Mortality in adult ewes associated with cold conditions despite moderate length wool

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Summary
The survival of Merino ewes in 8 flocks around Australia was examined in relation to weather conditions at the time of loss. Ewes with very low bodyweight or low condition score were at high risk, compared to ewes in good condition. For ewes with up to 190 days of wool growth during periods of cold weather, or when a sudden increase in chill index occurred, the risk of loss was increased 6-fold, compared with periods of warm weather or stable conditions and more than 190 days wool. Ewes with condition score <2.5 were at greatest risk of loss during these periods. Ewe losses in short wool may be reduced by weather localised weather forecasts to warn of high risk events, combined with more frequent monitoring of weight and condition.

Introduction
Sheep with low body weight or low condition score are at greater risk of death than those in average or better weight and condition (Kelly et al. 2014). The risk of loss of sheep in poor condition was shown to be greater in autumn and winter than in spring and summer, suggesting that these sheep are at greater risk of loss in adverse weather conditions.

Cold stress is known to be responsible for deaths in newborn lambs (Donnelly 1984) and freshly shorn sheep (Hutchinson 1966), but is not generally considered a significant cause of loss in adult sheep with more than 14 days wool. However, GPS studies (Taylor et al. 2011) have shown that sheep with more than 28 days wool will seek shelter in cold conditions suggesting that there may be adverse effects beyond the immediate post-shearing period. Sheep have an increased metabolic rate in cold weather, so those in poor body condition may also be more susceptible to other stressful events during cold periods, such as high parasite burden.

Materials and Methods
Merino ewes in the Information Nucleus Flock (INF) were included in this analysis if they were between 360 and 960 days of age. Dates of death were not recorded exactly, but were determined from the date at which records were last obtained from the ewe. Weights and condition scores were recorded at least four times a year and as a result of additional measurements at other times, the date of death could be identified within a 2 month period. Sheep were shorn once each year and other information recorded as noted previously (Fogarty et al. 2007)

Weather records were available for all sites for the period of these observations. A chill index was calculated using the formula used by the Bureau of Meteorology for lamb chill alerts.

\[ C = (11.7 + 3.1 \sqrt{W})(40 - T) + 481 + 418(1 - e^{-0.04R}) \]

W is the average wind speed over the whole day, T is the average temperature and R is the daily rainfall.

Each timepoint at which a ewe was weighed and condition scored was considered and the ewe scored as survived if records were taken at a subsequent occasion, or lost if no further records were found. Average weather over 60 days, or the most extreme day in the period, do not adequately represent the conditions, so the worst 10% was used. The 6th highest chill index was the chill index used for that period. The increase in chill index was the 6th greatest increase in chill index from one day to the next over the period. There were 19,479 events with suitable data.

Results
The annual rate of loss of adult ewes was 3.4% per year, over the period 360 to 960 days of age. For ewes with a weight and condition score recorded in this period, 0.56% were not present at the next recording date for those sheep, consistent with a loss over a period of 2 months.

Of the ewes with body weight less than 30kg, 8% were lost in the next 60 days, but there were very few in this category. Those 35kg and over did not have significantly increased losses. Ewes with low condition score also had a higher risk of loss, with about 1.2% losses for those with a condition score under 2.5.

The loss rate for ewes with less than 190 days wool, while under conditions of high chill index (>1176) or a high increase in chill index (>168) was 6.5 times greater than the loss of ewes with longer wool and low chill index (<0.001) (ignoring weight and condition). The rate of loss for ewes with only one of these risk factors was double the risk for those with neither (relative risk 2.1-2.4, p<0.05).

Table 1 shows the % ewes lost in groups subdivided by wool length (<190 days vs longer wool), weight and condition score (either weight <33.4 kg or condition score <2.5 vs above both these limits) and cold conditions (Chill index >1176 or increase in chill index >168 vs below both these limits).
Only 3 ewes in 3737 (0.08%) were lost when none of the risk factors were present. For ewes with satisfactory weight and condition the losses were only 0.32 to 0.39% for cold weather in long wool or warmer weather in shorter wool. However, losses were 1.06% for ewes in good condition in cold weather and less than 190 days wool length.

Ewes with low weight or poor condition suffered losses of 0.67% or more without other risk factors, but losses were highest (1.65%) for the ewes in poor condition, with short wool in condition of high chill index.

Examination of individual weather measures suggested that temperature had the greatest effect, followed by rain and then wind. This is consistent with their weighting in the index.

Table 1. Adult ewe losses over 2 months with short (<190 days) or long wool, low weight (<33.4kg) or low condition score (< 2.5) in cold conditions (chill index >1176 or chill increase >168) or warmer weather

<table>
<thead>
<tr>
<th>Wool</th>
<th>Wt/CS</th>
<th>Warm</th>
<th>Cold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long</td>
<td>High</td>
<td>0.08%</td>
<td>0.39%</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>1.04%</td>
<td>0.67%</td>
</tr>
<tr>
<td>Short</td>
<td>High</td>
<td>0.32%</td>
<td>1.06%</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>0.98%</td>
<td>1.65%</td>
</tr>
</tbody>
</table>

*Significantly higher risk (p<0.001) than the combined group: no risk factors + short wool only + cold only.

Discussion

Adult ewes had a higher rate of loss during periods of cold weather with above average chill index. The losses were not due to very short wool immediately after shearing, but were spread over periods up to 190 days after the previous shearing. The management of these flocks required the provision of shelter during periods in which cold stress was predicted, so losses soon after shearing would not be expected in these sheep.

Losses were highest in periods during which there were large increases in the chill index from one day to the next. Some of these losses were during periods of low chill index, suggesting that sheep had acclimatised to warmer weather conditions and were stressed by sudden changes in the weather. The managers were required to provide shelter in poor weather, so the potential effects of the highest chill index may have reduced by good management in these flocks, whereas sudden changes in chill index may not have been anticipated. Losses could be reduced if sheep producers ensured that shelter was available in these situations in which they would not normally expect the sheep to require additional shelter.

It is not likely that adult ewes died of exposure, as can be the case for recently shorn sheep under severe conditions (Hutchinson 1966). However, the stress of severe weather or sudden changes in weather may have increased the susceptibility of the ewes to other conditions, such as parasites or nutritional problems, particularly if they were in below average condition, with limited fat reserves.

Weather forecasts are relatively accurate up to 7 days in advance and can be provided specifically for small regions. Although warnings of adverse weather are issued, these are only considered relevant for newborn lambs and freshly shorn sheep. The use of these forecasts could allow early warnings of adverse weather that would be more precise and better targeted than current warnings.

Sheep in poor condition may require more shelter than those in good condition, in addition to extra feed to improve their condition. Frequent monitoring of weight and condition is difficult (Brown et al. 2015), but groups of sheep could be separated on weight and condition at times when they are available for other purposes, then the groups adjusted as necessary when measurements are next available. Alternatively walk-over weighing (Brown et al. 2014) could be used to monitor individual sheep more frequently to allow action when required by forecast of inclement weather.

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References


