

Food Premises Inspection Violations and Inspection Frequency during COVID-19 in Vancouver Island Health Authority

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Abstract

Background: Food service establishments, such as restaurants are subject to regulatory compliance, which acts to protect the health of the public from health risks and hazards that may arise in these settings. Ensuring compliance during inspections is carried out by public health professionals including Environmental Health Officers (EHOs). The COVID-19 Pandemic has impacted the public health sector, with many programs, services and professional involvement being enhanced to better support the COVID-19 response. This study investigated whether restaurant inspections on Vancouver Island, British Columbia, were impacted during COVID-19, including inspection frequency, inspection violations and hazard ratings.

Methods: Electronic inspection data from Vancouver Island Health Authority (VIHA) was analyzed using NCSS 2022 Statistical Software. The data analysed included inspections conducted from January 2019 to December 2021. 2019 represented the year pre-COVID, 2020 represented the early days and first year of the pandemic, and 2021 represented the second full year of the COVID 19 pandemic. The type of inspections analysed were routine inspections conducted throughout VIHA's geographic jurisdiction. The obtained data were analyzed to determine whether inspection frequency, total, critical and non-critical violations, and hazard ratings changed between 2019, 2020 and 2021.

Results: The number of restaurant inspections throughout VIHA, and within its three regions (South, Central and North), decreased each year from 2019 to 2021. The number of total violations, critical violations and non critical violations also decreased for all of VIHA, and within each of the three regions, between 2019 to 2021. The proportion of inspections resulting in critical violations decreased from 2019 to 2020, then increased in 2021 for all of VIHA.

Conclusion: The findings of this study confirm VIHA restaurant inspections have decreased since the start of the COVID-19 pandemic. Critical violations increased from 2019 – 2021 and non-critical violations decreased during the same time period. The increase in critical violations is especially worrying if the trend continues since critical violations indicate immediate risks to public health.

Keywords: *environmental health officers (EHO), restaurant inspections, food service establishment, COVID-19, inspection violations*

Introduction

There remains many unknowns on if and how COVID-19, COVID-19 restrictions, and the general pandemic circumstances have impacted environmental health services. Public health inspections, such as food premises inspections, are generally part of routine operations for all regional health authorities. However, the COVID-19 pandemic has shifted many routine operations of environmental health towards COVID-19 response. This shift in operations impacts food premises, including loss of routine inspections. Routine

inspections involve assessing regulatory compliance, observing food handling and practises, and are also an opportunity for food handler and operator education. Maintaining safe food practices and procedures in food premises is vital to prevention of food borne illness and outbreaks. Therefore, maintaining high regulatory compliance and ensuring food is being handled and prepared in safe ways is important to public safety.

Literature Review

Food Safety

Health Canada estimates that 1 in 8 Canadians or about 4 million are affected by food borne illness every year. These numbers correspond to 11, 600 hospitalisations and 238 deaths every year (Government of Canada, 2016). Food borne illness can result from microbial, chemical or physical hazards. The majority of food borne illness reported, with known cause, is attributed to microbiological hazards. Food handling occurs in a variety of settings, such as, food service establishments, food processing establishments, in homes and in other places. The Ministry of Health has reported that in food borne illness cases where food mishandling was the known cause, the majority originated from food service establishments (BC Ministry of Health, 2006). In British Columbia (BC), food services establishments are defined by the Food Premises Regulation [B.C. Reg. No. 210/99] as a food premises where food is either processed, served or dispensed to the public, or where food is intended for immediate consumption (B.C. Food Premises Regulation).

Food safety is a major component of food premises inspections. These inspections are carried out by public health inspectors (PHIs), also called environmental health officers (EHOs) (BCCDC, 2010). EHOs play an integral part in food prevention through actions such as performing inspections, approving food safety and sanitation plans, education for food handlers and food premises operators, and enforcing legislation such as the Public Health Act and B.C. Reg. No. 210/99. During an inspection, EHOs are observing the premises for health hazards and critical health hazards, which indicate violations. Critical violations are identified as violations found within a food premises that have an increased risk to

food safety and are likely to cause food borne illness. Critical violations include actions such as potentially hazardous foods stored improperly, hot held, and cooled improperly. Non-critical violations differ as they may not directly result in a food borne illness, however they could pose a threat to food safety (BCCDC, 2010, Hutchings, J. 2019; Island Health 2021b).

