Preliminary Investigations on the Feasibility of a Stillbirth Evaluation in the USA

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Abstract

The importation of semen from the North American Holstein into Sweden has been suggested as a possible cause of the increased stillbirth rate in that country (Steinbock, 1997). That work has prompted the National Association of Animal Breeders to undertake an evaluation of the appropriateness of a genetic evaluation for stillbirth in the United States.

Analysis under the assumption of continuous data has resulted in a low estimate of Heritability (.006). Further examination of the data has shown that variation among sire progeny groups with relatively small numbers (< 1,000 obs.) diminishes as progeny group size increases. This is consistent with the low heritability of stillbirth.

The genetic correlation between dystocia and stillbirth supports greater progress through indirect selection for dystocia. At this time, the data does not support the development of a stillbirth evaluation in the US. Additional work will be undertaken to determine whether a categorical analysis can increase heritability sufficiently to justify an evaluation.

1. Introduction

Substantial increases in the rate of stillbirths have been reported in Sweden over the last ten years coinciding with the importation of semen from the North American Holstein (Steinbock, 1997). The vitality of the North American Holstein has also been questioned (Berglund and Philipsson, 1992) resulting in demand for a genetic evaluation for stillbirths in the United States.

Potential losses due to stillbirth in the US were estimated to be in excess of 132 million dollars in 1981 (Thompson et al. 1981).
More recently, Dematawewa and Berger 1997 documented economics losses due to difficult calving including associated calf mortality. Respective losses were $0.00, $50.45, $96.48, $159.82, and $379.61 for dystocia codes 1 (unassisted) to 5 (extremely difficult). The economic loss due to calf mortality was 17.2% of the total. With this level of economic loss, a genetic evaluation for Stillbirth could be warranted if: 1.) The trait has adequate heritability and 2.) there is adequate data available on progeny test bulls.

Recently, the National Association of Animal Breeders undertook a study to determine the feasibility of a stillbirth evaluation in the United States. This study began with a review of the known genetic parameters for stillbirth (Martinez et. al., 1983a, 1983b, 1983c). The study also evaluated the amount and quality of data available in the US along with raw frequencies and progeny group averages.

2. Data

Stillbirth data in the US is collected through the National Association of Animal Breeders. The major emphasis of this program is to collect dystocia data for the national calving ease evaluation. Livability data is collected as a part of the dystocia program. Calvings are scored by producers on a scale of 1 = Alive at 48 hrs. 2 = dead at birth and 3 = dead by 48 hrs post parturition.

Data enter the national database through either the regional Dairy Records Processing Center (DRPC) or an AI Organization.
Data from AI organizations is collected under a standard format and forwarded to the NAAB. DRPC data is collected through the routine milk recording program and forwarded to NAAB on a semi-annual basis. Each DRPC processes on farm records differently resulting in some centers not including stillbirth information in the data sent to the NAAB.

Most analysis work has combined scores 2 and 3 resulting in a binomial trait of alive or dead at 48 hrs. post parturition. Currently there are approximately 3.5 million records with a valid livability score. The data used in this report includes calvings in the years 1978 to 1995.

3. Relevant genetic parameters

Martinez et al. 1983a analyzed data from the National Association of Animal Breeders reporting the heritability of the direct effect for stillbirth to be .006. These results are slightly lower than heritabilities cited by Philipsson 1996 of .02 to .05 for stillbirth. Failure to properly account for the binomial nature of this data likely biases heritability estimates downward.

In the same study, Martinez et al. 1983b reported a genetic correlation of .66 between dystocia and stillbirth. This level of genetic correlation along with the higher heritability of dystocia supports indirect selection for a lower stillbirth incidence through selection against dystocia over direct selection against stillbirth.

4. Results

The overall incidence of calf mortality was 6.7% with a higher incidence of mortality in heifers (10.1%) as opposed to cows (5.0%). This result is consistent with results reviewed by Philipsson 1996. While the incidence of calf mortality varied across years, no clear trend in calf mortality was observed in the US.

The level of stillbirths for bulls with at least 2,500 progeny ranged from 3.6 to 10.8% indicating that the there is progeny group variation in mortality. However, this incidence was observed to decline as progeny group size increased (see figure 1.) Bulls with progeny groups of over 10,000 reports showed less variation with approximately 80% of the bulls within one percentage point of average (5.7% to 7.7%).

Analysis of data available on sires currently on the USDA active list showed that 70% of the bulls had at least 50 livability reports and 57% of the bulls had at least 100 livability reports. This represents a less than satisfactory situation in that a minority of the bulls would not have an evaluation with a minimum of 50 reports for a low heritability trait. However, an evaluation with over 100 reports would be available on over half of the bulls.

Table 1. Incidence of calf mortality by year in the United States.

