Restaurant inspection frequency: The RestoFreq Study

Olanrewaju Medu, MBBS, MPH,¹⁻³ Hollie Turner, BA, MA,¹ Jennifer A. Cushon, BA, MA, PhD,¹ Deborah Melis, CPHI(c),¹ Leslie Rea, CPHI(c),¹ Treena Abdellatif, CPHI(c),¹ Cory O. Neudorf, MD, MHSc, FRCPC,^{1,2} Michael Schwandt, MD, MPH, FRCPC^{1,2}

ABSTRACT

OBJECTIVES: Foodborne illness is an important contributor to morbidity and health system costs in Canada. Using number of critical hazards as a proxy for food safety, we sought to better understand how to improve food safety in restaurants. We compared the current standard of annual inspections to twice-yearly inspections among restaurants “at risk” for food safety infractions. These were restaurants that had three or more elevated-risk inspection ratings in the preceding 36 months.

METHODS: We conducted a two-arm randomized controlled trial between November 2012 and October 2014. The intervention was twice-yearly routine restaurant inspection compared to standard once-yearly routine inspection. Included were all restaurants within Saskatoon Health Region that were assessed as “at risk”, with 73 restaurants in the intervention arm and 78 in the control arm. Independent sample *t*-tests were conducted between groups to compare: i) average number of critical hazards per inspection; and ii) proportion of inspections resulting in a rating indicating an elevated hazard.

RESULTS: Over time we noted statistically significant improvements across both study arms, in number of both critical food safety hazards (decreased by 61%) and elevated-risk inspection ratings (decreased by 45%) ($p < 0.0001$). We observed no significant differences between the two groups pre- or post-intervention.

CONCLUSION: Results suggest increasing the number of annual routine inspections in high-risk restaurants was not associated with a significant difference in measures of compliance with food safety regulations. Findings of this study do not provide evidence supporting increased frequency of restaurant inspection from annually to twice annually.

KEY WORDS: Food safety; restaurants; food inspection

La traduction du résumé se trouve à la fin de l'article.

Can J Public Health 2016;107(6):e533–e537
doi: 10.17269/CJPH.107.5399

Foodborne illness is an important contributor to human morbidity and mortality.¹⁻³ This burden of disease creates demand on the health care system and increases in out-of-pocket health care costs.^{2,3} Estimates from the recent past suggest an incidence of 13 million cases of foodborne illnesses in Canada per year, with a projected cost of approximately \$12 billion.^{4,5} The causes of these illnesses vary greatly and include bacteria, parasites, viruses, toxins, metals and prions. The sources of contamination have also been found to include chemical contaminants of water and the food itself.^{4,6}

To preventively limit the occurrence of these illnesses, a number of approaches to enhance food safety have been instituted. These include: food handler training and education; restaurant health inspection and enforcement; disclosure systems for restaurant inspection findings; and managerial and engineering interventions.² Restaurant inspection is a staple activity of public health departments to ensure the safety of the food prepared and served to the population in these public eating facilities. As part of the inspection process, public health inspectors are able to provide food safety education to enhance safe food handling practices and compliance with regulations.^{2,5,7}

As in most Canadian jurisdictions, Saskatoon Health Region (SHR) utilizes restaurant inspection and enforcement to safeguard food safety. Provincial legislation requires a minimum of one

routine annual inspection for most public eating facilities, and follow-up inspections are conducted when necessary based on the findings of routine inspections. The health region has considered a move to twice-yearly inspections to enhance food safety compliance, particularly aiming to reduce the number of “critical hazards” present in restaurants at risk for food safety violations based on prior inspections. Food safety infractions defined as critical hazards are known to be associated with risk of foodborne illness.⁶

Currently the evidence for increased frequency of inspection in decreasing food safety risk is unclear, with one study showing an equivocal relationship between increased inspection frequency and compliance levels while also showing a paradoxical relationship between frequency of inspections and food safety compliance.^{5,8} These inconsistencies in the evidence, along with substantial resource requirements related to inspection frequency, led us to

Author Affiliations

1. Saskatoon Health Region, Population and Public Health, Saskatoon, SK
2. Department of Community Health and Epidemiology, University of Saskatchewan, Saskatoon, SK
3. School of Epidemiology, Public Health and Preventive Medicine, University of Ottawa, Ottawa, ON

Correspondence: Dr. Michael Schwandt, Saskatoon Health Region, 104 Clinic Place, Room 3228, Health Sciences Building, E-Wing, Saskatoon, SK S7N 5E5, Tel: 306-655-4338, E-mail: michael.schwandt@saskatoonhealthregion.ca

Conflict of Interest: None to declare.

examine in our jurisdiction the effects of increased inspection frequency among “at risk” restaurants on compliance with food safety regulations.^{2,9,10}

RESEARCH OBJECTIVES

We undertook a study to evaluate the effect of twice-yearly restaurant inspections on food safety. Specific research questions of the study were:

- i) Compared with the current standard of annual inspections, will a change to twice-yearly inspections among “at risk” restaurants be associated with a lower number of critical hazards found per inspection?
- ii) Compared with the current standard of annual inspections, will a change to twice-yearly inspections among “at risk” restaurants be associated with a lower proportion of inspections resulting in an elevated hazard rating?