Impacts of COVID-19

At this time, the global population is still experiencing life in the COVID-19 pandemic context. On January 30, 2020, the World Health Organization declared the COVID-19 outbreak a public health emergency of international concern. Following the declaration was WHO's assessment that COVID-19 was characterized as a pandemic (World Health Organisation, 2021). While the world watched as the number of cities and countries were quickly gaining COVID-19 cases, the Canadian federal and provincial governments started implementing public health guidelines and orders affecting all Canadians. Some of the first public health orders were the closures of public schools in March 2020 and the banning of large events and meetings such as conferences, nightclubs, and sporting events. The BC provincial government declared a provincial state of emergency March 18th, 2020, and on March 20, 2020, all dine-in establishments, including dine-in food premises were ordered closed (BC CTV News, 2021). This did not include take-out and delivery services (BC CTV News, 2021). The closure order for dine-in establishments was rescinded May 19, 2020, and replaced with a new order, with accompanying restrictions for dining and food premises. Key takeaway restrictions imposed on May 19, 2020, included, the must for 2-meter distancing between parties and staff, and other patrons, 6

maximum patrons per table, gathering and retaining contact information of at least one person per table, and a capacity limit of 50% maximum of the usual capacity present at one time (AbleBC, 2021). Further relaxation of dining restrictions has occurred since, with dining tables needing not to be from one household, however, indoor dining remains far from historically normal.

The impacts of the COVID-19 pandemic and provincial state of emergency are far reaching. All Canadians from all walks of life have been impacted, and possibly business owners and operators the greatest. Food safety and food security have been affected in ways both direct and in-direct, including food supply chain disruption, high market demand for retail food needs, worker protection and retention, and maintaining food safety and quality while dealing with staff COVID-19 cases and quarantine protocols (Menu Canada's foodservice magazine, 2021; Nakat & Bou-Mitri, 2021). These impacts to food premises were intertwined with the impacts of public behaviour, such as a change in food purchasing behaviour. The dine-in order, accompanied with restrictions including essential only travel and social distancing, as well as other factors such as health and nutrition behaviour change resulted in a surge of food purchasing impacts that saw retail, especially online grocery shopping, going up and dine-in dining taking a hit (Goddard, 2020).

The COVID-19 pandemic has shaken all sectors, including public health. Public health, especially communicable disease response has awakened as COVID-19 response strategies and policies have quickly been mandated and rolled out throughout the province. To maintain necessary public health services, public health professionals have been deployed to various jobs such as contact tracing and,

emergency management. Many of these professionals are certified EHOs who have the education, designation and qualifications to be utilized in various communicable disease roles and tasks (Sekercioglu et al., 2020). While some COVID-19 response positions were created, many roles and duties were filled with EHOs who already were employed by health authorities and other agencies (Sekercioglu et al., 2020).

Impacts of Restaurant Inspection Frequency

For this literature review, a combination of peer-reviewed journal articles and publications were used, as well as grey literature from various sources such as BCIT Environmental Health Journal (Besharah, 2015; Thandi, 2020; Tung, 2018). Of the four articles chosen for this literature review, two explore restaurant inspection frequency and effects on food safety compliance and number of critical hazards per inspection (Newbold et al., n.d.; Medu et al., 2016). The initial study utilized mixed methodology to capture quantitative and qualitative data. First, high-risk food premises were assigned an inspection frequency of 4, 5, or 6 inspections for one calendar year, and compliance indicators such as number of critical and non-critical infractions for the study year were recorded, analyzed, and compared (Newbold et al., n.d.). The same study also utilized two surveys directed to public health inspectors and focus groups sessions to gain qualitative data around impacts of increased inspection frequency on various factors (Newbold et al., n.d.). The second study utilized a two-arm randomized, two-year controlled trial with at-risk restaurants, in which half the group received twice-yearly inspections and the control receiving the usual once-yearly inspection frequency, and critical hazards and elevated-risk ratings were observed (Medu et al., 2016). A meta-analysis was also used,

which assessed impacts of food handler training and education interventions on food handler behaviours and attitudes, and inspection scores (Young et al., 2019). Finally, the fourth study utilized a cross-sectional survey of Canadian environmental public health professionals (EPHPs) working during the COVID-19 pandemic using a questionnaire to gain both quantitative and qualitative information (Sekercioglu et al., 2020).

