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Disclosed restaurant inspection results on food safety show regional and local differences in Finland

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ABSTRACT

The consistency of inspections is an important requirement of official food control. Inconsistency may endanger food safety and lead to mistrust in official food control. The reasons leading to inconsistency and the mitigation of inconsistency are therefore important. Here we investigated the distribution of restaurant (n = 4989) inspection grades from 2014 in Finland to elucidate reasons for possible differences in grades. The analyses revealed both regional and local differences in the overall grades. In addition, the distribution of the own-check sections' grades between local food control units revealed a large variation, indicating inconsistent assessments of inspection findings. The inspector resources in the local food control units did not explain the discrepancies. However, we found that differences in grades are to a certain extent explained by factors related to the economic status and urbanization of the area. The effects of socioeconomic factors appear moderate, and the differences in the inspectors' evaluations of compliance remain an important issue that should be addressed on a national level through inspector training.

1. Introduction

Official food control carries out inspections of food premises to ensure that food business operators (FBOs) comply with food safety regulations (EC 625/2017), and therefore these inspections have an important role in food safety. In the European Union (EU), common legislation lays the basis for official control, which can be complemented with national legislation and instructions. The legislation underlines that official control should be efficient and consistent (EC 625/2017). The importance of consistency is also highlighted in the national food control plan in Finland (Anonymous, 2019). Consistency can be defined as equal treatment of the FBOs in identical situations, that is, similar control actions taking into account the risk level of the operations (Kettunen, Lundén, Läikkö-Roto, & Nevas, 2017). However, official control inspections have been indicated as being inconsistent in several countries, such as Finland (Kettunen et al., 2017; Läikkö-Roto, Mäkelä, Lundén, Heikkilä, & Nevas, 2015), the Netherlands (Mascini & Wijk, 2009), the US (Lee, Nelson, & Almanza, 2010) and the UK (Lee-Woolf, Bain, & Fell, 2015).

The inconsistency of inspections may have serious consequences. Inconsistency has led to dissatisfaction among FBOs (Kaskela, Vainio, Ollila, & Lundén, 2019; Yapp & Fairman, 2006), which may lead to distrust in official control and further undermine the willingness to comply with food safety regulations (Yapp & Fairman, 2006). Food safety can be endangered not only by the unwillingness of the FBOs to correct non-compliances pointed out by the inspectors, but also due to possible differences in the requirements of the inspectors. Inconsistency is therefore important to mitigate.

Official control in Finland is carried out in 64 local food control units in six regional areas, which sets challenges for consistent control. Since May 2013 a disclosure system for food safety inspection results has been introduced to increase the efficacy of the correction of food safety violations (HE 293/2010), but also to increase the consistency of official control (FFA, 2019a). Consistency is considered to be improved through common and publicly available assessment instructions for inspections (HE 293/2010). On the other hand, the disclosure of the inspection results have raised concerns among FBOs because publicly stated inspection results may not be based on an equal interpretation of regulations (Kettunen et al., 2017). The disclosure of inspection results may affect dining decisions (Vainio, Kaskela, Finell, Ollila, & Lundén, 2020; Wong et al., 2015), which is a desired effect of the disclosure system, but further increases the pressure to have consistent inspections. Disclosure

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systems are in use and may face similar challenges in many locations, such as New York (Wong et al., 2015), Singapore (Aik, Newall, Ng, Kirk, & Heywood, 2018), Denmark (Leisner et al., 2014) and England (Fleetwood et al., 2019).

However, it is not always clear if the perceived inconsistency is the result of an inspectors' differing interpretation of the same requirement or true differences in the premises' compliance. This ambiguity is highlighted by the fact that many FBOs do not know whether the inspectors' assessment of inspection findings are inconsistent or not (Kaskela et al., 2019), which is understandable as many FBOs cannot compare inspector requirements and the assessment of inspection findings with other food premises.