METHODS

Study design

We employed a two-arm randomized controlled trial. The intervention was twice-yearly routine restaurant inspection in half of the identified at-risk establishments (in addition to the high and moderate re-inspection priority follow-up inspections). As a control group, the other half of the “at-risk” restaurants received the standard once-yearly routine inspection.

We included in this study all public eating establishments (defined under Saskatchewan’s Food Safety Regulations) within SHR that received three or more elevated-risk inspection ratings in the 36 months prior to onset of the intervention. The lowest risk inspection rating assigned in our jurisdiction is a “Low priority for re-inspection”; elevated-risk inspection ratings include “Moderate priority for re-inspection” and “High priority for re-inspection.” At the commencement of the study, there were approximately 1,500 restaurants in SHR. This figure was obtained from a query of the SHR environmental public health inspectors database.

Restaurants with historical elevated-risk inspection ratings were randomized by computer-generated permutation to either the intervention or control arms.

Our intervention study commenced in November 2012. During the period November 2012–October 2014, the intervention group received twice-yearly random routine inspections and the control group received the standard one annual random routine inspection. Given that at least an annual inspection is mandated

and non-optional, restaurants did not have the option to withdraw from the study.

Data collection and analysis

To optimize consistency between observation (inspection ratings), one public health inspector was assigned to the restaurants included in the study.

The inspection findings and ratings were recorded using a paper-based manual system and subsequently entered into the health region’s data management system, from which data were exported to statistical software for analysis.

We measured the average number of critical hazards (primary endpoint) and elevated-risk inspection ratings for the intervention and control groups, for the year prior to the onset and for each of the two years following implementation of the intervention.

Independent samples *t*-tests were conducted between groups (intervention group and control group) and across time (pre- and post-intervention) to compare: i) average number of critical hazards per inspection; and ii) chi-squared test to test for the difference in the average number of elevated-risk inspection ratings per inspection.

Independent samples *t*-tests were also used to confirm that the experimental group received approximately twice as many inspections as the control group during the intervention period. In addition to comparing the primary and secondary outcome measures at baseline, to confirm inter-group similarity following randomization, a chi-square test of independence was used to determine that there was no relation between probationary status (an indicator of escalated enforcement for poor inspection history) and group assignment. All analysis was completed using SPSS Version 18 (SPSS, Inc., Chicago, IL, USA).

An ethical review was completed by the University of Saskatchewan Research Ethics Board. The project was deemed exempt due to the quality improvement intent and minimal risk associated with the study.

RESULTS

A total of 156 restaurants were identified as meeting the eligibility criterion of elevated-risk inspection ratings in the preceding 36 months. Five restaurants were excluded because they were no longer operational at the time of randomization, leaving 151 restaurants. These facilities were randomized into two groups. Table 1 displays characteristics of the restaurants by group: the number of facilities under a probationary status prior to the intervention and the number of inspections in the pre-intervention and intervention periods.

Table 1. Characteristics of study restaurants and total number of inspections between groups and over time			
	Intervention group (N = 73)	Control group (N = 78)	Test statistic (p-value)
Probationary status			
Pre-intervention	N = 5 (6.8%)	N = 8 (10.3%)	$\chi^2 = 0.56$ (p = 0.46)
Total number of inspections			
Pre-intervention	$\bar{x} = 9.64$ (SD = 1.97)	$\bar{x} = 9.71$ (SD = 2.32)	$t = 0.17$ (p = 0.87)
Post-intervention	$\bar{x} = 3.89$ (SD = 1.0)	$\bar{x} = 2.77$ (SD = 0.97)	$t = -6.33$ (p < 0.001)*

* Indicates statistically significant difference (p < 0.05).

Group characteristics

At the time of randomization, 13 restaurants were on probationary status: 5 in the intervention group and 8 in the control group. We conducted a chi-square test of independence to check for any relation between group and probationary status. There was no significant association between study arm and the restaurant being on probationary status ($\chi^2 = 0.56$, $p = 0.46$) (see Table 1).

