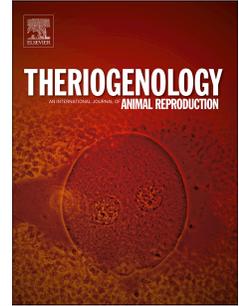


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Associations between dairy cow inter-service interval and probability of conception

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1 Associations between dairy cow inter- 2 service interval and probability of 3 conception

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8 **Abstract**

9 Recent research has indicated that the interval between inseminations in modern dairy
10 cattle is often longer than the commonly accepted cycle length of 18-24 days. This study
11 analysed 257,396 inseminations in 75,745 cows from 312 herds in England and Wales.
12 The interval between subsequent inseminations in the same cow in the same lactation
13 (inter-service interval, ISI) were calculated and inseminations categorised as successful
14 or unsuccessful depending on whether there was a corresponding calving event.
15 Conception risk was calculated for each individual ISI between 16 and 28 days. A
16 random effects logistic regression model was fitted to the data with pregnancy as the
17 outcome variable and ISI (in days) included in the model as a categorical variable. The
18 modal ISI was 22 days and the peak conception risk was 44% for ISIs of 21 days rising
19 from 27% at 16 days. The logistic regression model revealed significant associations of
20 conception risk with ISI as well as 305 day milk yield, insemination number, parity and
21 days in milk. Predicted conception risk was lower for ISIs of 16, 17 and 18 days and
22 higher for ISIs of 20, 21 and 22 days compared to 25 day ISIs. A mixture model was
23 specified to identify clusters in insemination frequency and conception risk for ISIs
24 between 3 and 50 days. A "high conception risk, high insemination frequency" cluster
25 was identified between 19 and 26 days which indicated that this time period was the true
26 latent distribution for ISI with optimal reproductive outcome. These findings suggest that
27 the period of increased numbers of inseminations around 22 days identified in existing
28 work coincides with the period of increased probability of conception and therefore likely
29 represents true return estrus events.

30 **Keywords**

31 Estrous cycle; inter-service interval; conception; pregnancy; dairy cow; mixture model

32 **1. Introduction**

33 Good reproductive performance in dairy herds is essential for efficient milk production.
34 At cow level, good reproductive performance involves two main steps: 'submitting' cows
35 for insemination in a timely manner, followed by conception and maintenance of
36 pregnancy. Successfully detecting and inseminating cows in estrus is important as it is
37 one of the most commonly used strategies to submit cows for artificial insemination,
38 particularly in the UK. A good understanding of the physiology of the cow's estrous cycle
39 has potential to improve both aspects. Better insight into expected interval between
40 estrus events can help with accurate heat detection monitoring, and has potential to
41 inform improved heat detection strategies on farm. Exploring associations between inter-
42 service interval (ISI) and subsequent fertility may provide insights which help to improve
43 conception risk (the probability of an insemination resulting in a pregnancy).

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