Year	Valid calvings	Percent mortality
78	22083	7.2
79	21657	6.5
80	35749	6.0
81	87359	6.5
82	56092	6.4
83	74656	6.6
84	137104	5.3
85	218120	5.4
86	225118	5.5
87	244083	5.8
88	247917	6.1
89	275152	5.8
90	267854	6.0
91	287350	6.5
92	379024	7.2
93	374155	6.8
94	335012	6.6
95	148980	6.3
Total	3437465	6.7

The incidence of mortality was found to be highly related to dystocia in this data set. Again, this is consistent with the review of Philpsson 1996. Mortality ranged from 3.7% in unassisted births from parity 2 and greater animals to 53.7% in the most difficult births from primiparous animals.

Table 2. Incidence of calf mortality by reported dystocia score in cows and heifers.

Dystocia Score	Mortality Incidence	
	Cows	Heifers
1	3.7	5.4
2	10.0	11.3
3	16.1	17.1
4	27.1	28.9
5	51.3	53.7

This data supports the finding of Martinez et al. 1983b that avoiding dystocia is a viable method to reduce the incidence of calf mortality.

5. Conclusions

Based upon work done to date, the National Association of Animal Breeders has concluded that a stillbirth evaluation is not justified at this time. However, the NAAB also realizes that continued research is justified for a trait with large economic losses. Additional work is planned using more up-to-date models and advanced methods to better estimate the variance components among stillbirth and dystocia. Until those studies are completed, the NAAB plans to address the calving complex through the development of a genetic evaluation for the maternal component of dystocia and the development of an index combining the direct and maternal components of dystocia with the appropriate linear traits to limit the level of dystocia in the US-population. The currently available state of knowledge in the US indicates that this approach will result in more progress than a separate genetic evaluation for calf mortality.

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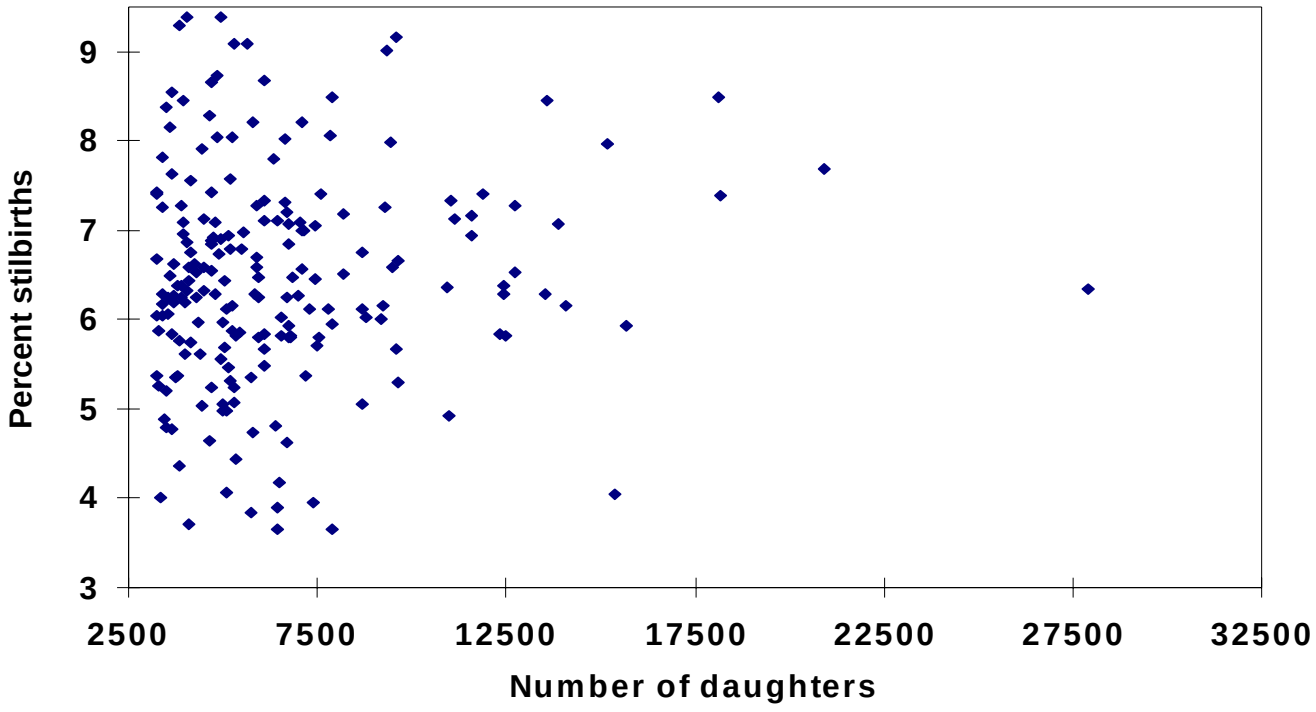

Figure 1. Percentage of stillbirths versus the total number of valid records for 200 sires with the largest amount of livability data.