Two studies found no significant difference in the number of violations and increased inspection frequency. This was noted to be consistent with literature in that increased inspection frequency was not associated with decreased violations (Newbold et al., n.d.; Medu et al., 2016). Further, the study by Newbold et al., also showed no significant difference in average time between inspections and measured compliance. Framing this research in a pandemic context may have highlighted different results. Regardless of inspections not occurring as routinely during COVID-19, there are various other societal and economic factors at play currently. For example, COVID-19 precautions and restrictions such as increased awareness of disease transmission, sanitation, masks and social distancing could impact food handler and operator food handling practises. It would be normal to assume that such sanitation awareness could positively affect sanitation in the workplace. However, economic factors such as food supply impacts, decreased dine-in customers, seating changes, and staff turnover may negatively affect operator and food handler behaviour and mentally, perhaps leading to negative effects on food handling and thus inspection compliance.

Restaurant Inspection Education

Several articles noted the importance of education during routine inspection. Routine premises

inspections act not just as a tool for compliance, but also allows the inspectors to identify issues in food safety practises, observe critical and non-critical hazards, and create opportunities for ongoing education (Newbold et al., n.d.; Medu et al., 2016). In a meta-analysis reported by Young et al. (2019), there were mixed results when assessing the effects of education interventions on food handler knowledge, behaviour and food premises inspection scores. Nonrandomized trials elicited no significant positive impact of education interventions on food handler knowledge, behaviour and food premises inspection scores. Also, randomized control trials showed a difference. However, the author noted that two of the eight randomized control trials showed strong education intervention effects (Young et al., 2019). Past research assessing whether increased inspection frequency above what is normal in those conditions impacting compliance and violations has shown mixed results (Young et al., 2019). Therefore, assessing whether or how a decrease in inspection frequency impacts compliance and violations found during inspections may possibly show no effect. This would be contrary to common sense, however, perhaps inspection education and enforcement is not the biggest driving force in operator and food handler practises. Indeed, this literature search did not find research on whether decreased inspection frequency negatively impacts compliance and violations during inspections, which is not to say the search is exhaustive, as it was limited to public information and databases identified on the BCIT library website. Since early in the pandemic, there have been whispers of EHOs redeployment to COVID-19 response duties and thus halting or slowing regular duties such as inspections. However, this literature search found no grey literature detailing these

changes. Sekercioglu et al. has confirmed the accuracy of these whispers, with results from surveys directed at EHOs throughout Canada, including BC (Sekercioglu et al., 2020). The study did not delve into the repercussions on the food premises, but other research assessing education interventions, including education provided during routine inspections, has generally found no impacts on compliance and violations (Medu et al., 2016; Sekercioglu et al., 2020). Although research on education interventions shows little impact on food premises inspection compliance, the COVID-19 restrictions have been in place for over 12 months and thus, there may be food premises who have foregone routine inspections at least this long. Although research on education interventions shows little impact on food premises inspection compliance, the impacts of potentially forgoing routine inspections during the pandemic, in addition to the constraints and challenges that the pandemic places on food premises remain unknown.

Purpose of the Study

In light of vast changes and challenges the COVID-19 pandemic has brought to all public and business sectors, it would be beneficial to public health to confirm whether the loss of routine inspections had impacted food premises. This research will focus on restaurant inspections under Vancouver Island Health Authority's (VIHA) jurisdiction. The research seeks to determine if VIHA restaurant inspection frequency, inspection violations and inspection hazard ratings were impacted during the COVID-19 pandemic.

Methods and Materials

Materials

For this research project, restaurant inspection data from HealthSpace Cloud, was provided by Mr. Cole Diplock, Regional Manager of Health Protection and Environmental Services at Vancouver Island Health Authority, VIHA, in British Columbia. The inspection data was in a Microsoft Excel document and a computer was used to receive it. Microsoft Excel was used to organize the data, as well as to generate descriptive statistical tables and graphs. Inferential statistical analysis of the inspection data was performed on statistical analysis software, NCSS 2022 (NCSS, 2022).