An independent samples *t*-test was conducted to check if there were differences between the total number of inspections (routine, follow-up, and complaint) between the two study groups in the three-year pre-intervention period. We did not find any significant difference in the total number of inspections between the intervention group ($\bar{x} = 9.64$, $SD = 1.97$) and the control group ($\bar{x} = 9.71$; $SD = 2.32$) during the pre-intervention period ($t = 0.172$; $p = 0.864$) (see Table 1).

During the two-year intervention period, we found that the intervention group received significantly more inspections ($\bar{x} = 3.89$, $SD = 1.00$) compared to the control group ($\bar{x} = 2.77$; $SD = 0.97$); $t = -6.33$; $p < 0.001$ (see Table 1).

Critical hazards

We found that there was no significant difference between the study groups in terms of the number of critical hazards identified per inspection, either pre- or post-intervention (see Table 2). In both the intervention group and the control group, the number of critical hazards per inspection was lower in the post-intervention period (0.30 critical hazards per inspection) compared to the pre-intervention period (0.77 critical hazards per inspection): $t = 21.01$ ($p < 0.0001$).

Elevated-risk inspection ratings

We measured the number of high or moderate priority for re-inspection ratings per inspection. This variable was computed

by summing the total number of high or moderate priority ratings and dividing by the total number of inspections (routine, complaint, and follow-up) for the same time period. There was no significant difference in the proportion of inspections resulting in a rating indicating elevated hazard ($\chi^2 = 8.3770$, $p = 0.1366$) (see Table 3). We also found no significant difference between the number of elevated-risk re-inspection ratings between the study groups in the pre-intervention period ($t = 1.28$; $p = 0.20$) or in the post-intervention period ($t = -1.76$; $p = 0.080$) (see Table 4).

While there was no significant difference for the number of elevated-risk re-inspection ratings between the study groups, we found that a significant difference existed in this measure between the pre- and post-intervention periods. Prior to the intervention, approximately one in two inspections resulted in an elevated-risk inspection rating, in both the control and experimental groups. Conversely, after the intervention, approximately one in four inspections resulted in a moderate or high priority rating in both groups. Overall, elevated-risk inspection ratings decreased after the intervention was implemented, with no effect associated with group assignment (see Table 5).

DISCUSSION

The aim of this study was to assess whether increased frequency of restaurant health inspections would impact the number of critical hazards identified per inspection, or the number of elevated-risk inspection ratings assigned. The randomized controlled trial design of this study minimized the potential influence of bias in our findings, controlling for sampling and inter-rater bias and enhancing the internal validity of our findings. As far as we are aware, this is the first study comparing the impact of twice-yearly restaurant inspections to annual inspections in Canada.

Table 2. Number of critical hazards per inspection, between groups and over time

	Intervention group (N = 73)	Control group (N = 78)	Test statistic (p-value)
Pre-intervention	$\bar{x} = 0.83$ (SD = 0.44)	$\bar{x} = 0.71$ (SD = 0.33)	$t = -1.73$ ($p = 0.09$)
Post-intervention	$\bar{x} = 0.31$ (SD = 0.33)	$\bar{x} = 0.28$ (SD = 0.34)	$t = 0.54$ ($p = 0.59$)

Table 3. Number of critical hazards per inspection, pre- and post-intervention

	Pre-intervention	Post-intervention	Test statistic (p-value)
Total (intervention + control groups)*	$\bar{x} = 0.77$ (SD = 0.39)	$\bar{x} = 0.30$ (SD = 0.34)	$t = 21.01$ ($p < 0.0001$) [†]

* Total number of food service establishments included was 151.

[†] Indicates statistically significant difference ($p < 0.05$).

Table 4. Elevated-risk inspection ratings, between groups and over time

	Treatment group	Control group	Test statistic (p-value)
Pre-intervention	$\bar{x} = 0.51$ (SD = 0.13)	$\bar{x} = 0.48$ (SD = 0.16)	$t = 1.28$ ($p = 0.20$)
Post-intervention	$\bar{x} = 0.31$ (SD = 0.25)	$\bar{x} = 0.22$ (SD = 0.27)	$t = -1.76$ ($p = 0.08$)

Table 5. Elevated-risk inspection ratings, pre- and post-intervention

	Pre-intervention	Post-intervention	Test statistic (<i>p</i> -value)
Total (intervention + control groups)	$\bar{x} = 0.49$ (SD = 0.14)	$\bar{x} = 0.27$ (SD = 0.26)	$t = -36.6$ ($p < 0.001$)*

* Indicates statistically significant difference ($p < 0.05$).

