Act* (*1986*, POCTAA),[11] provides the authorising environment for the investigation of animal welfare complaints. Suitably qualified Agriculture Victoria (AgVic) staff are appointed by the Minister or Secretary to be Authorised Officers (AO). Those AOs have various powers under POCTAA to inspect situations where they reasonably believe there are breaches of the legislation.[11] These powers allow AOs to sample affected animals, perform euthanasia, arrange feed, water and seek veterinary attention where it is deemed necessary[12] to assist with the investigation and achieve compliance.[11]

In Victoria, animal welfare investigations are triggered in response to AgVic receiving a complaint.[13–15] Complaints may be received from veterinarians,[4] government staff, the general public[16,17] and animal protection organisations such as the RSPCA.[18] Complaints are triaged by AOs to determine the urgency of response. This decision is based on the likely severity of welfare compromise and the number of animals affected. Some complaints are resolved through a telephone conversation with the alleged offender (AOff). The majority of complaints are investigated through a visit to the farm and inspection of the livestock. Based on the visit findings, the AOs decide if there has been an alleged breach in the legislation (non-compliance).[19] If so, the complaint is referred to as substantiated.[20] Most situations are resolved by providing advice to owners on the measures required to improve the health and welfare of the livestock.[13,14] In some more serious incidents, AOff will be prosecuted,[13,14,17] sometimes accompanied with seizure of the animals.[13,14]

As poor welfare of livestock on farms continues to occur, more needs to be done to understand the complex underlying problems.[21,22] Animal welfare challenges associated with farming livestock in extensive production systems have been studied widely in the literature.[1,6,7,23–27] However, studies of welfare investigations that have identified breaches in the relevant legislation, in extensive farming systems, are rare.

Previous research has identified that the farmer is vital in managing animal welfare.[28–31] Issues such as stress,[21,30] poor mental health,[21,30] age[30] and financial issues[21] have been identified as possibly contributing to the occurrence of poor livestock welfare events. In Victoria, seasonal

*Corresponding author.
[a]Animal Welfare Science Centre, Faculty of Science, University of Melbourne, Parkville, Victoria, Australia; natscottw@gmail.com
[b]Agriculture Victoria, Department of Energy, Environment and Climate Action, Tatura, Victoria, Australia
[c]School of Electrical and Data Engineering, Faculty of Engineering & IT, University of Technology Sydney, Sydney, New South Wales, Australia

rainfall was found to have some predictive capacity for the number of complaints, with lower rainfall being associated with a rise in complaints. However, it was not the only factor involved, as many animal welfare incidents occur in years when rainfall has not been limiting.[18] Other factors that impact on pasture growth[32] may also be associated with the number of welfare incidents, including the timing of rainfall[18] and temperature. Seasonal conditions that vary the prevalence of endemic problems such as fly strike,[33] footrot[8] and internal parasites may also impact the number of welfare cases.

It is likely that there is no single factor, but instead a complex range of factors that underlies the state of animal welfare on a farm.[16,21,22] Understanding the underlying factors that occur in each situation of poor welfare is important.[29] Reviewing outcomes of previous welfare investigations should help to identify underlying issues for first time and repeat offenders, enabling more specific intervention and more effective monitoring.[29] Others have proposed that livestock at risk of poor welfare may be predicted by identifying key indicators commonly available in pre-existing databases[34–37] or by identifying farm-based factors,[21,25,30,38] allowing for early intervention and appropriate farmer support.

Through detailed analysis of a large database of past livestock welfare investigations, this study aimed to describe and understand the nature, extent and cause of substantiated livestock welfare issues affecting cattle, sheep and goats in non-dairy extensive farming systems in Victoria, Australia. Secondly, this study aimed to identify issues more commonly associated with more severe welfare cases and those that reoffend. It may be possible to use this type of information to assist in developing a risk assessment tool to identify livestock at risk of poor welfare.

Methodology

The details of Agriculture Victoria's past animal welfare investigations have been recorded electronically in two successive databases, since 1981. The first, Animal Disease Management Information System (ADMIS), was replaced by Compliance MAXimum Biosecurity (CMAX), from 1 July 2017, however some data were recorded in both databases until the end of the data collection period, at the end of December 2020. Prior to ADMIS, investigations were recorded in paper files stored in regional offices.[20] It is likely that the use of these files continued well after 1981 as there were few entries in ADMIS until the 2000s. Historical paper animal welfare files were not reviewed in this study. In Victoria, the ADMIS and CMAX records were made by animal health and veterinary officers pertaining to all animal welfare investigations. The records included some drop-down fields, but the majority of the investigation details were recorded in free text boxes. There was considerable variation in the amount of detail recorded.

Data preparation

The ADMIS data from 1981 until November 2020 included 17,457 entries. The CMAX data included investigation notes from 1 July 2017 to 31 December 2020, including 4399 activities. Officers recorded every event (e.g. visit, telephone call, letter) relevant to an animal welfare investigation in the appropriate database.[20]

For this study, only substantiated incidents of poor welfare impacting on cattle, sheep and goat non-dairy farming systems (livestock), where there were at least 10 livestock present, were considered.

For the current study, an AOff was a person or several persons responsible for livestock found to have poor welfare, allegedly in breach of the legislation, on at least one occasion. An AOff could own or manage several properties. Each AOff had at least 10 non-dairy cattle, sheep or goats present on the property, although only one animal may have had poor welfare. An "incident" was any new, substantiated animal welfare investigation occurring in an extensive farming system. Reoffenders were AOff that had more than one incident of poor welfare. An 'event' was any interaction or attempted interaction with the person responsible for the animals. This included visits to the property, telephone calls, interviews, advisory letters, the use of legal instruments such as Notice to Comply (NTC), warning letters or prosecution. Investigations are the process of responding to animal welfare complaints, identifying if there has been an offence under the legislation and working with the farmer to resolve the issues.

In the ADMIS data, there was a '*contact outcome*' field, and outcomes of no further action, no action required or nil were unsubstantiated cases and removed. In CMAX, cases that were unsubstantiated were identified during the data analysis step below and removed at that point. Entries involving non-target species (e.g. dairy cattle, pigs, horse, etc.) and where there was insufficient information to determine the type of animals affected or the nature of the issue were also removed. In CMAX there was an '*identifier category*' which made it possible to easily identify and remove welfare issues that were found associated with the identifiers: abattoirs, feedlots, carriers, sale yards, knackery's, stock agents and transporters, that were not relevant here. Identifiers of producer, hobby farmer and bee keeper were retained if the affected animals were the key species of this study. Duplicate entries for the same case were removed. Any entries that referred to animals that were abandoned (owner unknown) or were from outside of Victoria were also removed. By comparing CMAX entries to ADMIS, incidents or events duplicated in both databases were identified and the CMAX copy was removed.