Some studies have investigated the consistency of inspectors' assessments or possible reasons explaining the differences in the grading of restaurants. Läikkö-Roto et al. (2015) showed that inspectors' opinions varied considerably on whether the described imaginary situations in food premises were adequate or not. Other studies have found associations between the grading of restaurants or food stores and socioeconomic factors such as the level of poverty or economic development (Darcey & Quinlan, 2011; Pothukuchi, Mohamed, & Gebben, 2008; Sha et al., 2020) and the proportion of black residents (Leinwand, Glanz, Keenan, & Branas, 2017; Pothukuchi et al., 2008). These findings show that the inspection result can be associated with many factors that should be considered when assessing the consistency of inspections.

Restaurants are the most important sources of food-borne outbreaks in Finland (Zoonosis Centre, 2019). However, no analysis of the regional distribution of grades has been done in Finland, nor has any attempt been made to recognize the reasons for the possible differences in grades, even though the quality of official control in restaurants is important from the point of view of food safety. The aim of the study was to investigate the distribution of the Oiva grading in restaurants regionally and locally in Finland and to elucidate reasons for possible differences in grades. We expect to see variation in grades regionally and locally and hypothesize that some variation is caused by inconsistent grading and some due to true variation in compliance. The results will increase the understanding of the underlying reasons for differences in grading.

2. Material and methods

2.1. Restaurants and inspection reports

Inspection reports from restaurants covering the year 2014 were collected from Land Survey Finland, which is responsible for the collection of the inspection reports from all local food control units (64) in Finland. The local food control units carry out inspections at municipal level independently according to national instructions. The number of inspected restaurants was 4989 (50.6% of the restaurants) and the number of inspections 6716. The number of inspections was higher than the number of the restaurants because some restaurants were inspected more than once during the study period. The majority of the inspections were preplanned (n = 5576), and a smaller number were follow-up inspections (n = 1140). Collected information included the results of 14 own-check sections (Fig. 1), each consisting of several inspected items and their grading. The own-check sections cover the issues the FBOs must comply with and the compliance is inspected by official food control. Each inspected item is graded using a 4-point scale; "Excellent" (A = compliance), "Good" (B = minor non-compliances not impairing food safety or misleading the consumer), "To be corrected" (C = impairment of food safety or misleading the consumer) and "Poor" (D = jeopardising food safety or considerably misleading the consumer). The letter-based grading was transformed to numerical values for statistical analyses (A = 4, B = 3, C = 2, D = 1). The lowest grade for an item determines the inspection result (overall grade). The inspectors assess each inspected item according to instructions (FFA, 2019b) based on EU and Finnish legislation. The instructions include descriptions on what

