

Frequency and Type of Food Safety Infractions in Food Establishments with and without Certified Food Handlers

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ABSTRACT

North Americans consume food from food service establishments frequently; therefore, restaurants may be a significant source of foodborne illness. Food Handler Certification provides food handlers with knowledge to control factors that may contribute to foodborne illnesses. Food Handler Certification is mandatory in a number of provinces in Canada as well as several states in the United States. This study compared two groups of food establishments, one with mandatory Food Handler Certification for staff and management and one without. Establishments in which Food Handler Certification was mandatory were 1.97 times less likely to receive infractions during inspections ($P = < 0.0000001$; OR: 1.97, 95% C.L: 1.54–2.50). The types of infractions commonly noted during inspections between the two study groups were similar, but the mandatory Food Handler Certification group had fewer infractions noted during inspections in almost all of the infraction categories, indicating that Food Handler Certification should be implemented in all food establishments because it has a positive effect on inspection scores.

Further research comparing food service establishments with mandatory Food Handler Certification of both staff and management to establishments that have at least one certified person in charge should be conducted to determine which system is more effective.

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INTRODUCTION

According to the Canadian Restaurant and Food Association (CRFA), the average Canadian household patronizes a restaurant for a meal or snack 536 times per year (8). In the United States, 44% of adults eat out at a restaurant daily, and more than 40% of foodborne illness outbreaks reported from 1993–1997 were linked to public food establishments (14). A United Kingdom government report indicated that “eating out is a very important source of food poisoning” (5). Therefore, ensuring the safety of food consumed outside the home should be a priority.

The potential economic impact of foodborne illness is indeed substantial in both Canada and the United States. In Canada, it is estimated that approximately 11–13 million cases of foodborne illness occur annually (11). Toronto Public Health reported over 16,700 cases of enteric foodborne illness between 2000 and 2004 (25). In the US, foodborne illness causes approximately 76 million illnesses each year (17). The costs associated with foodborne illness in the US are an estimated \$7.7–23 billion per year to consumers, the food industry and the economy (7).

Some of the risk factors that contribute to foodborne illness include improper reheating and heating, inadequate hot-holding, and cross-contamination (5). According to Taylor, most food poisonings result from food handler error, which may be mitigated with food safety training (22). These factors may be directly controlled and influenced by food handlers. Therefore, Food Handler Certification courses are beneficial because they provide participants with the knowledge to identify and mitigate the risks that may contribute to foodborne illness (18). The Ontario Ministry of Health and Long Term Care (MOHLTC) has identified the benefits of food handler training to include a reduction in foodborne illness; prevention of hazards during food preparation; early identification of potential hazards; and a decrease in consumer complaints (18).

The Ontario MOHLTC Programs & Services Guidelines require the local Public Health Unit to provide a food handler training course or to refer members of the public to a resource that pro-

vides training. In Ontario, the minimum food-handler training course requirements must include these components: The Role of the Local Health Department, Public Health Legislation, Safe Handling, Preparation and Storage of Food, Food Handler Hygiene and Food Premises Sanitation (18).

Since 1999, the Ontario MOHLTC has examined proposals for mandatory Food Handler Certification, but to date these proposals have not been implemented. Despite this, a number of provinces in Canada, including British Columbia, Saskatchewan, Nova Scotia and Alberta, have mandatory Food Handler Certification. As an alternative, Food Handler Certification programs may also be implemented at the municipal level. This is the case in Brantford, Winnipeg and Toronto, where mandatory Food Handler Certification was implemented in September 2006. The by-law (City of Toronto, Municipal Code, Chapter 545) requires that “every owner or keeper of an eating and drinking establishment shall ensure that there is, at all times when the establishment is operating, at least one certified food handler working in a supervisory capacity in each area of the premises where food is prepared, processed, served, packaged or stored” (2).

In the US, most states rely on local public health departments to provide training for food handlers. Training programs sponsored by the health department are made available, but, in most cases, the training is left in the hands of the operators/owners of food service establishments (1). As of 2004, seventeen states, including California, Washington, D.C., Florida, Pennsylvania and Washington State, had introduced mandatory Food Handler Certification in the US. Other states are in the process of developing programs (1).

Research has been conducted in an attempt to determine if there is a correlation between certified food handlers and inspection scores (Table 1). For example, Riben et al. (20) conducted a critical appraisal of literature pertaining to the effectiveness of food handler training and routine restaurant inspections. As a result of this literature appraisal, the following recommendations were made; more research should be conducted to prove the effectiveness and efficiency for both routine inspections and training, and training

should continue because, although weak, there is evidence that suggests a positive correlation between Food Handler Certification of managers and staff and inspection scores (20).