In the ADMIS data, the town where the incident occurred was retained for location mapping purposes, but there was no location data in CMAX.

Data analysis

Sixty-six variables were used as a template to code information from the case data. The list of the variables, their definitions and the key descriptors used to decide if they were relevant or not to a case can be seen in appendices 1–7. The variables were divided into seven categories: (1) Investigation details; (2) Main welfare issues; (3) Animal; (4) Farm; (5) Nutrition; (6) Management/husbandry; and (7) Farmer. It is acknowledged that many of the variables in the animal, farm and nutrition categories could have been included under management, but were separated out for the purposes of this study. Six of the variables were about the time spent, distance travelled and related to the use of legal instruments and prosecution and these variables were not considered further in this study. The variables were selected based on

experience in investigating instances of poor welfare, an initial review of the first 50 cases and an extensive review of the literature. The aim was to identify variables that could be used to summarise the basic investigation details of the case and secondly, to identify variables that may be more commonly observed on properties where the livestock welfare is poor. Variables that were more likely to be easily observed and also recorded in investigation records were preferred.

All of the recorded information about every case, including every visit or communication via letter or telephone were reviewed in detail. If a factor was identified to be relevant to the case based on any of the records for any investigation, it was considered relevant/present. To be considered not relevant there needed to be direct evidence in the records that the factors were not relevant/present. For example, 'there was plenty of feed present'. If it was not possible to determine the presence/relevance of a factor from the records, it was classified as not determinable. As the data were not created with the intent of detailed analysis, there was considerable variability in details recorded between cases. It was not possible to determine the presence/relevance of every variable for every case, so there were a lot of missing values in the final data set. Therefore, the number of cases with a value (either presence/relevance or absence/not relevance) for each variable was divided by the total number of cases, to determine the proportion of cases with a value (CWV). When CWV was less than 10%, the variables were removed from further analysis. This was because it was deemed these results were not necessarily reflective of all cases and insufficient to provide any meaningful evaluation.

The CWV is included throughout the analysis so the results can be considered based on the proportion of cases for which the relevance/presence of the variable was known. The CWV for all the variables in the farm section varied from 3% to 9%, and were not analysed further. Additionally, 10 of the farmer variables had CWV ≤10% and were removed including variables about the farmer's age, health, finances, time, support, knowledge, attitude and their involvement in a dispute or working off the farm. Finally, the quality of the pasture or hay in the nutrition section could only be determined in 9% of cases and was not analysed further.

Investigation outcomes of historical animal welfare cases. The number of cases that had one or more incidents was determined, as was the proportion of cases that had 1, 2, 3, 4 or ≥5 incidents. The proportion of cases that involved the different species was calculated and compared to the number of properties farming that species in Victoria currently. In addition, that proportion of cases where the welfare issue did or could have impacted on the whole herd was determined. The cases were then summarised according to the main welfare issues that were occurring. In order to review the density of cases based on location, the ADMIS cases were mapped using density mapping, noting these details were not available for the CMAX cases. They were then visually compared to a population density map of Victoria[39] based on data from the Australian Bureau of Statistics.[40]

Comparison using animal welfare severity categories (AWSC). Cases were categorised according to animal welfare severity categories (AWSC) developed for this study, which is detailed in Table 1. The categories of severity were determined by considering the number of visits and incidents, if the incident was ongoing or reoccurring and whether the issues involved 1–3 animals or the whole herd. Cases that were not reoccurring or ongoing, with one incident and 0–2 visits and not involving the whole herd, were nominated as the least severe (AWSC 1), while those cases that were reoccurring, had multiple incidents potentially affecting the whole herd and more than 20 visits were determined to be the most severe (AWSC 10).

In Microsoft® Excel®, the number of cases where a variable was present or relevant was compared between the least and most severe AWSC using the Chi square test (CST) of independence, and those with $P \leq 0.05$ were considered significantly different.

Using cases for which the number of livestock present could be determined, the average number of non-dairy cattle, sheep and goats was determined for each AWSC. For properties where there were mixed species, only non-dairy cattle, sheep and goats were included in this calculation. The number of livestock present was converted into a Dry Sheep Equivalent (DSE) allowing a standardised comparison of stocking rate across different species of livestock. The base DSE unit is the 'amount of feed required by a two-year-old, 50kg Merino wether to maintain its weight'.[41] As the productive nature of the stock present was mostly unknown, all sheep and goats were taken to be 1 DSE and cattle 9 DSE.[41] The average DSE per case for each AWSC was calculated and compared to the average DSE over all

Table 1. Selection criteria to determine animal welfare severity categories (AWSC)

AWSC	No. cases	Herd issue	Ongoing/recurring	No. visits	No. incidents
1	412	No	No	0–2	1
2	910	Yes	No	0–2	1
3	161	Yes and no	No	3–4	1
4	112	Yes and no	Yes	0–2	1–2
5	153	Yes and no	Yes	3–4	1–2
6	83	Yes and no	Yes and no	5–6	1–2
7	103	Yes and no	Yes	2–6	3+
8	114	Yes and no	Yes	7–10	Any number
9	82	Yes and no	Yes	11–19	Any number
10	49	Yes	Yes	20+	Any number

cases in all categories, where a value could be determined. The proportion of cases that reoffended when the DSE was ≤50 and >1000 was compared to the overall average number of cases that reoffended using the CST. All calculations were completed in Microsoft® Excel®.

The average and median distance from Melbourne (the capital city of Victoria) for cases in the least and most severe AWSC (AWSC 1 and 10, respectively) were calculated. Then the CST was used to compare the number of cases that were 100 km or less from Melbourne.

Of the cases where an extenuating circumstance was determined to be present, the proportion of cases with the following types of challenges was determined: natural disaster, family illness/loss, drought, dispute/relationship issues, cold snap, age, significant disease event, producer physical or mental health issues and miscellaneous.

Reoffenders. The proportion of AOff that reoffended when a variable was present/relevant was determined and was compared to the overall number of AOff that reoffended using the CST, differences were considered significant when $P \leq 0.05$.

Results

Investigation outcomes of past animal welfare cases

There were 2179 cases that were investigated for one or more substantiated incidences of poor welfare affecting key livestock species in extensive farming systems in Victoria between 1981 and 2020, as recorded in ADMIS and CMAX. Two thirds (66%) of cases were resolved after two or less visits. A total of 594 (27%) of cases had more than one incident. Of the 594 cases that had more than one incident: 54% had two incidents, 19% had three, 11% had four and 16% had five or more incidents.