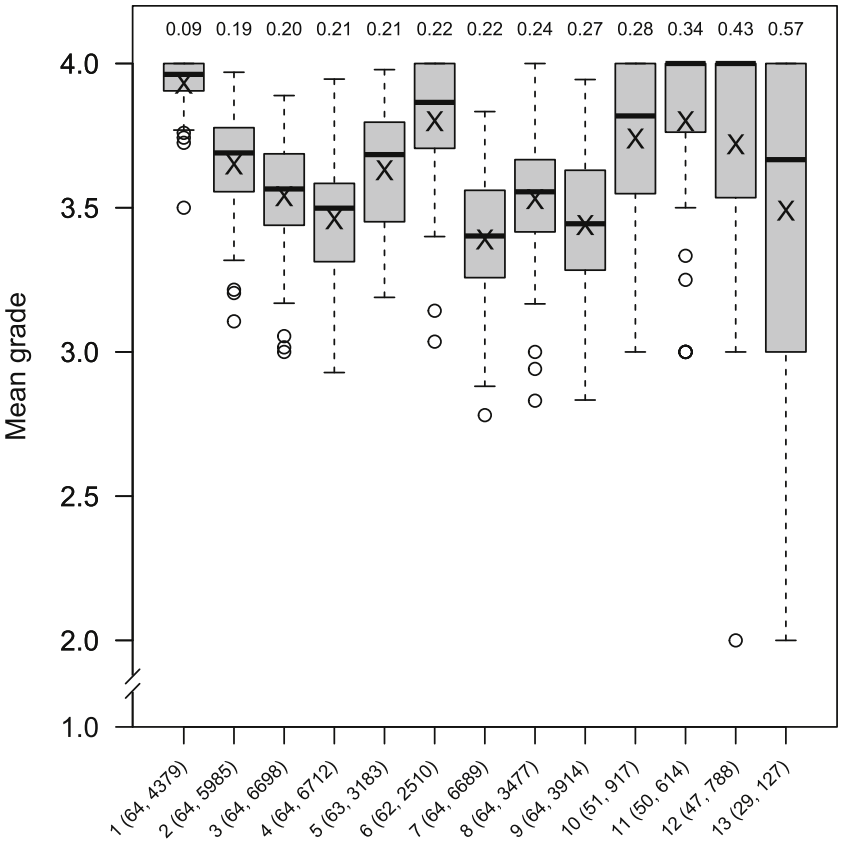

Fig. 1. Boxplot of Oiva grades for own-check sections in local food control units. The inspected own-check sections are displayed in ascending order of standard deviation of the mean Oiva grades of local food control units. Standard deviation is displayed at the top of the figure. The values in parentheses indicate the number of food control units and inspections. The X in the boxplot indicates the mean of the own-check sector. 1 = Allergens and food intolerances; 2 = Conditions at retail and serving; 3 = Training and actions of the personnel; 4 = Cleanliness of premises' surfaces and equipment; 5 = Displaying of the Oiva report; 6 = Food transport; 7 = Temperature control of food; 8 = Own-check plan; 9 = Adequacy, suitability and maintenance of premises; 10 = Own-check samples; 11 = Package and other food contact material; 12 = Traceability and recall; 13 = Information provided on the food. The own-check sector Composition of products is not visualized due to the small number of inspections. Y-axis: 4 = Excellent, 3 = Good, 2 = To be corrected, 1 = Poor.

kind of findings result in grades A, B, C or D.

2.2. Statistical analysis

The inspections were stratified according to the following parameters: Regional State Administrative Agencies (RSAA) (6 regions), local food control units (64 units) and postal codes (1161 codes). Means for the overall grade for RSAAs and local food control units were calculated. Also mean grade for every own-check section was calculated for each local food control unit.

The Kruskall-Wallis test along with post hoc pairwise tests with the Bonferroni correction were used to detect any significant differences in the overall grade between the RSAAs. In addition, Spearman's rho correlation analysis was done to establish a possible correlation between the overall grade and the following local food control unit parameters acquired from the Food Safety Authority: the number of food premises, the number of restaurants and the person-years allocated for food control. In addition, the ratios for the number of food premises and person-years in the local food control unit were calculated and included in the correlation analysis.

Further, the standard deviation of the local food control units' mean grades of each own-check section was determined. The standard deviation was used to assess the magnitude of variation of the grading between own-check sections.

The postal codes, which represent geographical areas, were used to investigate the possible association of grades with socioeconomic factors collected from Statistics Finland (Statistics Finland, 2017). The socioeconomic factors included variables related to population, housing, education, income, unemployment and family structure in each postal code area. The most adequate variables were recoded into categorical variables with four levels. Recoding was done in a way that the range and number of observations were approximately similar between categories. These recoded variables were included in a factor analysis, which revealed two distinct factors. The first factor included the median income and unemployment rate of the area. The second factor included the proportion of university-level education, the proportion of owner-occupied housing, the proportion of apartment buildings and the number of residents in the area. Based on these factors, sum variables were created. These sum variables were further recoded to four-level economic and urban indexes to ease the interpretation and comparison of results. A low economic index implies that an area has a low median income and a high unemployment rate, and vice versa. A low urban index implies an area that has a low proportion of university-level education, a high proportion of owner-occupied housing, a low proportion of apartment buildings and a low number of residents.