Methods

The methods used for this research included requesting electronic data from VIHA's Mr. Cole Diplock. Requested was food service establishment inspection data for routine inspections from the Island Health Authority region, including restaurant name, facility type, location, inspection date, number of total violations, number of critical violations, number of non-critical violations, violation codes, and hazard ratings.

The sample population for this study was selected using the inclusion and exclusion criteria as discussed below. A large sample population was selected, and included restaurant inspections conducted from January 2019 to December 2021. The number of inspection data for 2019, 2020 and 2021 was unequal, and inspection data were not specifically chosen for this study, rather, all inspection data meetings requirements were included which allowed for the large sample population.

Inclusion and Exclusion

Previous studies have compared restaurant inspection data between groups, such as violations and violation codes (Besharah, 2015; Thandi, 2021; Tung, 2018).

These studies provided suggestions on methodology of data collection, inclusion and exclusion criteria and statistical analysis; however, for this research, exclusion and inclusion criteria was formatted to best represent the research questions, the COVID-19 context, and Island Health's unique geographical area. For this study, inspections occurring in all Island Health regions were included.

Inspection data for inspections conducted between January 1, 2019, and December 31, 2021, were included. For this research, food service establishment inspection data, the region, inspection data, hazard rating, total number of violations, number of critical violations, non-critical violations and violation codes were retained. In addition, only restaurant types were included, and take-out and mobile carts were excluded.

Further exclusion of restaurant data was conducted, specifically the exclusion of certain types of facilities. Exclusion of facility types was done to specifically target restaurants for this research. The following types of facilities were excluded: fast-food facilities, coffee shops, cafes, deli's, markets, ice-cream parlours, convenience stores, gas stations, grocery stores, concession stands, schools, cafeterias, hospitals, juice bars, catering, bakeries, centers, fitness centers, gyms, and soup kitchens.

Violations are generally categorized, Island Health categorizes violations as critical hazards, and sanitation and maintenance violations. Critical hazards and maintenance violation categories are aligned with sections of the B.C. Reg. No. 210/99, which is enforceable by Island Health's EHOs under

the Public Health Act (BC Food premises regulation, 1999; Public Health Act, 2008). For this research, violation categories followed Island Health's inspection report and included all possible violations in the analysis.

Statistical Analysis

Descriptive Statistics

Data used in this research included secondary numerical, nominal and ordinal data. Numerical data included inspection frequency, inspection dates and number of violations. Nominal data included regions, and ordinal data included hazard ratings. Microsoft Excel was used to organize the data, as well as to generate descriptive statistical tables and graphs. Two inferential statistical tests were used, the Kruskal-Wallis One-Way ANOVA on Ranks and the Pearson's Chi-Square Test. A summary of results is provided in Table 2. Inferential statistical analysis of the inspection data was performed on statistical analysis software, NCSS 2022.

Results

The research included data from restaurants inspections conducted between January 2019 to December 2021, and the total number of inspections included is N= 4227. Inspections for the South Region (N=2197), Central Region (N=1425) and North Region (N=605) were included.

Key Findings

- The number of restaurant inspections throughout VIHA, and within the three regions (South, Central and North), decreased each year from 2019 to 2021 (Table 1).
- The number of total violations, critical violations and non-critical violations also decreased for all

of VIHA, and within each of the three regions, between 2019 to 2021 (Tables 2 & 3).

- Given there were overall fewer inspections, it made sense that there were fewer violations. As such, the proportion of violations per inspection was calculated. The proportion of total, critical and non-critical violations was always lowest in 2020. The proportion of critical violations was highest in 2021 and the proportion of non-critical violations was highest in 2019 (Table 2).
- Discrepancies in proportion of violations per inspection between the Regions were identified: The Central Region had a higher proportion of total and of critical violations compared to the other two regions for each time period. The South region had a lower proportion of total, critical and non-critical violations than the other two regions in each time period (Table 3).
- The percentage of inspections resulting in zero violations was highest in 2020 (48%) followed by 30% in 2021 and 21% in 2019 (Figure 1).

Descriptive Statistics

Inspection frequency was evaluated to indicate differences during the study time frame. VIHA inspection frequency decreased from 2019 (N=1981) to 2020 (N=1600), and further decreased in 2021 (N=646). Similarly, inspection frequency, for all regions: South, Central and North, decreased from 2019 to 2020, and further decreased in 2021 (Table 1).