Since this appraisal of the literature, a number of studies have concluded that food-handler training may have a significant impact on inspection scores (6, 12, 14, 15, 21, 23). In contrast, studies such as those of Frash et al. (9) and Powell et al. (19) have determined that training has no substantial impact on inspection scores (Table 1).

In Canada, Mathias (15) conducted one of the largest studies of its kind with 630 restaurants across three provinces and twenty-one health unit jurisdictions. The formal education and level of food safety training and certification of food handlers were surveyed. It was determined that the restaurants with certified food handlers had better inspection scores than restaurants with staff that were uncertified (15). Similarly, another Canadian study completed by Thompson et al. (23), analyzed data from the Toronto Healthy Environments Information System (THEIS) to determine the impact of Food Handler Certification on inspection results. Analysis of 8,498 inspection records found an association between having at least one certified food handler and obtaining a pass notice during an inspection; premises with at least one certified food handler were 2.2 times more likely to receive a pass notice than those without (23). In fact, 93% of premises with at least one certified food handler received a pass notice on initial inspection, in comparison to 85.7% of those without at least one certified food handler (23).

In another study conducted by Hedburg et al. (12) and the Environmental Health Specialists Network working group, a comparison was made between food-handling practices and characteristics in outbreak and non-outbreak restaurants. Differences that impacted food safety were noted (12). Data collected included food-handler training and certification. The presence of certified kitchen managers was associated with decreased risk for an outbreak; 71% of non-outbreak restaurants had certified kitchen managers, in comparison to 32% of outbreak restaurants (12).

TABLE I. Summary of studies reviewed

Lead Author	Frash	Hedberg	Thompson	Kassa	Smith	Cotterchio	Powell	Mathias
Year	2006	2006	2005	2001	2000	1998	1997	1995
Sample size	1,000	347	8,948	70	28	94	12	630
Personnel trained	Managers	Managers	Managers & staff	Managers & staff	Staff	Managers	Staff	Managers & staff
Criteria	Inspection scores	Outbreaks	Inspection scores	Inspection scores & micro. tests	Post-test & inspection scores	Inspection scores	Test scores and inspection scores	Inspection scores
Significant impact?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Country	US	US	Canada	US	US	US	UK	Canada

In the US, the largest national study to date was conducted by Frash et al. (9) to determine the impact of Food Handler Certification on inspection scores. The study, conducted in eight states (Alabama, Arizona, California, Delaware, Georgia, Indiana, Michigan and Minnesota), surveyed one thousand food service managers. Data were collected regarding the managers' food safety credentials and food safety knowledge as well as specific information about the restaurant. The inspection reports for the establishments were then matched to the manager surveys. Statistical analysis revealed that the presence of certified managers did not have a substantial impact on inspection scores (9). Powell et al. obtained similar results after examining twelve small catering and retail food establishments and comparing the level of staff food safety knowledge and inspection ratings; no correlation was found between the inspection rating and the level of staff knowledge in regard to food safety (19).

The purpose of our study was to determine whether or not the frequency and type of food safety infractions noted in food establishments with mandatory Food Handler Certification differed from those noted in food establishments without any certified food handlers. This was accomplished by comparing a group of food service establishments with mandatory Food Handler Certification of management and staff to a group that had did not have certified food handlers. The

overall goal of our study was to gain insight into the effect that mandatory Food Handler Certification has on inspection scores and, ultimately, the health of consumers.

MATERIALS AND METHODS

Two study groups from the City of Toronto, Ontario were selected. The groups consisted of 104 premises from a National Pizza Chain (NPC) and 60 randomly selected pizza establishments (RSPs). The study groups selected were similar; members of both were medium risk establishments, served similar food products and received two routine compliance inspections annually. Medium risk premises are defined as premises that prepare hazardous foods without meeting the criteria for high risk, or premises that prepare a non-hazardous food with a great deal of handling and volume (3). The defining difference between the two study groups was that the NPC had mandatory food handler training of management and staff, while the RSPs selected did not have any certified food handlers.

The data selection criteria for both study groups included food premises that were in operation every year between 2001 and 2005. Data were collected for the north, south, west and east regions of the City of Toronto. The information captured in the data reports consisted of compliance inspection dates, infraction

descriptions, and infraction categories. Infraction categories were food temperature control, food protected from contamination, employee hygiene and hand washing, maintenance and sanitation of non-food contact surfaces/equipment, maintenance and sanitation of food contact surfaces/equipment, maintenance and sanitation of washrooms, storage and removal of wastes, pest control, conditions for closures and the disclosure posting by-law. The information in the Toronto Healthy Environments Information System (THEIS) database captured inspections results from Toronto Public Health's standardized Food Safety Inspection Reports that are utilized by Toronto Public Health Inspectors to conduct compliance inspections.