The inspections' overall grades were dichotomized to "acceptable" (grades A and B) and "control actions required" (grades C and D). Own-check sections with C and D grades in all of the RSAA areas (7/14 own-check sections) were included in the analyses. Multivariable logistic mixed models were used to test the effects of the economic index and urban index on grades. Because there were differences in grades between RSSAs and between preplanned and follow-up inspections, the analyses were adjusted for these variables. Since inspections in the same premises are not independent of each other, premises were included in the models as a random effect. In the case of model fit issues, normal logistic regression was used. In all of the analyses, the interaction between economic index and urban index was tested.

A significance level of $p < 0.05$ was used in all analyses. Analyses were performed using SPSS 25 (IBM SPSS Statistics, USA) and SAS 9.4 (SAS Institute Inc., Cary, NC, USA), and the figures were produced using R 4.0.0 (R Core Team, 2020).

3. Results

The proportions of the overall grades of all restaurant inspections were A = 24.7, B = 52.9, C = 21.0 and D = 1.3 percent. The mean overall grade in the whole country was 3.04 (Table 1), spanning from 2.95 to 3.32 between RSAAs. Both Eastern Finland and Lapland had significantly better mean overall grades compared to other RSAAs (Fig. 2) (Kruskall-Wallis test, $p < 0.001$). Further, the mean overall grade between local food control units varied greatly (min 2.27, max 3.53) (Table 1). Parameters related to the size of the local food control unit displayed large variations (Table 1). Only very weak correlations were observed between the mean overall grades and the number of food premises or the person-years for food control (correlation coefficient below 0.1, $p < 0.001$). No significant correlation was found between the mean overall grade and the number of food premises/person-year.

A wide variation between the mean grades of own-check sections was observed. The best overall grades considering the whole country were given to the own-check sections "allergens and food intolerances" (grade 3.94), "package and other food contact material" (grade 3.80) and "food transport" (grade 3.80) (Fig. 1). The poorest overall grades were given to "temperature control of food" (grade 3.39), "adequacy, suitability and maintenance of premises" (grade 3.44) and "cleanliness of the premises' surfaces and equipment" (grade 3.46) (Fig. 1).

Further analysis of the distribution of individual own-check sections' grades between local food control units revealed large differences in the standard deviation: the biggest difference was found within the own-check sections "information provided on the food" (the mean grade ranged from 4.00 to 2.00, SD 0.57) and "traceability and recall" (mean grade ranged from 4.00 to 2.00, SD 0.43) (Fig. 1). In addition, large differences were observed within the own-check sections "package and other food contact material" (the mean grade ranged from 4.00 to 3.00, SD 0.34), "own-check samples" (the mean grade ranged from 4.00 to 3.00, SD 0.28) and "adequacy, suitability and maintenance of premises" (the grade ranged from 3.94 to 2.83, SD 0.27) (Fig. 1). The least variation in grades between local food control units was found in the own-check section "allergens and food intolerances" (the mean grade ranged from 4.00 to 3.50, SD 0.09).

The multivariable logistic mixed model revealed significant associations between the overall grade and the economic and urban indexes. The higher the economic index or the urban index was, the less frequently grades A or B were achieved (OR = 0.89, $p < 0.0001$ and OR = 0.92, $p = 0.002$, respectively, for a one-level increase in the index) (Table 2). The economic index associated significantly with three own-check sectors and the urban index with five own-check sectors, of which four concerned premises and actions such as temperature control (OR = 0.82, $p < 0.0001$) and the adequacy, suitability and maintenance of premises (OR = 0.84, $p = 0.001$) (Table 2).

4. Discussion

Inconsistency in food control is often argued to be due to differences in the ways inspectors assess the findings at inspections. Indeed, inconsistency has been observed in inspectors' assessments (Läikkö-Roto et al., 2015), but other reasons for differences in restaurant

Table 1
Characterization of local food control units (n = 64).

