Using capture-recapture approaches for assessing livestock disease surveillance at supra-individual level: methods and limitations

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Capture-recapture (CR) approaches have been extensively used for analyzing data produced by imperfect human epidemiological surveillance systems. Their objective is to assess the number of infected individuals that remain undetected. Two broad types of CR approaches have been used: multilist and unilist CR approaches. Multilist CR approach can in theory be applied in contexts where at least two distinct, imperfect and independent surveillance protocols detect infected epidemiological units in the study population. Through log-linear modeling, this approach allows estimating the number of infected units detected by none of the protocols. Unilist CR approach is based on repeated detections and tries to model the frequencies of detection in order to estimate the number of infected units with zero detection. Zero-truncated or zero-inflated count models are generally used in this approach. CR methods should be very useful for studying livestock diseases surveillance data since surveillance systems generating them are often of limited efficiency, producing a large number of undetected units. While studying livestock diseases, the relevant epidemiological unit is usually a supra-individual unit such as an infected holding or even an infected administrative area. Such point of view may require methodological adaptations of CR approaches and of their underlying assumptions. Referring to animal disease applications from the literature, we propose a critical review of the possibilities arising from the different methodologies available given the specificities of animal disease surveillance data at supra-individual level. As a conclusion, we propose some thoughts on the interest and limitations of these methods for quantitatively evaluating animal disease surveillance systems.