Table 1: VIHA Region Inspection Frequency

	2019	2020	2021	Total
South Region	1097	806	294	2197
Central Region	607	588	230	1425
North Region	277	206	122	605
VIHA Region	1981	1600	646	4227

In regard to inspection violations, violation counts for the VIHA Region decreased from 2019 (N=2471) to 2020 (N=1248), and to 2021 (N=679). However, by looking at the proportions of violations per inspection, one sees a decrease from 2019 to 2020, then an increase in 2021. The proportion of inspections resulting in critical violations was the highest in 2021, compared to 2019 and 2020 (Table 2).

Table 2: Sum & Proportions of Violations for the VIHA Region

	Violation Counts		
	2019	2020	2021
Total violations	2417	1248	679
Critical violations	472	331	206
Non-critical violations	1945	917	473
	Proportion of Violations per Inspection		
	2019	2020	2021
Total violations	1.22	0.78	1.05
Critical violations	0.24	0.21	0.32
Non-critical violations	0.98	0.57	0.73

Violation counts were also evaluated for each region. The South Region inspection violations decreased from 2019 to 2021. Critical violations decreased from 2019 (N=169) to 2020 (N=82), to 2021 (N=44) (Table 3). In all regions, the proportions of inspections resulting in violations decreased from 2019 to 2020, and increased in 2021. The Central Region had the highest proportion of critical violations per inspection for 2019, 2020 and 2021. The South Region had the lowest proportion of critical violations per inspection for 2019, 2020 and 2021 (Table 3).

Table 3: Violation counts for the VIHA Regions

		Violation Counts		
		South Region	Central Region	North Region
2019	Total violations	1089	932	396
	Critical violations	169	247	56
	Non-critical violations	920	685	340
2020	Total violations	452	588	208
	Critical violations	82	241	35
	Non-critical violations	370	374	173
2021	Total violations	204	318	157
	Critical violations	44	124	38
	Non-critical violations	160	194	119
		Proportion of Violations per Inspection		
		South Region	Central Region	North Region
2019	Total violations	0.99	1.53	1.43
	Critical violations	0.15	0.41	0.20
	Non-critical violations	0.84	1.13	1.23
2020	Total violations	0.56	1.0	1
	Critical violations	0.1	0.39	0.17
	Non-critical violations	0.46	0.61	0.84
2021	Total violations	0.69	1.38	1.29
	Critical violations	0.15	0.54	0.32
	Non-critical violations	0.54	0.84	0.96

The proportion of VIHA inspections resulting in violations was also evaluated. The proportion of inspections resulting in zero violations increased

Table 4: Summary of Inferential Statistics

#	H ₀ and H _a	Test Used	Results	Interpretations
1	H ₀ 1 (H ₀ = H _a): There is no difference the in proportion of total violations between inspections conducted in 2019, 2020 and 2021 H _a 1 (H ₀ ≠ H _a): There is a difference between the proportion of total violations between inspections conducted in 2019, 2020 and 2021	Kruskal-Wallis One-Way ANOVA on Ranks	P= 0.0000	Reject H ₀ and conclude that there is a statistically significant difference between the proportion of total violations found during inspections in 2019, 2020 and 2021. Power = 100%, hence the test is powerful enough to detect a difference. The Scheffe’s Multiple Comparison Post Hoc test shows the proportion of total violations in 2020 to be statistically significantly lower than the proportion in each year from 2019 to 2021.

from 2019 (21%) to 2020 (48%), then decreased in 2021 (30%) (Figure 1). Furthermore, the proportion of inspections with critical violations was the highest in 2021 (24%), compared to 2019 (20%) and 2020 (16%) (Figure 1).

