Scottish sheep movements and their potential for disease transmission

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Animal movements play a major role in the spread of livestock diseases. Identifying and targeting farms that are pivotal to the network of livestock movements would act to curb disease transmission. In addition, if it were possible to integrate the control of livestock infections such that a single control measure could target multiple diseases, the result would be an economical and efficient way to ease the burden of farm animal disease. Different diseases spread via different mechanisms, and therefore different types of contact are important in their spread. Thus the relevant movement network underlying the spread of one disease between farms may be very different from that involved in the spread of another. Here, we describe work to assess the possibility of targeting a subset of Scottish hill sheep farms that are ‘important’ in terms of the types of movements involved in both a rapidly-transmitting and a slowly-transmitting sheep disease. Importance is calculated as the product of the movements on to the farm (proportional to the probability of becoming infected) and the movements off the farm (proportional to the probability of spreading that infection). All movements could potentially spread a rapidly-transmitting disease, whereas only movements resulting in long residence times would be relevant to a slowly-transmitting disease. Farms important in terms of both types of movements were identified. Disease simulations were then used to assess the effect that removing this one subset of farms could have on reducing the spread of both rapidly-transmitting and slowly-transmitting diseases. This work raises the possibility that targeting controls at a single group of sheep farms may enable the holistic control of multiple infectious diseases within the national flock.