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# Invited review: Associations between variables of routine herd data and dairy cattle welfare indicators

[M. de Vries](#) [E.A.M. Bokkers](#), [T. Dijkstra](#), [G. van Schaik](#), [I.J.M. de Boer](#)

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## Abstract

As farm animal welfare is high on the political and societal agendas of many countries, considerable pressure exists to establish audit programs in which farm animal welfare is routinely monitored. On-farm assessment of animal welfare, however, is time-consuming and costly. A promising strategy to monitor animal welfare more efficiently is to first estimate the level of animal welfare on a farm based on routine herd data that are available in national databases. It is not currently known which variables of routine herd data (VRHD) are associated with dairy cattle welfare indicators (WI). Our aim was to identify VRHD that are associated with WI in a literature review. The 27 VRHD used in this review included the main types of data that are currently collected in national herd databases of developed countries, and related to identification and registration, management, milk production, and reproduction of dairy herds. The 34 WI used in this review were based on the Welfare Quality Assessment Protocol for Cattle. The search yielded associations in 146 studies. Twenty-three VRHD were associated with 16 WI. The VRHD that related to milk yield, culling, and reproduction were associated with the largest number of WI. Few associations were found for WI that referred to behavioral aspects of animal welfare, nonspecific disease symptoms, or resources-based indicators. For 18 WI, associations with VRHD were not significant ( $n = 5$  WI) or no studies were found that investigated associations with VRHD ( $n = 13$  WI). It was concluded that many VRHD have potential to estimate the level of animal welfare on dairy farms. As strengths of associations were not considered in this review, however, the true value of these VRHD should be further explored. Moreover, associations found at the animal level and in an experimental setting might not appear at the farm level and in common practice and should be investigated. Cross-sectional studies using integrated welfare scores at the farm level are needed to more accurately determine the potential of VRHD to estimate levels of animal welfare on dairy farms.

**Key words:** [dairy cow](#), [animal welfare](#), [herd data](#), [monitoring](#)

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