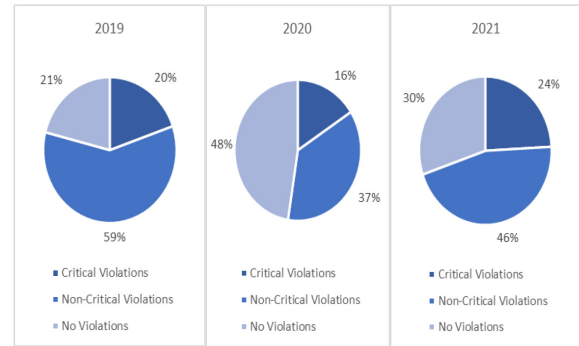


Figure 1: Proportion of VIHA Inspections Resulting in Violations

Inferential Statistics

Results from the inferential statistical tests are compiled in Table 4. Key takeaways include 2021 critical violations for the VIHA Region were found to be statistically significantly higher than 2019 and 2020. Critical violations in 2020 South Region were statistically significantly lower than 2019. Critical violations in 2020 Central Region where statistically significantly lower than 2021 (Table 4).

2	<p>H₀₂ (H₀ = H_a): There is no difference in the proportion of critical violations between inspections conducted in 2019, 2020 and 2021</p> <p>H_{a2} (H₀ ≠ H_a): There is no difference in the proportion of critical violations between inspections conducted in 2019, 2020 and 2021</p>	Kruskal-Wallis One-Way ANOVA on Ranks	P= 0.0001	<p>Reject H₀ and conclude that there is a statistically significant difference between the proportion of critical violations found during inspections in 2019, 2020 and 2021. Power = 98%.</p> <p>The Scheffe's Multiple Comparison Post Hoc test shows 2021 critical violations to be statistically significantly higher than in 2019 and 2020.</p>
3	<p>H₀₃ (H₀ = H_a): There is no difference in the proportion of non-critical violations between inspections conducted in 2019, 2020 and 2021</p> <p>H_{a3} (H₀ ≠ H_a): There is no difference in the proportion of non-critical violations between inspections conducted in 2019, 2020 and 2021.</p>	Kruskal-Wallis One-Way ANOVA on Ranks	P= 0.0000	<p>Reject H₀ and conclude that there is a statistically significant difference between the proportion of non-critical violations found during inspections in 2019, 2020 and 2021. Power = 100%.</p> <p>The Scheffe's Multiple Comparison Post Hoc test shows 2019 non-critical violations to be statistically significantly higher than in 2020 and 2021, and 2020 significantly lower than in 2019 and 2021.</p>
4	<p>H₀₄ (H₀ = H_a): There is no difference between the proportion of critical violations for South Vancouver Island inspections in 2019, 2020, and 2021.</p> <p>H_{a4} (H₀ ≠ H_a): There is no difference in the proportion of critical violations for South Vancouver Island inspections in 2019, 2020, and 2021.</p>	Kruskal-Wallis One-Way ANOVA on Ranks	P= 0.00210	<p>Reject H₀ and conclude that there is a statistically significant difference between the proportion of critical violations for South Region inspections in 2019, 2020, and 2021. Power = 79%, therefore, β = 0.21, indicating a slight beta error. Therefore, the test may not be powerful enough to detect a difference.</p> <p>The Scheffe's Multiple Comparison Post Hoc test shows 2020 critical violations to be statistically significantly lower from 2019. Critical violations are not statistically significantly different from 2020 to 2021, and from 2019 to 2021.</p>
5	<p>H₀₅ (H₀ = H_a): There is no difference between the proportion of critical violations for Central Vancouver Island inspections in 2019, 2020, and 2021.</p> <p>H_{a5} (H₀ ≠ H_a): There is no difference in the proportion of critical violations for Central Vancouver Island inspections in 2019, 2020, and 2021.</p>	Kruskal-Wallis One-Way ANOVA on Ranks	P= 0.00500	<p>Reject H₀ and conclude that there is a statistically significant difference between the proportion of critical violations for Central Region in 2019, 2020, and 2021. Power = 79.5%.</p> <p>The Scheffe's Multiple Comparison Post Hoc test shows critical violations in the Central Region not statistically significantly different between 2019 and 2020, and not statistically different between 2019 and 2021. The test shows 2020 critical violations to be statistically significantly lower from 2021.</p>
6	<p>H₀₆ (H₀ = H_a): There is no difference between the proportion of critical violations for North Vancouver Island inspections in 2019, 2020, and 2021.</p> <p>H_{a6} (H₀ ≠ H_a): There is no difference in the proportion of critical violations for North Vancouver Island inspections in 2019, 2020, and 2021.</p>	Kruskal-Wallis One-Way ANOVA on Ranks	P= 0.00309	<p>Reject H₀ and conclude that there is a statistically significant difference between the proportion of critical violations for North Region inspections in 2019, 2020, and 2021. Power = 67%, therefore β = 0.33, indicating low confidence in the results, however, a larger sample size may provide truer results.</p> <p>The Scheffe's Multiple Comparison Post Hoc test shows critical violations in the North region not statistically significantly different between 2019 and 2020, and not statistically different between 2019 and 2021. The test shows 2020 critical violations to be statistically significantly lower from 2021.</p>