The analysis of data provided a description of the following for both study groups: total number of premises, total number of inspections, number of inspections with and without infractions, number of infractions per inspection, and type of infractions.

OpenEpi Open Source Epidemiologic Statistics for Public Health, Version 2,[®] Dean AG, Sullivan KM, Soe MM was utilized to determine the statistical significance of the results; 2 × 2 table statistics produced Chi-square and exact measures of association and an odds based estimate with confidence limits.

TABLE 2. National pizza chain (NPC) and randomly selected pizza places (RSPs)

Summary	National Pizza Chain (NPC)	Randomly Selected Pizza Places (RSPs)	Total
Total number of inspections	920 (65%)	497 (35%)	1417
Inspections without infractions	725 (79%)	325 (65%)	1050
Inspections with infractions	195 (21%)	172 (35%)	367
Total number of infractions	388 (45%)	475 (55%)	863
Infractions/Inspections ratio	0.4	0.9	0.6

RESULTS

Frequency of infractions

As indicated in Table 2, a total of 1,417 inspection results were analyzed, comprised of 920 (65%) NPC and 497 (35%) RSPs. A total of 367 (26%) of these inspections detected infractions while 1,050 (74%) did not. Where infractions were identified during inspections, the NPC and RSPs had 195 (21%) and 172 (35%), respectively, while 725 (79%) of the inspections without infractions were NPC, compared with 325 (65%) of RSPs. The NPC establishments were 1.97 times less likely to be associated with infractions ($P = < 0.0000001$) than RSPs (Table 3).

A total of 863 infractions were identified from the 1,417 inspection records that were analyzed. The overall ratio of infraction/inspection was 0.6, while the individual ratios for the NPC and RSPs were 0.4 and 0.9, respectively (Table 2).

Types of infractions

The most common infraction categories for both study groups, in order of their frequency of occurrence were: Maintenance/Sanitation of Non-Food Contact Surfaces/Equipment (24.7% and 21.1% for RSPs and the NPC establishments, respectively); Employee Hygiene and Hand Washing (7.4% and 4.8% for RSPs and the NPC establishments, respectively); and Maintenance/Sanitation of Washrooms (5.4% and 5.2% for RSPs and the NPC establishments respectively) (Table 4).

Another infraction category worth noting is the Food Protected from Contamination category. The results for both study groups were 5.4% and 4.5% for

RSPs and the NPC, respectively (Table 4). Also important is the food temperature control category; the NPC had more infractions in this category, 1.4%, versus 1.2% for the RSPs.

While the differences between NPC and RSP establishments were not statistically significant in any infraction category, the P value for the maintenance and sanitation of food contact surfaces category was almost significant, with a P value of 0.06 (Table 4).

DISCUSSION

Frequency of infractions

The Toronto Public Health Food Safety Inspection Report includes ten infraction categories (Table 4). In these categories, various infractions may be categorized as crucial, significant or minor. A crucial infraction is defined as one that poses an immediate health hazard to the public and may be associated with foodborne illnesses, such as the contamination or adulteration of a food product (3). A significant infraction has the potential to pose a health risk and is only indirectly related to the handling, preparation and storage of food, such as failure to have an indicating thermometer present in a refrigeration unit (3). A minor infraction is unlikely to pose a serious or immediate health risk to the public and includes dirty floors, walls or ceilings in a food establishment (3).

Given the numerous studies that have found a positive correlation between certified food handlers and inspection scores (6, 12, 14, 15, 21, 23), it was expected that the NPC would have more inspections without infractions (725, or 79%) than the RSPs (325, or 65%). Food Handler Certification should in-

crease the knowledge of food handlers and translate into safe food handling practices. In fact, the results of our study suggest a positive correlation between the presence of certified food handlers and better inspection scores. The NPC was 1.97 times less likely to have infractions noted during inspections (Table 3). In 2005, Thompson et al. also found an association between having at least one certified food handler in a food establishment and obtaining a pass notice during inspections; establishments with at least one certified food handler were 2.2 times more likely to receive a pass notice than those without (23). This further supports the theory that certified food handlers may have a positive impact on inspection scores in a food premises.

The association between certified food handlers and reduced food safety infractions was replicated in several other studies with various measurement criteria (Table 1). Most notable and quite large in sample size ($n = 630$), was the Mathias et al. (15) study that involved the certification of managers and staff and resulted in better inspection scores in their restaurants.

