EPIDEMIOLOGICAL APPROACH TO STUDYING REPRODUCTIVE PERFORMANCE ON EQUINE BREEDING FARMS

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A greater application of epidemiologic principles to the investigation of health and disease in horses, as seen in recent years (Powell, 1982), will help to formulate strategic objectives for a health monitoring program on equine breeding farms. Broodmare health must be maintained in order to produce foals at the most efficient level, thereby providing maximum economic returns. These objectives can only be achieved through analysis and monitoring of specific reproductive performance targets which are considered to be optimal for each farm. In the equine breeding industry, there are no generally accepted targets of reproductive performance.

Presently, there is a relative lack of available farm level data from the individual breeding farm and inadequate analysis of individual horse data. This severely limits the determination of factors associated with reasonable targets for reproductive performance and hampers the development of management strategies to optimize reproductive efficiency. The objective of this paper is to discuss some of the difficulties encountered during the collection and analysis of data in two studies, each designed to describe specific parameters of reproductive performance on equine breeding farms.

MATERIALS AND METHODS

A prospective study (Meyers et al., 1991) investigated early embryonic mortality (EEM) and nonpregnancy (NP) in a population of 699 mares bred (1,014 breeding cycles) on three [1 Thoroughbred (TB) and 2 Standardbred (STB)] equine breeding farms in Ontario during one breeding season. Pregnancy diagnosis (PD) and embryonic loss data were recorded following transrectal ultrasonography (TRU) between days 12-20 (PD1) and 21-30 (PD2) and by TRU or palpations per rectum between days 31-40 (PD3). Verification of day 40 pregnancy status was attempted. Mares with no TRU signs of an embryo at the initial pregnancy exam were counted as not pregnant. Life tables were constructed to assist in the calculation of NP and cumulative embryonic mortality rates (EMR_{40}) for the complete 40 day embryonic period as well as during time specific pregnancy diagnosis time periods (EMR_{PD1}, EMR_{PD2}, EMR_{PD3}). Life tables were also used to calculate cumulative and specific mare withdrawal rates (MWR_{40} and MWR_{PD1} to MWR_{PD3}, respectively) for those breeding cycles that were not followed through to 40 days (other than those having

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EEM or NP). Also, per mare EMR's were calculated for mares losing embryos on their first (EMR_f) or any (EMR_a) breeding cycle. A multivariable stepwise logistic regression (MSLR) model of EEM including mare age, reproductive status, parity and foal heat breeding was developed.

A second retrospective longitudinal study of the TB farm involved in the previous study was undertaken to generate descriptive reproductive efficiency statistics from data available from existing farm records. The descriptive summary statistics calculated for one breeding season (n=309 mares) included age, reproductive status, the times mares were resident on the farm, foaling date, first breeding date and last breeding date. Reproductive efficiency statistics generated were 1) pregnancy rates per oestrous cycle for foal heat, first, second, third and fourth cycle, 2) cumulative pregnancy rates for second and third cycles, 3) pregnancy rates per cover for mares and cycles, 4) pregnancy rates for early pregnancy exams (between 13 and 20 days), day 40 or greater, and October, and 5) mean foaling to conception interval and mean number of days a mare was available for breeding.

RESULTS

In the first study, per cycle risk rates of NP were 36.4%, 45.0% and 22.1% for farms 1, 2 and 3. Per cycle EMR_{40} ranged from 8-17%. Per cycle MWR_{40} ranged from 56.5-98.9%. Significant differences ($p < 0.05$) in EMR_f and EMR_a per mare existed between two farms. The MSLR analysis revealed that mares bred on foal heat were 1.9 times more likely than mares not bred on foal heat to lose embryos (p=0.008). Age had a non-linear effect on EEM with middle-aged mares (7-11 yrs.) having a greater incidence of EEM (EMR_f = 10.0%) than either young (2-6 yrs., EMR_f = 2.5%) or old (≥12 yrs., EMR_f = 6.9%) mares.

In the second study, the mean age of the broodmare population was 9.6 (±4.2) yrs, with maiden, foaling, and barren mares comprising 14%, 61% and 20% of the total mare population on this farm. The percentage of mares that were "trailered in" for only one breeding, stayed on the farm only for the period of oestrus and 14, 28 and 42 day pregnancy exams were 11%, 15%, 25%, 17%, and 32%, respectively. The mean dates for foaling, first breeding and last breeding were day 88.1 (March 30) (±36.2 days), day 109.0 (April 1) (±35.7 days) and 124.7 (May 5) (±38.2 days), respectively. Pregnancy rates per oestrous cycle for foal heat, first, second, third and fourth cycle were 45.8%, 64.1%, 62.7%, 71.1% and 50.0%, respectively. Cumulative pregnancy rates for second and third cycles were 81.1% and 89.6%. There were 1.7 covers per mare bred, 1.1 covers per cycle and 1.67 covers were required to achieve a pregnancy in any one oestrous cycle. Cumulative pregnancy rates for early ultrasonic scans between day 13-20, pregnancy exams at day 40 or greater and pregnancy exams in October were 90.6%, 89.2% and 86.8%. The mean foaling to conception interval was 44.2 days while the mean days available for breeding was 48.1 days.

DISCUSSION

The TB farm in this study had a computerized record keeping system which had primarily been developed for billing and accounting services. Although some health and performance data was being recorded it was not in an analyzable format. Most of the data had to be reentered into an appropriate data base for calculation of summary statistics. This is expected to be a frequently encountered problem, as the people developing the systems do not have the epidemiologic background to predict what analyses will be possible or desirable in the future.

The population of mares on most breeding farms is very dynamic and there are marked between farm differences in data collection. In the EEM study 56-99% of mares were not followed for the full 40 day period of risk. This must be considered in the calculation of performance parameters. Historically, estimates from the literature have not accounted for the dynamic nature of the population-at-risk or for between farm differences.

The results of these studies have generated some interesting and potentially useful statistics, however, their relationship with farm efficiency is unknown. No generally accepted performance objectives are in place in the equine breeding industry and there is no tested measure of breeding farm efficiency. This has resulted partly from the nature of the industry, for example the unique financial considerations relative to delayed revenue from live foal guaranteed stud fees and the sale of yearlings. The focus on the value of the individual mare, stud and successful race horse, has lead to a reliance on traditional breeding techniques and less of an epidemiologic approach to management. Individual breeding farms must be efficient in order to survive and flourish. Managers and practitioners will become more attuned to a health management approach as studies such as these show the potential usefulness of such data. Epidemiologists and researchers must be willing to be part of a team approach in order to support and develop this area. However, they must be willing to work within the constraints of the field situation, recognizing the unique aspects of the equine industry and the diversity of practices and expectations among breeding farms.

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