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The effect of somatic cell count data adjustment and interpretation, as outlined in European Union legislation, on herd eligibility to supply raw milk for processing of dairy products

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ABSTRACT

Somatic cell count (SCC) limits are a key component of national and international regulation for milk quality. As yet, very limited work has been published on SCC regulatory standards, including on the effect of different approaches to SCC data adjustment and interpretation. This study examines the effect of SCC data adjustment and interpretation, as outlined in current European Union (EU) legislation, on herd eligibility to supply raw milk for processing of dairy products for human consumption, using Irish data for illustration. The study used Irish milk-recording data as a proxy for bulk tank SCC (BTSCC) data, to calculate an unadjusted monthly SCC value for each herd during each month of participation. Subsequently, 4 data adjustments were applied, as outlined in EU and national legislation: seasonal adjustment; 3-mo rolling geometric average, without accounting for a break in the supply; 3-mo rolling geometric average, after accounting for a break in the supply; and seasonal adjustment and 3-mo rolling geometric average combined, after accounting for a break in the supply. Analyses were conducted to examine the effect, during the period from 2004 to 2010, of data adjustment on the percentage of herds with herd SCC >400,000 cells/mL. In all, 4 interpretation scenarios, incorporating different data adjustment combinations, were used to estimate herd eligibility (compliant, under warning, or suspended, as defined by legislation) to supply raw milk for processing. The 4 methods of data adjustment each led to a sizable reduction (6.7, 5.0, 5.3, and 11.1 percentage points, respectively, compared with the unadjusted data) in the percentage of herds exceeding a herd SCC of 400,000 cells/mL. Herd eligibility varied by interpretation scenarios, in particular those incorporating seasonal adjustment. The study provides new perspectives on the effect of data adjustment on herd SCC and of interpretation scenarios on herd eligibility. The results provide an illustrative, rather than definitive, picture of this effect, as national authorities use BTSCC data when determining herd eligibility, whereas this study was conducted using milk-recording data as a proxy. Some aspects of the primary EU legislation are unclear, which may lead to differences in interpretation and application. The potential impact of data adjustment and milk purchaser pricing on farm-level mastitis control in Ireland is considered.

Key words: data adjustment, somatic cell count, European Union legislation, Ireland

INTRODUCTION

Somatic cell count is an important measure of milk quality, reflecting the health status of the mammary gland and the risk of nonphysiological changes to milk composition. High SCC milk is associated with reduced milk yield (Hand et al., 2012; Boland et al., 2013), as well as increased costs associated with treatment, culling, and changes in milk quality. During processing, high SCC milk adversely affects cheese production, as a result of reduced curd firmness, decreased milk yield, increased fat and casein loss in whey, and compromised sensory quality (Munro et al., 1984; Politis and Ng-Kwai-Hang, 1988). High SCC milk also affects the yield of milk protein concentrate and reduces the shelf life of pasteurized liquid milk (Ma et al., 2000; More, 2009). Processors generally use differential raw milk pricing, a series of penalties and bonuses to supplying farmers, to meet the market demand for low SCC milk. Somatic cell count limits are also a key component of national and international regulation for milk quality (More, 2009). These regulatory SCC limits can be considered the lowest quality acceptable, noting that lower SCC limits are generally achieved as a result of processor-driven differential milk pricing.

Different regulatory SCC limits have been set by different countries (within the United States, different standards also apply in different states), which creates

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difficulties if a country wishes to export to another country with more restrictive limits (Norman et al., 2000, 2011). The European Union (**EU**) regulatory SCC limit has progressively been adopted as the international export standard in many dairy countries (Brightling et al., 2009; More, 2009). The United States has a national penalty limit of 750,000 cells/mL for local consumption (US Food and Drug Administration, 2011), but recently introduced a European Union Health Certification Program, specifying an SCC threshold of 400,000 cells/mL for companies exporting products into the EU (USDA Agricultural Marketing Service, 2011).

Within the EU, the eligibility to supply raw milk for processing of dairy products for human consumption is governed by Regulations 853/2004 (European Community, 2004a) and 854/2004 (European Community, 2004b) using measurements of raw bulk tank milk SCC (**BTSCC**) to determine eligibility. Data gathered from an individual herd are subject to adjustment before an assessment is made of herd eligibility to supply. For each month, all the results from BTSCC testing are combined with the results from the previous 2 mo and geometrically averaged to create a 3-mo rolling geometric average, to even out monthly SCC fluctuations. At the end of each month, the herd's 3-mo rolling geometric average is compared with the regulatory SCC limit (400,000 cells/mL) and with additional rules as outlined in EU Regulation 854/2004. A further 3-mo period is needed to determine herd eligibility to supply raw milk for processing. Within Ireland, seasonal adjustments and an additional methodology for a break in supply are applied to the raw BTSCC, as provided for in EU Regulation 853/2004. The Food and Veterinary Office carries out audits to monitor compliance with relevant regulations.

Substantial work, over many years, has addressed concerns with SCC measurement. Work toward a reference system for SCC in milk was published in 2008 (Baumgartner, 2008; Orlandini et al., 2008), and progress has been made to address concerns relating to laboratory variability and other factors affecting data quality, including sampling methods, sample transport, and storage (Hillerton et al., 2004). Within the EU, national reference laboratories play an important role in verifying compliance with relevant Community legislation (European Community, 2004c). As yet, however, published work on SCC regulatory standards has been very limited, particularly in regard to the effect of different approaches to SCC data adjustment and interpretation. Norman et al. (2011) recently investigated the consequences of alternative BTSCC standards on the eligibility of herds in the United States to supply milk for human consumption.

In the current study, the effect of SCC data adjustment and interpretation was examined, as outlined in current EU legislation, on herd eligibility to supply raw milk for processing of dairy product for human consumption. The results provide an illustrative, rather than definitive, picture of this effect, as national authorities use BTSCC data when determining herd eligibility, whereas this study was conducted using milk-recording data as a proxy. The potential influence of these data adjustments with regard to on-farm mastitis control is discussed.

MATERIALS AND METHODS

European and Irish Legislation

As required under EU Regulation 853/2004, the SCC in raw milk must not exceed 400,000 cells/mL (based on a rolling geometric average over a 3-mo period, with at least one sample per month; European Community, 2004a). When raw milk fails to comply, the competent authority must be notified and the food business operator shall take measures to correct the situation. Further, EU Regulation 854/2004 (European Community, 2004b) states that, once the 3-mo geometric average exceeds 400,000 cells/mL, the supplier then has 3 mo in which to reduce the 3-mo geometric average to below the 400,000 cells/mL limit. In practice, the supplier will receive warnings from the milk purchaser during this period of recovery and of eventual rejection, if necessary, if the milk remains noncompliant at the end of the 3-mo recovery period. In addition, Ireland applies an adjusted calculation method to milk collected during the winter months to account for seasonal variations in production levels, as provided for in EU Regulation 853/2004 (European Community, 2004a).

In Ireland, therefore, several adjustments are made to herd SCC data, as outlined in EU legislation (either directly or following Irish interpretation), as follows:

(1) Seasonal adjustment: "To take account of the seasonality of milk production in Ireland and to ensure the SCC is not unduly distorted on this account, a formula has been devised for the recording of results for the winter months from November to February inclusive. The formula is based on the national monthly production pattern for the winter period before that during which it is used. A co-efficient is obtained by dividing the national milk production level recorded each month from November to February by 50% of the average monthly production level for each of the 6 mo from April to September inclusive" [DAFM circular of 14 October 2011, De-