Discussion

The main objective of this study was to determine if the COVID-19 pandemic impacted restaurant inspection frequency in the VIHA region. The provided data indicates that inspections decreased from 2019 to 2021 in the South, Central and North Regions of the health authority. This was to be expected and aligns with previous research, as throughout British Columbia, including VIHA's geographical region, EHOs and other public health professionals have been redeployed or partially taken away from routine operations, which include restaurant inspections, and placed on communicable disease and other pandemic support work (Sekercioglu et al., 2020). Interestingly, the greatest decrease in inspection frequency occurred from 2020 to 2021. British Columbia's provincial state of emergency was declared in March 2020, followed by various restrictions directly impacting the food service industry. Thus, it would have been assumed that inspection frequency in 2019 to 2020 would show the most difference. Inspection frequency in 2021 was the lowest for the VIHA Region, and may indicate a greater length of time necessary for routine operations to resume for both EHOs and for restaurant premises owners and operators. Since this study only evaluated routine inspections, perhaps other types of inspections such as complaint-based and COVID-19 inspections were still occurring at a pre-pandemic frequency. The decrease may also indicate a decrease in inspection capacity that is specific to VIHA, however, this study did not evaluate capacity. Inspection frequency in the South Region was found to have the greatest decrease from 2019 to 2020, and from 2020 to 2021. The South Region includes many municipalities, including the Greater Victoria, which represents almost 30% of

VIHA's total population (Island Health, 2019). It could be argued that due to the South Region's population density, a greater need of pandemic support would have been required and the capacity for routine inspections was impacted.

Another objective was to determine whether inspection violations were impacted during the COVID-19 pandemic time frame. The data indicates impacts to the number of total violations found during inspections, as well as the number of critical and non-critical violations from 2019 to 2021. This was found true for the VIHA Region as a whole, as well as for the South, Central and North Regions. The data indicated that the proportion of violations, including critical and non-critical violations changed from 2019 to 2021. The South, Central and North Region's critical violations in proportion to total violations increased, while non-critical violations decreased. Interestingly, the data indicates that the Central Region's proportion of critical violations was greater compared to the South and North Regions in 2019, 2020 and 2021. Comparing the increase in critical violations between the regions, while considering that in 2019 the proportion of critical violations in the Central Region was already greater, there is a similar upwards trend between the regions from 2019 to 2020, and 2020 to 2021. It appears that the Central Region may have a higher critical violation baseline. Although this study does not indicate why Central Region inspections generally had a greater proportion of critical violations, speculation may include differences in factors such as the Region's population, demographics, geographical area, inspection process, including EHO practices, or operator compliance. This study did not determine why critical violations increased from 2019 to 2021, regardless of the decrease in inspection frequency.

An evaluation of violation codes indicates differences in violation codes from 2019 to 2021, however, the differences were not tested for statistical significance. Unlike previous research on the evaluated impacts of increased inspection frequency on violations, this study evaluated decreased inspection frequency on violations, and confirmed the differences in violations to be significant (Newbold et al., n.d.; Medu et al., 2016). Further, the results from this study contradict a previous study which found no difference in the average time between inspections and measured compliance (Newbold et al., n.d.). This study did not measure the time between inspections, however, the stark decrease in inspection frequency from 2019 to 2021, together with the increase in critical violations may indicate a decrease in compliance.

The data also indicates an increase in the proportion of VIHA restaurant inspections resulting in zero violations from 2019 to 2020, and a decrease from 2020 to 2021. Further, from 2019 to 2020, fewer inspections resulted in critical violations and non-critical violations, then in 2020 to 2021, a greater number of inspections resulted in critical violations and non-critical violations. As these results are based on inspection frequency for 2019, 2020 and 2021 respectively, the decrease in inspection frequency cannot account for these differences. Differences in resulting violations may be due to several factors, such as changes in operator behaviour and food safety practices, new premises opening and changes to ownership or management, and inspection processes.