The most common welfare issues were related to management/husbandry (83%), failing to provide adequate nutrition (56%) and suitable and timely treatment (65%). Failing to provide suitable access to water and an appropriate environment contributed to poor welfare equally with 6% of cases each and 1% (13 cases) involved a malicious act against livestock. Many cases had more than one issue, hence the total is more than 100%.

Almost equal proportions of cases were recorded to involve just cattle (39%) or sheep (38%). Approximately 21% of cases involved mixed species and 2% goats. The precise number of goat farms in Victoria was not available, however in 2023, there were 3000 specialist sheep[42] and 5300 specialist cattle farms and 2430 mixed livestock farms.[43] This would suggest specialist beef cattle farms have had fewer incidents of poor welfare and sheep farms more incidents, relative to the number of each business type in Victoria. The vast majority of cases (80%) had welfare issues affecting or potentially affecting the whole herd.

The density of substantiated welfare cases by location can be seen in Figure 1. The density of cases mimics the distribution of population density of Victoria[39] based on data from,[40] with more cases reported close to major towns and cities. This excludes Melbourne where the population is very dense but there are no livestock properties.

On average, the least severe AWSC cases were located closer to Melbourne than the most severe AWSC cases, with an average distance of 179 km and 216 km respectively. There were significantly more cases within 100 km of Melbourne in the least severe AWSC compared to the most severe AWSC (23% vs 8%, $P = 0.02$).

Comparison using the animal welfare severity categories (AWSC)

In the most severe AWSC (AWSC 10) there was an average of 7.4 incidents and 33 visits. There was no significant difference between the least and most severe AWSC in the number of incidents that involved a malicious act, as defined in Appendix 2. In the most severe AWSC there were significantly more cases with welfare concerns resulting from issues with nutrition, water, environment, management/husbandry or treatment than in the least severe AWSC (AWSC 1) as seen in Table 2.

In Table 3, it shows there was a significantly higher proportion of cases with breeding animals, injured or unwell stock, livestock that were recumbent, deceased, stuck or in poor body condition in the most severe AWSC compared to the least severe AWSC. The CWV was 61% for DSE, and 59% for 'breeding animals present' indicating the number and sex of the animals were not routinely recorded in the investigation records.

The graphs in Figure 2 show the proportion of cases where animals were found to be unwell or injured, recumbent, stuck in the mud/yard/pen or in poor condition changed for the AWSC from least severe (AWSC 1, left) to most severe (AWSC 10, right). The proportion of cases with injured or unwell animals was the highest in AWSC 1 and 10. The proportion of animals that were recumbent or stuck was fairly consistent across the AWSC 1–7 and then increased in the last three AWSC categories. Lastly, the proportion of animals that were in poor condition increased from the AWSC 1 to 10, but the increase was not consistent between the categories with decreases of around 20% occurring between AWSCs 3–4 and 6–7.

Figure 3 shows the general trend of increasing average DSE with increasing welfare severity. The DSE for the most severe AWSC (AWSC 10) was 2389, more than nine times higher than the least severe AWSC (AWSC 1: 259). On properties where the DSE was ≤50, there were significantly fewer cases (16%) that reoffended compared to the overall average, while in the cases with ≥1000 DSE, 50% reoffended which was significantly greater than the overall average.

There were significantly more welfare cases with issues associated with each of the management/husbandry variables in the most severe AWSC compared to the least severe AWSC (AWSC 1) as seen in Table 4. The CWV for all the management/husbandry variables was more than 95%.

The graphs in Figure 4 show how the proportion of cases in which there was unsuitable use of males, overstocking, a failure to wean/cull, mark, dip/drench or draft increased as the severity of the AWSC increased from left (AWSC 1) to right (AWSC 10). For the variable, failing to wean/cull, the proportion of cases in AWSC 1 was higher than the following four categories. This corresponds with the high proportion of animals that were injured and unwell in this category. As all the cases in AWSC 1 only involved 1–3 animals, this is likely to reflect a failing to cull individual animals that were injured or unwell, rather than a failing to wean, which is more likely to be an issue affecting the whole herd.

