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BASING ANIMAL DISEASE SURVEILLANCE ON INFORMATION FROM MULTIPLE SOURCES - EVIDENCE FROM A RECENT EPIDEMIC

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Une épidémie due à une forme aiguë de diarrhée virale bovine (BVD) a conduit à la coordination de l'information issue des laboratoires de diagnostic, des troupeaux sentinelles de vaches laitières, des vétérinaires praticiens, d'informations sur les produits d'équarrissage et des ventes de bétail. L'information collectée à partir de ces sources de données a aidé à gérer cette épidémie et à améliorer l'approche de la surveillance des maladies animales dans l'Ontario. Des changements inattendus dans la structure temporelle des statistiques concernant les produits d'équarrissage de veaux et les veaux inaptes lors de ventes de bétail par des coopératives semblent avoir été des signaux précoces de cette épidémie de BVD. On a pu estimer la prévalence à 10 troupeaux pour 100 troupeaux de bovins au moment du pic de l'épidémie en août 1993 à partir des données fournies par les laboratoires de diagnostic. L'analyse des données diagnostiques a révélé un risque accru de BVD pour les troupeaux de boeufs et de veaux au début de l'épidémie, des taux de mortalité associés au BVD plus importants dans les troupeaux de vaches laitières adultes, et un risque accru de problèmes d'avortements dans la population de vaches laitières à la suite de l'épidémie. Beaucoup de ces observations ont été confirmées par une enquête envoyée aux vétérinaires praticiens. L'analyse de données sanitaires collectées sur 536 troupeaux sentinelles de vaches laitières a également confirmé les estimations de la prévalence faites à partir des données des laboratoires de diagnostic, tout en mettant en évidence le recours accru à la vaccination contre le BVD. Une vaccination appropriée a été recommandée lors de séminaires organisés dans la région en 1993-94. Les avatars d'une source d'information unique ont été moins importants alors qu'apparaissait une information raisonnée, validée et coordonnée dans un contexte de surveillance pendant toute la durée de l'épidémie. Un réseau de surveillance qui coordonne l'information émanant des laboratoires de diagnostic et des laboratoires chargés du contrôle de la qualité des aliments, des usines d'équarrissage, et des ventes de bétail par les coopératives, des vétérinaires praticiens sentinelles et des troupeaux de vaches laitières sentinelles, est actuellement expérimenté dans l'Ontario.

INTRODUCTION

Disease surveillance based on information from multiple data sources has been identified in medical and veterinary settings (Kellar 1996, Teutsch and Churchill 1994). Data collection (active or passive), analysis, summary and reporting are important, but are only the initial steps of disease surveillance. Co-ordination of these sources of information into action and a beneficial result comprises the larger process of surveillance (Teutsch and Churchill 1994). An epidemic of bovine viral diarrhea (BVD) forced the co-ordination of information from diagnostic laboratories, sentinel dairy herds, veterinary practices, rendering information, and livestock sales. This report discusses the contribution of these sources of data and how managing this epidemic helped improve the approach to animal health surveillance in Ontario.

SURVEILLANCE DURING AN EPIDEMIC

In February-March 1993 rendering statistics indicated a significant, unexpected 2-fold increase in the volume of calves received at processing sites across the province of Ontario. During this period unexplained peaks also occurred in the rate of calves that were too sick to be sold at community sales. These two sources of regulatory data were not usually summarized for surveillance purposes and these results were found retrospectively.

In April 1993 three acutely affected veal herds had crude calf mortality rates ranging from 5-30%. The veterinary practitioners examining these herds suspected an acute form of BVD. This acute form of BVD has been reported in Great Britain, Quebec and the USA (David et al 1994; Pellerin et al 1994; Corapi et al 1989). The local practitioners requested assistance from provincial cattle health consultants which led to further farm visits to the affected herds and an epidemiologic examination of provincial diagnostic laboratory data.

Diagnostic data were retrospectively and prospectively alerted for records of cattle herds with clinical disease suggestive of BVD as well as histopathology evidence or had a positive test for BVD virus fluorescent-antibody. A proportional rate with affected herds in the numerator and all cattle herds submissions as the denominator was used as a period prevalence estimate. In May-August 1993 a significant and unprecedented rise in the monthly prevalence estimate of cattle herds with BVD was detected using information based on diagnostic data from the Animal Health Laboratories of the University of Guelph. These estimates peaked in August 1993 at 10 per 100 herds and gradually fell to a plateau by January 1997 at about twice the level expected. In a non-epidemic period from 1989-1992, the expected prevalences were 2-3 affected herds per 100 cattle herds submitting specimens to the diagnostic laboratory .

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Changes in the rate of submission to the laboratory explained 25% of the variability of the proportional rate used to estimate the prevalence of herds affected with BVD. Hence, the disruption in the yearly and seasonal effects due to the epidemic explained most of the variability of the proportional rate. This estimate was also consistent with at least two other independent sources of data (described below). In Ontario, BVD is viewed as an important infectious cattle disease, veterinarians send a large number of submissions to the Animal Health Laboratory (about 20,000 cattle herd submissions 1991-1995 excluding routine testing), and these diagnostic laboratories are located reasonably close to the regions with the highest cattle densities. These factors may have trivialized the biases often cited with laboratory diagnostic data and made it valid for surveillance purposes in this instance.