This study also sought to evaluate restaurant inspection hazard ratings in the COVID-19 pandemic context. The data indicates that for moderate and low ratings, the South, Central and North Regions showed

a similar trend, in which moderate ratings decreased in 2020, then increased in 2021. The Central Region had overall higher hazard ratings in 2019, 2020 and 2021, which is understandable since the region also has a higher proportion of critical violations. There may be numerous explanations for the higher high ratings, however, this study does not explain them. Critical Violations indicate hazards that pose a threat to public health and require urgent attention. Hazard ratings typically are acquired based on the compliance history and violations history, as well as violations, especially critical violations observed during inspections. Thus, it would be interesting to determine whether the Central Region's potentially high critical hazard baseline is due to a subset of restaurants that frequently demonstrates lack of compliance and lacks in addressing critical hazards.

Limitations

Several limitations were identified through the progression of this study. First, although acts to exclude and include data that is relevant to the research questions and the proposed sample population was conducted, there may exist data for premises that do not match entirely. Second, since routine inspections solely were included in this study, the results may not be extrapolated to other inspection types such as complaint-based inspections or COVID-inspections. Third, it was identified during the study that a number of routine inspections also noted COVID compliance checks in the inspection comments not included in this study, however, it was determined that these inspections would remain in the study since these inspections were reported as routine in the HealthSpace database. Fourth, the inspection data used in this study was collected during inspections and input into HealthSpace by various

EHOs and potentially other health professionals. Differences likely exist in the collection of data between EHOs, who use their own personal knowledge and discretion during inspections, and when issuing violations and hazard ratings, therefore, the results of this study may not be representative of inspections in other health authority jurisdictions. Finally, this study did not account for restaurants that either closed or opened during the study's time frame. Outside of the COVID-19 context, these factors may impact inspection results since reasons for closing may be due to lack of food safety and operating education or an unprepared operator. Opening of new restaurants, especially those by new operators or managers may also impact results since coming into and staying in compliance of the BC Food Premises Regulation can require additional time, training and education

Knowledge Translation

Findings from this research could be implemented by VIHA and other health authorities when considering strategies for returning to normal inspection operations. While there was a decrease in inspection frequency and violation frequency, the proportion of critical violations was greatest in 2021. This may indicate that an increase in operator education during inspections could be beneficial, especially regarding observations and risks that would indicate a critical violation. If results indicate significant impact from a loss of inspections on observed compliance and violations, new education strategies to target deficiencies could be developed, which may result in policy change. Overall, results from this research brings clarity to whether VIHA food premises have been affected by a reduction of routine inspections in a COVID-19 context.

Future Research

The following are recommended ideas for future research

- An in-depth evaluation of the types of violations resulting from inspections during the COVID-19 pandemic.
- Evaluating the impacts of the COVID-19 pandemic on inspection frequency or violations in different health authorities.
- Evaluating VIHA inspection data from 2017-2019 to determine whether the Central Region has a history of identifying more critical violations than the other regions
- Conducting interviews with EHOs within VIHA, or another health authority regarding inspection experiences, opinions, and processes during COVID-19 inspections.
- Evaluating the number of reported foodborne illness cases during COVID-19 and assessing correlations resulting from a decrease in inspection frequency.

Conclusion

The findings of this study confirm VIHA restaurant inspections have decreased since the start of the COVID-19 pandemic. A decrease in inspection frequency was observed up to the end of 2021, therefore, it would be useful to confirm whether this decrease will continue into 2022. Inspection violations, including critical and non-critical were confirmed to have increased and decreased, respectively, from 2019 to 2021. The increase in critical violations is especially worrying if the trend continues, and future research should examine what types of violations are increasing and why they are increasing. If it is determined that premises operators

are less prone to compliance or behaviour changes regarding critical violations, any potential knowledge or skill deficit can be addressed by specific education strategies that are suitable and equitable to the learner. The discrepancy between high hazard ratings in the Central Region and the other regions imply a deviation, and an exploration of potential factors of the deviation could be beneficial to the operators, the health authority and the public.

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Competing Interest

The author declares that they have no competing interests while conducting this study.

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