Number of food premises Median (min-max)	Number of restaurants Median (min-max)	Person-years for food control Median (min-max)[a]	Number of food premises/ person-year Median (min-max)[a]	Overall Oiva grade[b] Mean (min mean – max mean)
527 (179–6064)	96 (24–1401)	3.3 (0.5–33.4)	157 (79–611)	3.04 (2.27–3.53)

[a] 62 local food control units due to missing information from two units.
[b] Mean Oiva grades from 4 to 1 (4 = Excellent, 3 = Good, 2 = To be corrected, 1 = Poor). Minimum mean refers to the local food control unit with the lowest Oiva mean grade, and maximum mean refers to the local food control unit with the highest Oiva mean grade.

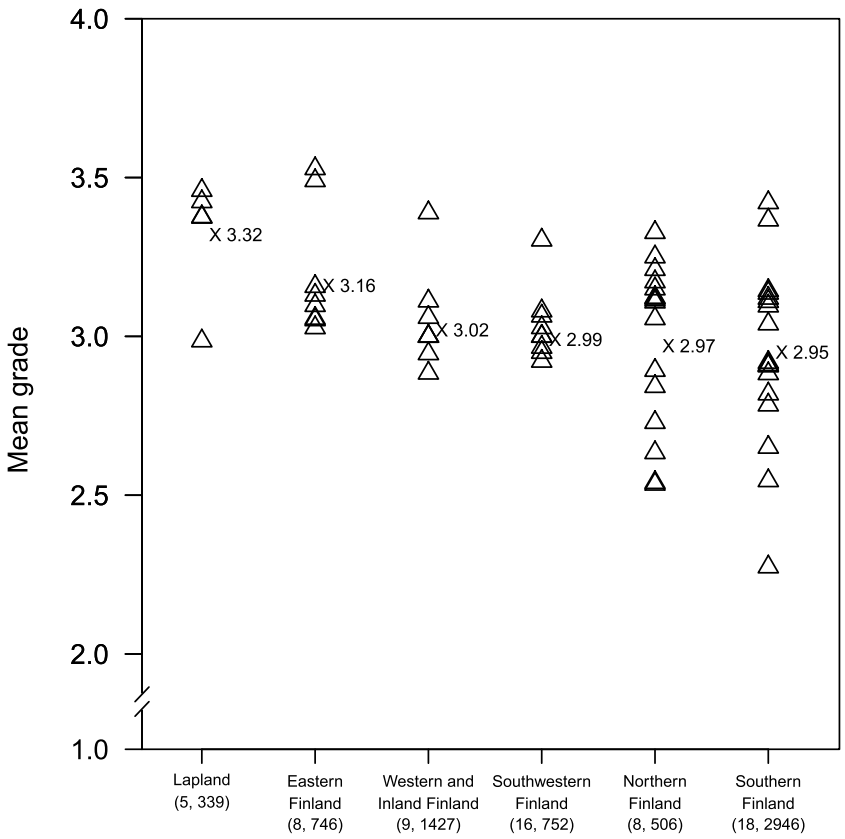

Fig. 2. The mean Oiva grade of each local food control unit (Δ) is plotted under the Regional State Administrative Agency. The number of local food control units and the number of inspection reports are displayed within brackets and the mean Oiva grade in the area of the Regional State Administrative Agency with the symbol X. Y-axis: 4 = Excellent, 3 = Good, 2 = To be corrected, 1 = Poor.

grades have also been raised (Leinwand et al., 2017). We investigated local and regional differences in the distribution of the grades and sought reasons for these to increase understanding of the phenomenon.

Variation in the distribution of the overall grades between RSAAs and between the 64 local food control units' grading of own-check sectors raises concerns about the consistency of food control in restaurants. The local food control units' size and resources showed only very weak correlations with the grades, therefore not offering any explanation for the discrepancies. It is possible that the differences in the distribution of grading are true differences in compliance. However, it is also possible that the interpretation of the legislation is ambiguous, leading to discrepancies in the assessment.