Comparing study arms assigned to receive yearly or twice-yearly inspection, a reduction in the number of critical hazards and elevated-risk inspection ratings was observed in both groups, with an improvement of more than twofold in each of these measures. In both the pre- and post-intervention periods, the intervention group and the control group did not differ in these study measures. We observed an effect of time (pre-intervention to post-intervention) but no effect related to group assignment.

Despite the strengths of this study, we have identified limitations. Due to some turnover of restaurant ownership and management, it is likely that some of the restaurants in the intervention and control groups experienced new operational leadership at some point over the course of the study, which may have had an impact on the food safety practices. However, it is not expected that this factor would vary between intervention and control groups, due to the randomized assignment.

Trends external to this study may have had a role in the improved food safety measures seen across study arms. In October 2013, an educational program titled “*Germ Smart*” was instituted by the Population and Public Health (PPH) Department of SHR, working in cooperation with many schools, workplaces and facilities, including restaurants in the jurisdiction of the Health Region. None of the restaurants under study (in either the intervention or control group) have participated in the *Germ Smart* program course offered to restaurants through SHR’s PPH department. Nonetheless, transmission of good practices between restaurant staff and establishments, as well as generally enhanced food safety awareness, are plausible. As well, a provincial online system for public disclosure of restaurant inspection ratings was established in 2009, with the expectation of a positive effect on food safety practices.² These possible impacts are not expected to differ between the randomized groups, but should be considered in the improvements seen across groups. It is possible that effects from these other ongoing initiatives may have rendered effects of inspection frequency undetectable. Finally, it is possible that the intervention could require longer implementation to exert an effect on food safety practices. The generalizability of these findings is not known; while the inspection protocols in the study region are similar to many public health jurisdictions, challenges in transferability related to contextual differences have been noted in previous literature, and it has been postulated that the optimal frequency of inspections may vary by locality.^{2,5,11} A review by the National Collaborating Centre for Environmental Health has suggested that optimal frequency and scope of inspections may be jurisdiction-specific.^{2,9,10}

CONCLUSION

Our study did not find that increased frequency of health inspections among high-risk restaurants had an effect on measures of food safety. Public health system investments may

be better placed in other food environment interventions, such as improved education for food-handlers and enhanced public disclosure of inspection results.^{7,10}

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Received: December 1, 2015

Accepted: August 19, 2016

RÉSUMÉ

OBJECTIFS : Les intoxications alimentaires contribuent beaucoup à la morbidité et aux coûts du système de santé au Canada. En utilisant le nombre de dangers critiques comme variable substitutive à la salubrité des aliments, nous avons cherché à mieux comprendre comment améliorer la salubrité des aliments dans les restaurants. Nous avons comparé la norme actuelle d’inspections annuelles aux inspections deux fois par année dans les restaurants « à risque » d’infractions aux règlements de salubrité des aliments. Il s’agissait de restaurants ayant reçu trois notes d’inspection à risque élevé ou plus au cours des 36 mois précédents.

MÉTHODE : Nous avons mené un essai comparatif randomisé à deux volets entre novembre 2012 et octobre 2014. L’intervention était une inspection régulière des restaurants deux fois par année, par opposition à l’inspection annuelle habituelle. Nous avons inclus tous les restaurants de la Région sanitaire de Saskatoon évalués comme étant « à risque », dont 73 restaurants dans le volet d’intervention et 78 dans le volet témoin. Nous avons mené des tests *t* sur un échantillon indépendant pour comparer entre ces groupes : i) le nombre moyen de dangers critiques par

inspection et ii) la proportion d'inspections s'étant soldées par une note indiquant un niveau de danger élevé.

RÉSULTATS : Au fil du temps, nous avons remarqué des améliorations significatives dans les deux volets de l'étude, tant pour ce qui est du nombre de dangers critiques pour la salubrité des aliments (qui ont diminué de 61 %) que pour les notes d'inspection indiquant un risque élevé (qui ont diminué de 45 %) ($p < 0,0001$). Nous n'avons observé aucun écart significatif entre les deux groupes avant ou après l'intervention.

CONCLUSION : Nos résultats indiquent que l'augmentation du nombre d'inspections annuelles régulières des restaurants à risque élevé n'était associée à aucun écart significatif dans les indicateurs de conformité aux règlements de salubrité des aliments. Les constatations de l'étude ne fournissent pas de preuves justifiant de faire passer la fréquence d'inspection des restaurants d'une à deux fois par année.

MOTS CLÉS : salubrité des aliments; restaurants; inspection des aliments