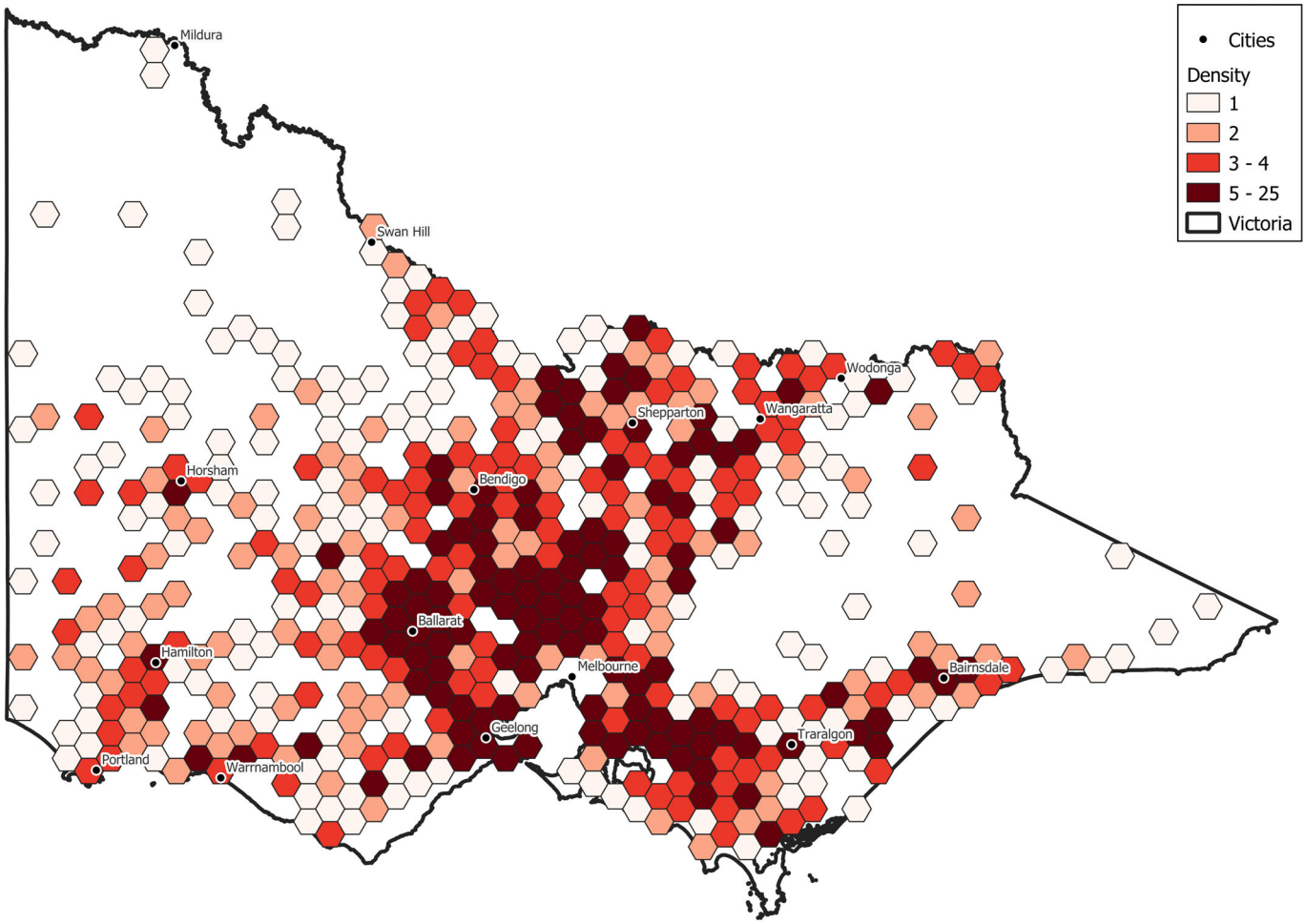

Figure 1. **Density map of substantiated livestock welfare cases in Victoria, Australia 1981–2017. The legend shows the number of cases that respond to each colour.**

Table 2. **Results from the analysis of the variables in the investigation details and welfare issue summary categories**

Variable	CWV for all cases	Proportion of CWV where variable was present/relevant		
Welfare issue summary	CWV	All cases	AWSC 1	AWSC 10
Nutrition	99.3%	56%	**11%**	**94%**
Water	99.5%	6%	**2%**	**29%**
Environment	99.6%	6%	**3%**	**12%**
Management/husbandry	99.9%	83%	**45%**	**100%**
Treatment	99.8%	65%	**89%**	**98%**
Malicious	100%	1%	2%	0%

From the left to right: variables, as defined in Appendix 2. The cases with a value (CWV) for all cases. The proportion of CWV where the variable is present/relevant for, all cases, AWSC 1 and AWSC 10. When the proportion of CWV where the variable is present/relevant for cases in AWSC 1 and AWSC 10 were significantly different using the Chi Square Test, they are in bold font.
Bold font—P ≤ 0.05 significantly different.
AWSC, animal welfare severity category; CST, Chi Square Test; CWV, The number of cases in which the relevance/presence of the variable could be determined.

All the nutritional variables were significantly more relevant in the most severe AWSCs compared to the least severe AWSCs (P ≤ 0.001) as seen in Table 5. The largest difference was for the variable 'feed that was not proper or sufficient', where the proportion of cases in the most severe AWSC (AWSC 10) was almost nine times greater than the least severe AWSC (AWSC 1). Apart from the

Table 3. Results from the analysis of the variables in the investigation details and welfare issue summary categories

Variable	CWV for all cases	Proportion of CWV where the variable was present/relevant		
Animals	CWV	All cases	AWSC 1	AWSC 10
Cases with cattle	100%	39%	**59%**	**24%**
Cases with sheep	100%	38%	**29%**	**18%**
Cases with goats	100%	2%	3%	0%
Cases with mixed species	100%	21%	**8%**	**57%**
Breeding animals present	59%	91%	**85%**	**98%**
Injured or unwell livestock present	99%	57%	**78%**	**94%**
Recumbent livestock present	99%	22%	**18%**	**78%**
Livestock stuck in mud/yard/pen	99%	5%	**5%**	**41%**
Carcasses present	99%	35%	**8%**	**81%**
Livestock in poor condition	88%	56%	**21%**	**96%**
DSE	CWV		DSE	
Average DSE	61%	546	259*	2389*

From the left to right: variables, as defined in Appendix 3. The cases with a value (CWV) for all cases. The proportion of CWV where the variable is present/relevant for, all cases, AWSC 1 and AWSC 10. When the proportion of CWV where the variable is present/relevant for cases in AWSC 1 and AWSC 10 were significantly different using the Chi Square Test, they are in bold font.
Bold font—P ≤ 0.05 significant.
AWSC, animal welfare severity category; CST, Chi Square Test; CWV, The number of cases in which the relevance/presence of the variable could be determined.
* No CST analysis.

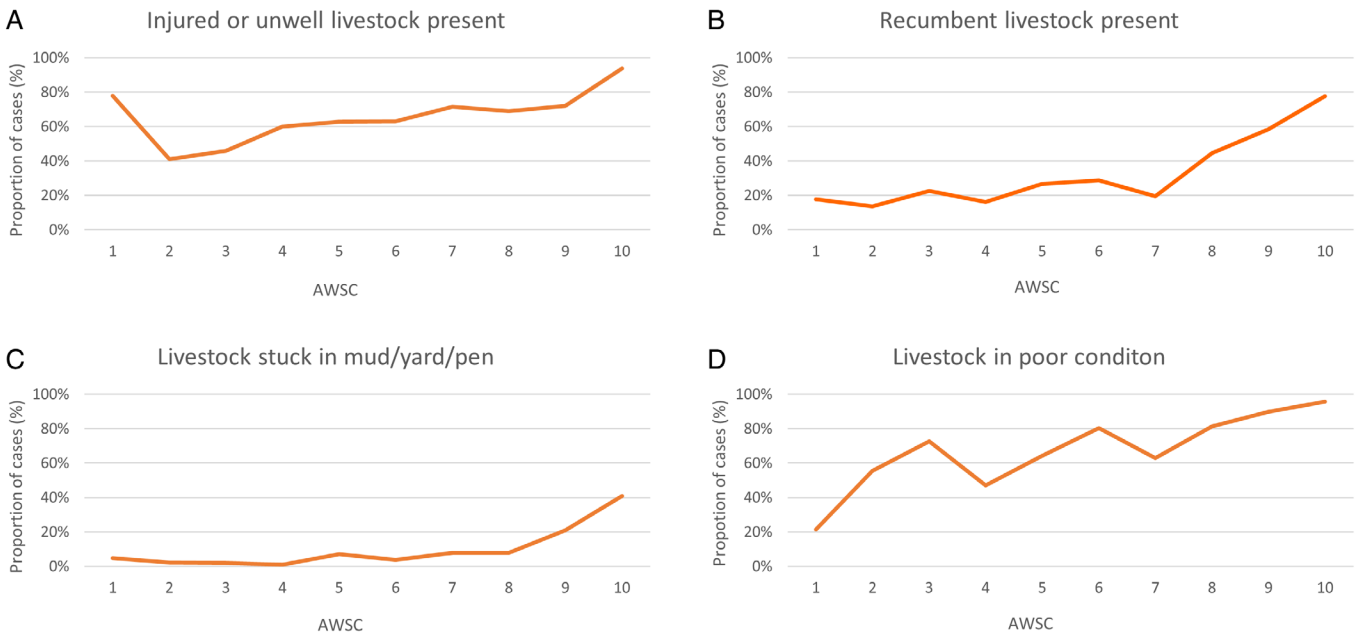

Figure 2. The proportion of cases where the animals were (A) injured or unwell, (B) recumbent, (C) stock in the mud/yard/pen or (D) in poor condition, with increasing animal welfare severity categories (AWSC), from AWSC 1 (left) to AWSC 10 (right).

variable 'feed that is not proper and sufficient' with a CWV of 92.6%, the CWV for the nutrition variables were all less than 60%.