It is justified to presume that the level of particularity and unambiguousness of the legislation and instructions affect the consistency of food control. The EU hygiene regulation requirements concerning food premises are only stipulated on a general level. For example, regulation EC 852/2004 stipulates that the design and layout of rooms where food is prepared must permit good food hygiene practices, including protection against contamination between and during operations. This is an important food safety requirement expressed in a very general way. For example, the grading of the own-check sector adequacy, suitability and maintenance of premises requires inspectors to be able to apply the requirements to suit the prevailing situation in the individual restaurants. The grading of this particular own-check sector has also raised disagreements between restaurant FBOs and inspectors (Kaskela et al., 2019), underlining the challenging task of assessing findings at inspections. On the other hand, the grading of the own-check sector allergens and food intolerances showed the least variation between local food control units, suggesting that the interpretation of the sector is straightforward.

The largest variation between local food control units' grading was observed in own-check sections with less than a thousand inspections. This can indicate that the assessment of these own-check sections was not established among inspectors due to the low amount of inspections. The authorities should pay additional attention to the assessment of own-check sections where routine assessment skills have not necessarily developed.

Our results suggest that some of the variation in the grading of some own-check sectors is caused by geographical attributes. The fact that the grades were lower in urban areas may be related to the scarcity of space for restaurants. Some of the restaurants are located in old buildings in the city center that do not allow for sufficient space for operations. This could have consequences on how FBOs are able, for example, to clean and maintain the premises. This study does not offer any obvious reasons for the association between the lower-income areas and higher grades. Some other studies have also observed associations between economic factors and grades. Sha et al. (2020) observed an association between low economic development regions and high food safety risks in Gansu, China. The authors suggested that low-income regions may consist of food operators and service personnel with poor food safety risk literacy. They also found that areas with a higher population density have more food safety risks. They hypothesized that having more inspectors in these areas would lead to more frequent inspections and more violations being recorded. This hypothesis is not supported by our study since we did not find a significant correlation between the mean overall grade and number of food premises/person-year.

Darcey and Quinlan (2011) also found an association between the economic situation of residents and grading in Philadelphia; higher poverty areas had more facilities with at least one critical health violation, whereas lower poverty areas had a greater number of critical health violations per inspection. Leinwand et al. (2017) again found associations between the grading of non-chain restaurants and the proportion

Table 2
Multivariable logistic mixed model results of the effect of the economic index and urban index on Oiva grades. Results are adjusted for the Regional State Administrative Agency and for the reason for the inspection (preplanned or follow-up). The premises inspected are incorporated in the model as a random effect. Odds ratio (OR) < 1 denotes the following: as the index increases, the less frequently Oiva grade A or B is achieved.

Own-check section	OR	95% CL	p-value
Overall grade (n = 6716)			
Economic index	0.89	(0.84–0.94)	<0.0001
Urban index	0.92	(0.87–0.97)	0.002
Own-check plan (n = 3477)			
Economic index	0.90	(0.81–1.00)	0.053
Urban index	0.90	(0.81–0.99)	0.04
Adequacy, suitability and maintenance of premises (n = 3914)			
Economic index	0.93	(0.83–1.03)	0.15
Urban index	0.84	(0.76–0.93)	0.001
Cleanliness of premises' surfaces and equipment (n = 6712)[a]			
Economic index	0.89	(0.82–0.96)	0.003
Urban index	0.83	(0.77–0.90)	<0.0001
Training and actions of the personnel (n = 6698)			
Economic index	1.00	(0.91–1.09)	0.96
Urban index	1.03	(0.95–1.13)	0.48
Temperature control of food (n = 6689)[a]			
Economic index	0.88	(0.82–0.94)	<0.0001
Urban index	0.82	(0.77–0.88)	<0.0001
Conditions at retail and serving (n = 5985)			
Economic index	0.80	(0.73–0.88)	<0.0001
Urban index	0.85	(0.77–0.92)	0.0002
Displaying the Oiva report (n = 3183)			
Economic index	0.99	(0.78–1.26)	0.94
Urban index	1.25	(0.96–1.62)	0.09

[a] Due to model fit issues, normal logistic regression was used.

of black residents. These results show that the effect of socioeconomic factors on grading is complex, and results are not necessarily applicable to other food control systems and societies.