Examination of age patterns in the diagnostic data revealed that before the peak of the epidemic, calves were more likely to be affected than adult cattle. This was in contrast to adult cattle being significantly more affected at the peak of the epidemic and afterwards. Beef herds were more likely to be affected than dairy herds, however this effect gradually decreased and was not significant towards the end of 1995. In 1993, about 18% of dairy herds submitted valid clinical mortality information on the laboratory submissions. From these data (60 dairy herds diagnosed with BVD and 474 non-affected dairy herds) median mortality levels were 11% among adult cattle in affected herds and significantly lower (2%) in non-affected herds.

Using a two-page data sheet, information was received from 54 food-animal practitioners in 1993 about BVD and the impact of the problem to their clients. These data confirmed the results from the diagnostic data that beef and veal farms were experiencing a higher risk of BVD than dairy farms, overall the prevalence was 8-10% at the peak of the epidemic and that the mortality levels in cattle ranged from 10-100%.

Since BVD can also cause chronic reproductive problems in cattle herds, the level of herds with abortion problems was described using the diagnostic database. The proportional rate of dairy herds with abortion problems (using all dairy cattle herds in the diagnostic data as the denominator) was 32-34% in 1994-1995, this was significantly higher than the 24% reported for 1993. Although not all of the excess herds with abortion problems were due to BVD, the time sequence indicated that this could have been part of the fall-out from the BVD epidemic. The proportional rate of dairy herds with abortion was accurately predicted for the winter 1995-96 period by statistical forecasts using exponential smoothing (Alves et al 1996).

For 1994, health questions were piggy-backed onto a farm financial program that received data from about 536 dairy farms using intensive farm visits from all counties in the province. From these data, the prevalence of herds affected with BVD was estimated to be 5-8%. This was very similar to the mean prevalence of 36 affected herds per 500 herd submissions estimated by the diagnostic data for this period. Vaccination for BVD had a significant sparing effect on herd calf mortality in regression models developed from the health-question data. The percent of dairy herds using BVD vaccination was estimated at 88%. This was markedly higher than the 55% estimated by a dairy health monitoring project in 1992 (Kelton 1995). In 1993-94, of the 80-100 BVD case herd investigations conducted by government cattle health consultants, none of the herds were properly vaccinated and other biosecurity problems were common (estimate unavailable).

To address the increased risk of BVD, between 200-250 seminars were given to producers to describe the proper methods of herd vaccination for BVD and general animal health risk management for cattle herds. Many of the teaching points in these seminars included the findings uncovered in the surveillance data. For example the importance of age (eg. adult cattle were at risk), commodity (eg. beef herds were at greater risk than dairy herds early on), and impact (eg. excess mortality and abortion). More passive methods of risk management included lay articles, scientific reports, veterinary newsletters and alerts to the farm media. Seminar evaluations indicated a better understanding of herd vaccinations was achieved. The increase in BVD vaccination between 1992 and 1994 was likely due in part to the awareness of the epidemic through media and education activities. Follow-up research to characterize the BVD virus isolates from the epidemic, the pathology lesions and the clinical findings has also been conducted (Carman et al 1997)

CONCLUSIONS AND NEXT STEPS

Each data source in the surveillance of this BVD epidemic had a strength. Non-specific community salesbarn and rendering data functioned as early warnings of oncoming health problems in calf populations that were at higher risk of disease. Sentinel practices in regions of high cattle density provided efficient early warning, as well as specific animal health information upon request. A strong system of regional diagnostic laboratories tracked events over time, assessed the impact of changes in disease patterns over time, and provided quantitative results for risk management. Active surveys were useful to validate the findings of the other data sources, provide estimates of management factors that influence the risk, and evaluate the response to control and preventive work. When taken together as information components of a surveillance network these data sources alerted the cattle industry in a more valid and prompt manner than any individual data source in isolation. The weaknesses associated with each source of information became less important as consistent information emerged that was critically appraised and co-ordinated in the context of a surveillance network.

Ontario has recently formed an animal health surveillance network that includes a core group of veterinarians and epidemiologists from Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph. Currently the network co-ordinates information from the diagnostic laboratories and food safety and quality laboratories, rendering plant data, and community livestock sales data; collaborates on active surveys for selected health issues (eg. Cryptosporidium sp., verotoxigenic E. coli, Johnes disease); electronically scans local and international news wire stories on food safety and agriculture; and conducts research reviews. The network has received support from industry to follow-up health concerns highlighted from these data sources and is strongly linked to the extension education staff of OMAFRA. Research examining the use of sentinel dairy herds and sentinel practices is underway and is financially supported by the dairy industry, bovine practitioners, the University of Guelph and the provincial government .

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