Figure 5 shows how the proportion of cases where feed was not proper and sufficient tended to increase from the least severe AWSC 1 to the most severe AWSC 10. The increase is not linear and there was a large decrease in the proportion of cases where feed was not adequate in AWSC 4.

The analysis of the variables about the farmer is presented in Table 6. There was no significant difference between the number of

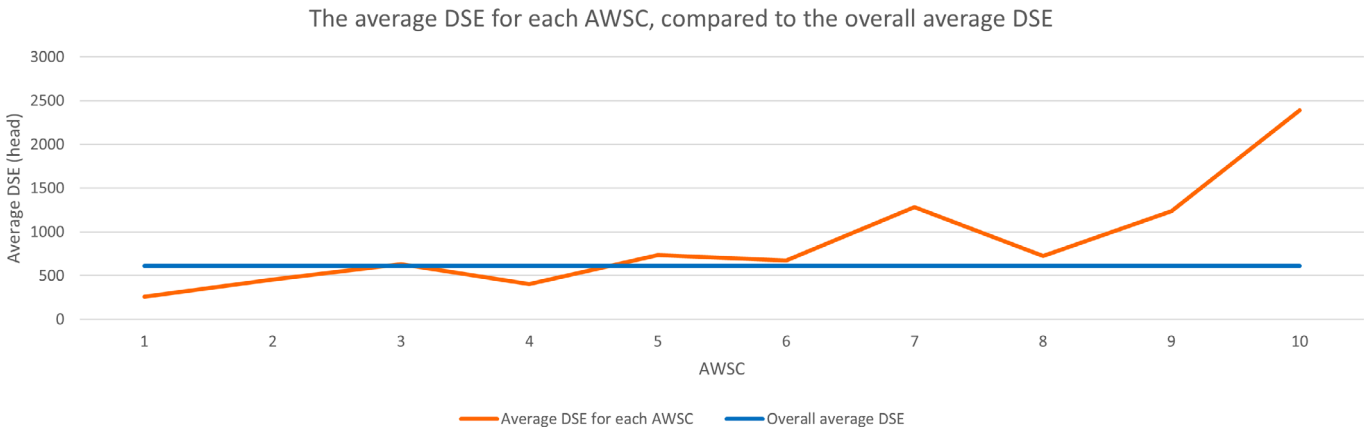

Figure 3. **Relationship between Dry Sheep Equivalent (DSE) and animal welfare severity categories (AWSC) 1 to 10, compared to the overall average DSE.**

Table 4. **Results from the analysis of the variables in the investigation details and welfare issue summary categories**

Variable	CWV for all cases	Proportion of CWV where variable was present/relevant		
Management/husbandry	CWV	All data	AWSC 1	AWSC 10
Require shearing/crutching (sheep only)	98.8%	45%	**17%**	**67%**
Livestock uncontained	97.6%	4%	**2%**	**26%**
Livestock have insufficient supervision	98.8%	52%	**61%**	**92%**
Unsuitable use of males	97.3%	8%	**1%**	**43%**
Overstocking	97.3%	30%	**3%**	**78%**
Unsuitable conditions	97.8%	8%	**6%**	**25%**
Failure to wean/cull	97.8%	52%	**66%**	**92%**
Failure to mark	97.4%	7%	**0%**	**38%**
Failure to dip or drench	95.9%	24%	**4%**	**69%**
Failure to draft	96.5%	44%	**10%**	**92%**

From the left to right: variables, as defined in Appendix 5. The cases with a value (CWV) for all cases. The proportion of CWV where the variable is present/relevant for, all cases, AWSC 1 and AWSC 10. When the proportion of CWV where the variable is present/relevant for cases in AWSC 1 and AWSC 10 were significantly different using the Chi Square Test, they are in bold font.
Bold font—P ≤ 0.05 significant.
AWSC, animal welfare severity category; CST, Chi Square Test; CWV, The number of cases in which the relevance/presence of the variable could be determined.

cases in the least and most severe AWSCs (AWSC 1 and AWSC 10, respectively) that had a farm manager or absentee farmers. Adverse behaviour, unreliability and extenuating circumstances were significantly more common in cases in the most severe AWSC (AWSC 10). The CWV was low for the variables absentee and owned multiple properties with 45.9% and 31.6% respectively. For the other farmer variables, CWV of ≥77%.

Extenuating circumstances included anything that was recorded by officers that possibly made it more difficult for the farmer to provide adequate care to their livestock. This might be based on an observation made by the officer, provided by a third party (e.g. partner, neighbour or stock agent) or offered as an explanation by the farmer themselves. Overall, in 21% of cases an extenuating circumstance was identified. Producer ill health was the most common problem identified with 29%, followed by financial problems (19%) and dispute or relationship problems (18%), age related issues (16%), family illness/loss (12%) and mental health issues (12%). Some farmers had more than one challenge which is why the total is more than 100%.

Reoffenders

Significantly more AOff reoffended compared to the proportion of all cases, when the welfare issue was associated with nutrition, water, environment, management and treatment. In contrast, there was no significant difference between the proportion of AOff that reoffended when the incident was associated with a malicious act compared to the proportion of all cases (Table 7).

Only 6% of AOff reoffended when the incident involved 1–3 animals as opposed to when potentially the entire herd were involved, where 33% of AOff reoffended (Table 8). When animals were found to be injured/unwell, recumbent, stuck, deceased, in poor condition or used for breeding, the proportion of AOff that reoffended was significantly greater than the overall average of reoffending of 27%.