Despite the influence of geographical attributes on the variation in grading, there is still regional variation in grades explained by other factors. It can be contemplated whether the variation is due to differences in compliance or inconsistent assessment by inspectors. We argue that a substantial part of the regional variation and the local variation is caused by inconsistent grading. This is supported by the findings of Läikkö-Roto et al. (2015), who observed marked differences in the grading done by inspectors in imaginary situations. It is also possible that some of the inspectors enforce compliance more strictly than others, which would probably result in time in better grades.

Inconsistency between inspectors should be addressed. The mitigation of inconsistency is important not only because of the mistrust the inconsistency may create towards food control (Yapp & Fairman, 2006), but also because of food safety reasons (Lee, Nelson, & Almanza, 2012). Inconsistency can affect food safety if inspectors assess the findings differently. For example, following grade B or C, the food control actions will be very different. Grade B does not lead to any further control actions, but C leads to corrective measures and a follow-up inspection (FFA, 2019b). The inspection findings are described in the inspection reports, which would allow for the further analysis of possible discrepancies in grading. We suggest that the Finnish Food Authority should carry out such analyses to allow mitigating actions.

Strategies to mitigate inconsistency abound, including the standardization of inspections, training in rating violations and co-inspections (Jones, Pavlin, LaFleur, Ingram, & Schaffner, 2004; Kettunen et al., 2017; Lee et al., 2012). It seems also important that the inspectors would not inspect the same restaurants for years, but would rotate at some interval. However, there are no instructions on such procedures in Finland. Efficient mitigation strategy must without doubt also include instructional assessment of inspection findings. The Oiva instructions on assessment of inspection findings aim to standardize the assessment (FFA, 2019b). However, at the end of this study the Oiva instructions had been in use for only one and a half years, which is a short time with regard to the harmonization of assessment procedures. Previously, local food control units had no common assessment instructions. Therefore, it is not surprising to find regional and local differences in grades.

In addition to the variation in the individual own-check sectors' grades between local food control units, this study showed differences between the compliance of own-check sectors. The compliance of the own-check sector for allergens and food intolerances was the highest, which is important from a food safety point of view. Exposure to allergens can cause serious illness in sensitive restaurant customers, and it seems that this has been taken into consideration in restaurants. However, important own-check sectors such as temperature control, the adequacy, suitability and maintenance of premises, and the cleanliness of the premises' surfaces and equipment showed the lowest compliance. This is worrying since violations in these own-check sectors predispose the restaurants to foodborne outbreaks (FDA, 2017; EFSA, 2018; Zoonosis Centre, 2019). These own-check sectors clearly require more consideration from both the FBOs and inspectors.

It is noteworthy to point out that only one fourth of the inspections resulted in the best grade. This differs markedly from the results in Denmark that have a similar kind of disclosure system in use since 2001. The majority of the restaurants receive the best possible grade (DVFA, 2020). It would be of interest to study possible regional differences in grades also in Denmark. It would be expected that the differences are smaller than in Finland since the disclosure system have been in use already for almost 20 years.

This study includes all restaurants inspected during 2014 and is therefore representative of the whole country at that time. The data did not allow restaurants belonging to a chain to be identified, and therefore we were unable to study the effect of being part of a restaurant chain. However, we would have expected chain restaurants to have better grades based on earlier studies. Information on the size of the restaurants was also not available due to limitations in the national database for inspection reports. In addition, we were not able to carry out inspector-based analyses due to data limitations.

To conclude, we have here described differences in grading regionally and within own-check sectors between local food control units. The differences in the grades are to a certain extent explained by factors related to the economic status and urbanization of the area. However, the effects of the socioeconomic factors appear moderate, and the differences in the inspectors' evaluations of compliance remain an important issue. Authorities should monitor the consistency of grading, and inspectors should be trained in assessment.

CRediT authorship contribution statement

Janne Lundén: Conceptualization, Methodology, Writing - original draft, Supervision. **Mikko Kosola:** Formal analysis, Writing - review & editing. **Juho Kiuru:** Investigation. **Jenni Kaskela:** Writing - review & editing. **Tommi Inkinen:** Conceptualization, Supervision.

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