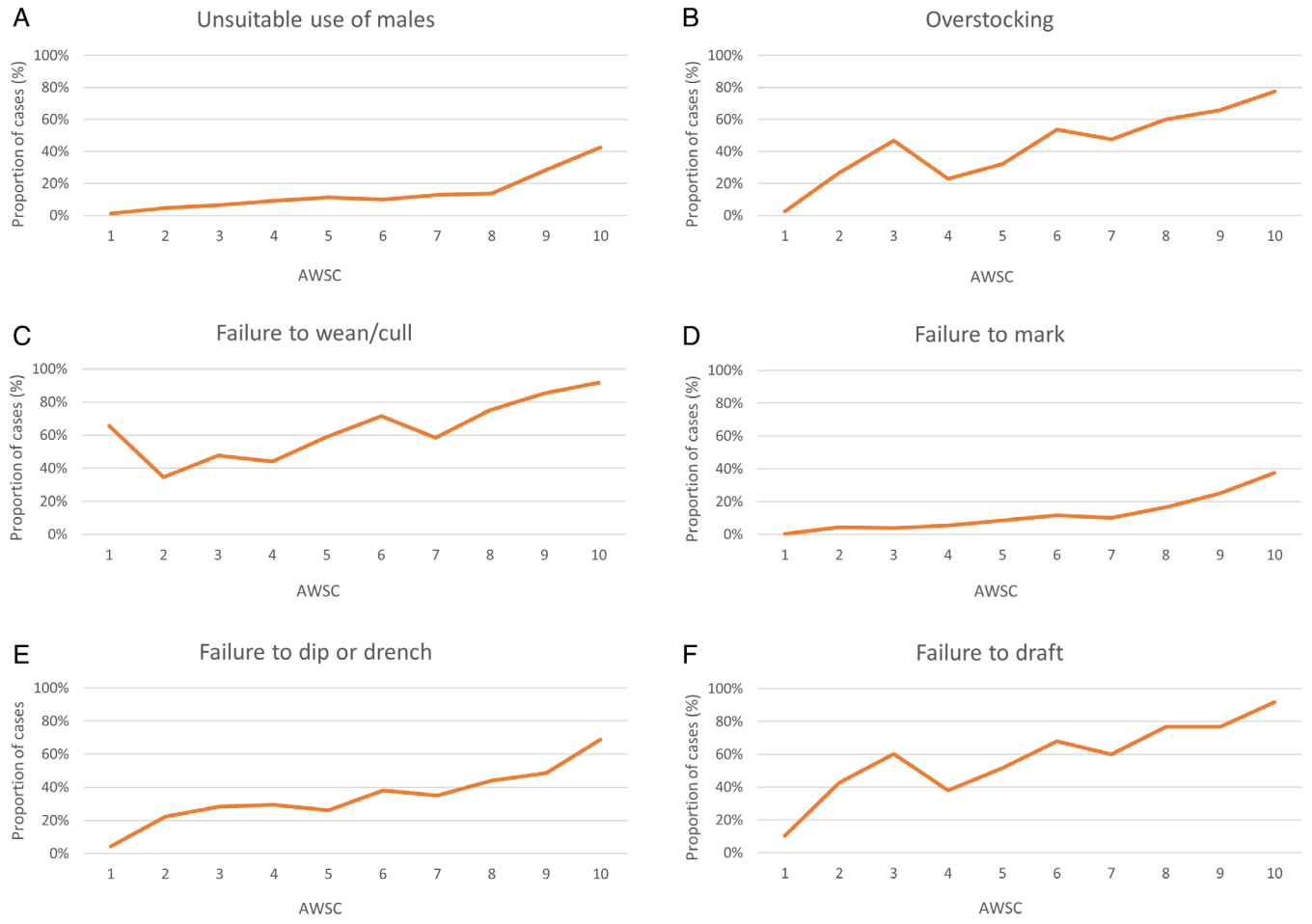

Figure 4. The proportion of cases where there was (A) unsuitable use of males, (B) overstocking, failure to (C) wean/cull, (D) mark, (E) dip or drench or (F) draft with increasing animal welfare severity categories (AWSC) from 1 (left) to 10 (right).

Table 5. Results from the analysis of the variables in the investigation details and welfare issue summary categories

Variable	CWV for all cases	Proportion of CWV where variable was present/relevant		
Nutrition	CWV	All cases	AWSC 1	AWSC 10
Insufficient pasture	59.2%	83%	**43%**	**98%**
No evidence of supplementary feed	57.7%	39%	**11%**	**48%**
Feed is not proper and/or sufficient	92.6%	55%	**11%**	**90%**
Feed present but not made available	41.8%	13%	**0**	**15%**
Grazing all farm at once (no paddocks locked up)	34.3%	10%	8%	22%

From the left to right: variables, as defined in Appendix 6. The cases with a value (CWV) for all cases. The proportion of CWV where the variable is present/relevant for, all cases, AWSC 1 and AWSC 10. When the proportion of CWV where the variable is present/relevant for cases in AWSC 1 and AWSC 10 were significantly different using the Chi Square Test, they are in bold font.
Bold font—P ≤ 0.05 significant.
AWSC, animal welfare severity category; CST, Chi Square Test; CWV, The number of cases in which the relevance/presence of the variable could be determined.

AOff were significantly more likely to reoffend when each of the variables in the management/husbandry section was present/relevant, as seen in Table 9. Notably, the proportion of reoffenders was especially high when the livestock were not contained (59%), there was a failure to mark (60%) and when there was unsuitable use of males (61%).

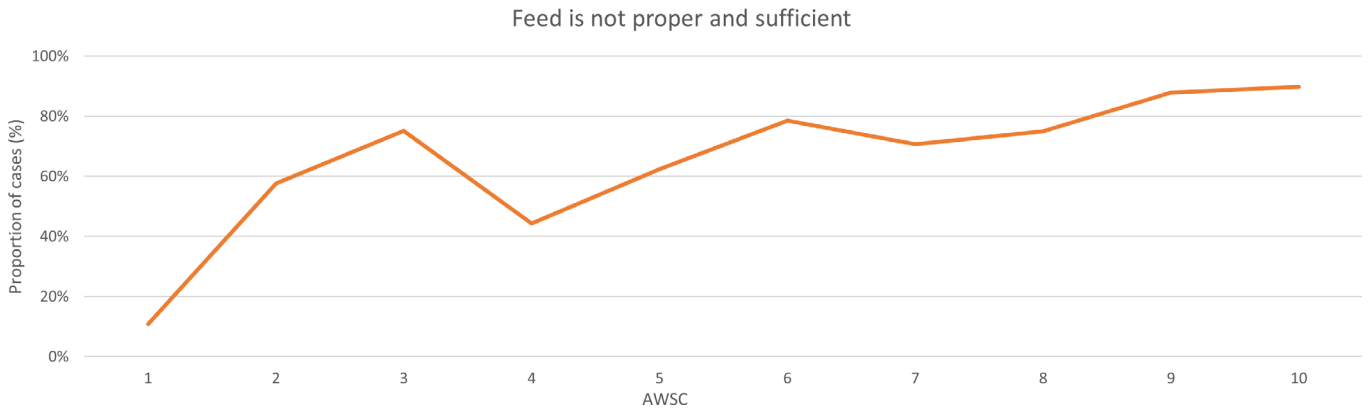

Figure 5. **The proportion of cases where there was not proper and sufficient feed with increasing animal welfare severity categories (AWSC), from 1 (left) to 10 (right).**

Table 6. **Results from the analysis of the variables in the investigation details and welfare issue summary categories**

Variable	CWV for all cases	Proportion of CWV where variable was present/relevant		
Farmer	CWV	All cases	AWSC 1	AWSC 10
Absentee farmer	45.9%	49%	44%	41%
Property has a manager	83%	4%	4%	7%
Displays adverse behaviour	77.4%	10%	**7%**	**38%**
Unreliable in doing as instructed/promised	77.1%	16%	**4%**	**90%**
Extenuating circumstances	82.1%	21%	**8%**	**19%**
On property during visit	83%	36%	**27%**	**70%**
Uses multiple properties	31.6%	52%	**32%**	**85%**

From the left to right: variables, as defined in Appendix 7. The cases with a value (CWV) for all cases. The proportion of CWV where the variable is present/relevant for, all cases, AWSC 1 and AWSC 10. When the proportion of CWV where the variable is present/relevant for cases in AWSC 1 and AWSC 10 were significantly different using the Chi Square Test, they are in bold font.
Bold font—P ≤ 0.05 significant.
AWSC, animal welfare severity category; CST, Chi Square Test; CWV, The number of cases in which the relevance/presence of the variable could be determined.

Table 7. **Comparison of the proportion of alleged offenders (AOff) that had >1 incident (reoffended) when different welfare issues (variables) were present/relevant**

Variables	1 incident	> 1 incident
Nutrition	65%	**35%**
Water	48%	**52%**
Environment	57%	**43%**
Management	69%	**31%**
Treatment	70%	**30%**
Malicious	85%	15%

Chi Square Test comparing the number of AOff that reoffended when the variable was present/relevant compared to the overall number of AOff's that reoffended (27%).
Bold font—The proportion of AOff that reoffended when the variable was present/relevant was significantly different than the number of AOff that reoffended overall (27%, ≤0.05).
AOff, alleged offenders; CST, Chi Square Test.

Issues with all of the nutritional variables were associated with a significantly higher proportion of reoffenders compared to the overall AOffs (Table 10). Notably, when there was grazing all of the farm at once, 59% of AOffs reoffended.

When the farmer was absentee or had a manager the rate of reoffending was not significantly different to the average of all cases. Farmers that displayed adverse behaviour or were unreliable at doing as instructed/promised were significantly more likely to reoffend than the average with rates of 50% and 65%, respectively (Table 11).

DISCUSSION

In the current study, intentional or unintentional neglect was the main cause of livestock welfare issues while malicious acts were uncommon, which has also been reported in previous studies.[1,17] More specifically, failing to provide adequate nutrition,[1,25] appropriate treatment[25,44] or suitable management/husbandry[1,25] were observed here and previously in the literature as causes of livestock

Table 8. Comparison of the proportion of alleged offenders (AOff) that had >1 incident (reoffended) when different variables in the animal category were present/relevant

Animal variables	1 incident	>1 incident
Beef cattle	67%	**33%**
Goats	66%	34%
Sheep	71%	29%
Herd issue	67%	**33%**
Breeding animals	63%	**37%**
Injured/unwell livestock	67%	**33%**
Recumbent livestock	58%	**42%**
Livestock stuck in mud/yard/pen	44%	**56%**
Carcasses	59%	**41%**
Livestock in poor condition	64%	**36%**

P value for the Chi Square Test comparing the number of AOff that reoffended when the variable was present/relevant compared to the overall number of AOff's that reoffended (27%).
Bold font—The proportion of AOff that reoffended when the variable was present/relevant was significantly different than the number of AOff that reoffended overall (27%, ≤0.05).
AOff, alleged offenders; CST, Chi Square Test.

Table 9. Comparison of the proportion of alleged offenders (AOff) that had >1 incident (reoffended) when variables in the management/husbandry category were present/relevant

Management/husbandry variables	1 incident	>1 incident
Require shearing	63%	**37%**
Livestock uncontained	41%	**59%**
Insufficient supervision	66%	**34%**
Unsuitable use of males	39%	**61%**
Overstocking	57%	**43%**
Unsuitable conditions	58%	**42%**
Failure to wean/cull	64%	**36%**
Failure to mark	40%	**60%**
Failure to dip/drench	58%	**42%**
Failure to draft	61%	**39%**

P value for the Chi Square Test comparing the number of AOff that reoffended when the variable was present/relevant compared to the overall number of AOff's that reoffended (27%).
Bold font—The proportion of AOff that reoffended when the variable was present/relevant was significantly different than the number of AOff that reoffended overall (27%, ≤ 0.05).
AOff, alleged offenders; CST, Chi Square Test.

welfare issues. Specific issues also observed in the current study and other studies include overstocking,[1,22] inadequate supervision,[1,25,44] failing to group animals according to their age and sex and uncontrolled breeding.[45] Failing to wean, cull, dip, drench or draft were frequently observed on farms with poor welfare in this study but have not been specifically reported previously, to the best of the authors' knowledge. Furthermore, animals that are recumbent,[16]

Table 10. Comparison of the proportion of alleged offenders (AOff) that had >1 incident (reoffended) when variables in the nutrition category were present/relevant

Nutrition variables	1 incident	> 1 incident
Insufficient pasture	63%	**37%**
No evidence of supplementary feed	63%	**37%**
Feed is not proper and/or sufficient	64%	**36%**
Feed present but not made available	61%	**39%**
Grazing all farm at once (no paddocks locked up)	41%	**59%**

P value for the Chi Square Test comparing the number of AOff that reoffended when the variable was present/relevant compared to the overall number of AOff's that reoffended (27%).
Bold font—The proportion of AOff that reoffended when the variable was present/relevant was significantly greater than the number of AOff that reoffended overall (27%, ≤ 0.05).
AOff, alleged offenders; CST, Chi Square Test.

deceased[1,16,46,47] as cited by,[22] in poor condition[1] and injured or unwell[1,25,44] were associated with poor welfare investigations here and in previous studies.

The least severe AWSC (AWSC 1) as defined by this present study had welfare issues impacting 1–3 animals (rather than the herd), were resolved in 0–2 visits and did not reoffend during the data capture period. Approximately 89% of cases in AWSC 1 were due to a lack of suitable treatment, while issues with nutrition and management or husbandry were significantly less common than in the most severe welfare AWSC (AWSC 10). Additionally, in AWSC 1, less than 10% of cases failed to provide suitable conditions, mark, dip/drench, draft, or have a suitable stocking rate and animals were less likely to be recumbent, stuck, deceased or in poor condition compared to AWSC 10. This may suggest that while still in breach of the legislation, cases in AWSC 1 may reflect isolated incidents or accidents rather than a systemic failure to manage livestock in keeping with the POCTA Act. Only 6% of cases that had poor welfare affecting 1–3 animals reoffended. This is significantly less than the overall proportion of reoffending at 27% and further supports the possibility that substantiated incidents affecting 1–3 animals are at a lower risk of having severe or reoccurring animal welfare incidents.

With the exclusion of the Melbourne Metropolitan area, the location of substantiated welfare cases reflected the population density and distribution within Victoria.[39] Ideally, the proportion of complaints would have been represented as a proportion of the number of farms in an area, but unfortunately that data is not available. It is possible that the same proportion of farms had substantiated poor welfare across the state and the cluster of cases in peri-urban areas simply reflects the smaller farm size and increased density of farms in those areas, however, this cannot be confirmed. In addition, as welfare investigations are largely initiated based on a complaint, which are frequently made by the general public,[18] properties that are in high traffic areas are more likely to be noticed and problems reported than issues in more remote and less visible locations.

Table 11. Comparison of the proportion of alleged offenders (AOff) that had >1 incident (reoffended) when the variables in the farmer category were present/relevant

Farmer variables	1 incident	>1 incident
Absentee farmer	72%	28%
Property has a manager	64%	36%
Displays adverse behaviour	50%	**50%**
Unreliable in doing as instructed/ promised	35%	**65%**
Extenuating circumstances	62%	**38%**
On property during visit	60%	**40%**
Uses multiple properties	56%	**44%**

P value for the Chi Square Test comparing the number of AOff that reoffended when the variable was present/relevant compared to the overall number of AOff's that reoffended.
Bold font—The proportion of AOff that reoffended when the variable was present/relevant was significantly different than the number of AOff that reoffended overall (27%, ≤ 0.05).
AOff, alleged offenders; CST, Chi Square Test.

The current study suggests that poor welfare in breach of the legislation can affect properties with a varying number of livestock, with the total DSE ranging from 10 to 12,500, which has also been noted in previous studies.[1,4] In the most severe welfare cases, the DSE was almost four times the average DSE of all categories. Furthermore, cases with a DSE of ≥1000 were more than three times as likely to reoffend than those cases with a DSE≤50. The average DSE for reoffending was 938, 1.5 times greater than the overall DSE of 613. There were, however, potential inaccuracies with the DSE calculations in this study, firstly, a DSE value could only be calculated in 61% of cases. In addition, the numbers of livestock as recorded in the data were likely to be just an estimation or based on unverified information provided by the farmer, as on most property visits it would not be possible for officers to accurately count stock. Lastly, it is likely that the DSE values were an underestimation, as all sheep and goats were counted as 1 DSE, and cattle 9 DSE, not taking into account pregnant or lactating stock. Despite these challenges, the current study shows that properties of all sizes can be impacted by poor livestock welfare.

It was not possible to determine the presence/relevance of any variable in every case. There is also potential for a positive bias in recording information, for example, if the fencing on a farm was obviously of a poor standard or there was a severe weed issue this may be noted, but if the fencing was good or there was an absence of weeds this is less likely to be recorded. There was a higher number of CWV for the severe welfare categories and this may be because of the increased number of visits, observation opportunities and familiarity with the property. Although it would have been preferable to have data without gaps, access to this investigation data has still provided a unique and detailed understanding of some of the issues that occur on properties where the welfare of the livestock is poor. Lastly, this study has shown that in many instances, there are numerous problems occurring at once, with a failure to provide adequate care across a number of areas. This highlights the complexity of livestock animal welfare non-compliance and some of the challenges to improving welfare outcomes.

The farmer has been identified as pivotal in managing livestock welfare.[28–31] Although only having a small proportion of CWV for many of the variables about the farmer, issues in regard to the farmer's health,[21,22,48] stress, mental health,[21,30] age,[30] financial issues[21,30,48] and family loss[22] have all been identified as affecting farmers that have been found to have poor livestock welfare in previous studies. Some farmers maintain a high standard of animal care despite significant pressures while others do not.[48] The importance of farmer well-being at improving animal welfare has been recognised by researchers[29,31] and farmers alike.[31] While there has been some research in this area,[21,22,30,48] further work on ways to better understand and support the farmer is crucial. A collaborative approach between human health agencies and veterinarians could provide better on-farm support.[4,49] There is potential for the implementation of the one health and welfare approach to incidences of poor animal welfare[29] and this is worthy of future research.

While the data reviewed here was not created with the intention of such detailed analysis, taking time to consider what can be learnt from past experiences is crucial to improving livestock welfare response as well as developing strategies to reduce incidences of poor welfare in the future. With 27% of all AOff reoffending, developing a way to predict situations where livestock are at risk of poor welfare could facilitate early intervention and extension, as well as the allocation of resources and response planning. The variables identified as commonly present/relevant on farms with poor livestock welfare may be risk factors that could be used to develop an animal welfare risk assessment tool. Future work is planned to consider this potential.

Conclusion

The vast majority of cases of poor livestock welfare result from neglect, more specifically due to inappropriate nutrition, management/husbandry and treatment. More severe welfare cases tend to have more complex multifactorial deficiencies, while the least severe cases were more likely to result from a failure to provide adequate treatment or to cull, alone. While the majority of cases had only a single incident, 27% of AOff reoffended. Incidents of poor livestock welfare were not isolated to peri-urban areas, small land holders or absentee farmers. Variables that were more common in the severe animal welfare cases and associated with reoffending included overstocking, livestock in poor body condition, feed that is not proper and sufficient and when there was a failure to wean/cull, mark, dip/drench and draft, and farmers that were unreliable at doing what they promised or were instructed to do. More research, using purposefully collected data and comparing farms with both good and poor welfare, is necessary to truly determine the value of these factors in predicting poor livestock welfare under extensive conditions. Despite the limitations of using the past records not created for detailed analysis, the current study has highlighted the complexity of issues that may contribute to instances where livestock welfare is poor. This may be used to inform investigation strategies and potentially facilitate more rapid resolution of cases and limit reoffending.

Conflicts of interest and sources of funding

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Data availability statement

The data set presented in this paper are not readily available because of an agreement made with Agriculture Victoria who supplied the data. Therefore, we cannot supply raw data even though they are anonymised. Unfortunately, requests to access the data set cannot be considered.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site: http://onlinelibrary.wiley.com/doi/10.1111/avj.13342/suppinfo.

Appendix Table S1. Supporting Information.

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