Also, the study by Cotterchio et al. (6) noted a significant impact on inspection scores for both mandatory and voluntary Food Handler Certification groups. Cotterchio and the Boston Inspection Services Division compared pre/post training inspection scores for three different groups of managers for 94 restaurants. Groups that had low baseline inspection scores were selected and randomized into groups; a mandatory food handler certification group, a voluntary group and a control group. The group that was mandated to obtain Food Handler Certification saw an improve-

TABLE 3. Statistical analysis

2×2 Table Statistics				
		NPC	RSPs	
		(+)	(-)	
No infraction	(+)	725	325	1050
Infraction	(-)	195	172	367
		920	497	1417

Square and Exact Measures of Association			
Test	Value	P-value (1-tail)	P-value (2-tail)
Uncorrected Chi square	30.24	< 0.0000001	< 0.0000001
Yates corrected Chi square	29.55	< 0.0000001	< 0.0000001
Mantel-Haenszel Chi square	30.22	< 0.0000001	< 0.0000001
Fisher exact		< 0.0000001	< 0.0000001
Mid-P exact		< 0.0000001	< 0.0000001

Risk-based Estimates and 95% Confidence Intervals			
Point Estimates Type	Value	Confidence Limits Lower, Upper	Type
Risk in exposed	69.05%	66.19, 71.77	Taylor Series
Risk in unexposed	53.13%	48.02, 58.18	Taylor Series
Overall risk	64.93%	62.4, 67.37	Taylor Series
Risk ratio	1.3	1.171, 1.442	Taylor Series
Risk difference	15.91%	10.09, 21.73	Taylor Series
Etiologic fraction in pop. (EFp)	18.16%	11.42, 24.9	
Etiologic fraction in exposed (EFp)	23.05%	14.59, 30.67	

Odds-based Estimates and Confidence Limits			
Point Estimates Type	Value	Confidence Limits Lower, Upper	Type
CMLE Odds Ratio	1.967	1.542, 2.509	Mid-P Exact
		1.53, 2.527	Fisher Exact
Odds Ratio	1.968	1.543, 2.509	Taylor Series
Etiologic fraction in pop. (EFp/OR)	38.75%	28.12, 49.38	
Etiologic fraction in exposed (EFp/OR)	49.18%	35.19, 60.15	

ment in their mean inspection scores (6). The voluntary food handler training group also saw improvement in their mean inspection scores (6). Although the study demonstrated a positive correlation between training and scores, the authors acknowledged that the results might have been biased in that the improvement may have resulted from the perceived threat of restaurant closure, be-

cause some restaurants had closed since the study began (6).

Last, Kassa et al. (14) examined inspection reports and microbiological testing to determine the impact of certified food handlers. Seventy full-service restaurant inspection reports (1998–1999) from the Toledo, Ohio, Health Department were reviewed. The results indicated the premises without certi-

fied food handlers had more infractions noted than restaurants with certified staff (14). It was concluded that restaurants with certified staff had significantly better inspection scores. However, microbiological testing did not correlate with better inspection scores.

In contrast, Frash et al. (9) conducted a study with certified food establishment managers and found no signifi-

TABLE 4. Number of infractions in each category

Infraction Category	Infraction RSPs		Infractions NPC		Total Infractions RSPs & NPC	P values	Odds Ratio	95% Confidence Intervals
	no.	%	no.	%				
Maintenance and sanitation of non-food contact surfaces/equipment	213	24.7%	182	21.1%	395	0.54	0.9	0.7 – 1.2
Employee hygiene and handwashing	64	7.4%	41	4.8%	105	0.19	1.3	0.8 – 2.0
Maintenance/sanitation of washrooms	47	5.4%	45	5.2%	92	0.41	0.8	0.5 – 1.2
Food protected from contamination	47	5.4%	39	4.5%	86	0.93	0.9	0.6 – 1.5
Maintenance/sanitation of food contact surfaces/equipment	46	5.3%	24	2.8%	70	0.06	1.6	0.9 – 2.7
Posting bylaw 574-2000	27	3.1%	26	3.0%	53	0.53	0.8	0.4 – 1.4
Storage/removal of waste	16	1.9%	15	1.7%	31	0.69	0.8	0.4 – 1.7
Food temperature control	10	1.2%	12	1.4%	22	0.35	0.6	0.2 – 1.5
Pest control	5	0.6%	3	0.3%	8	0.67	1.3	0.3 – 5.7
Condition(s) for closure	-	-	1	0.1%	1	0.26	0	-
Grand total	475	55%	388	45%	863			

cant impact on health inspection scores. The authors concluded that transfer of training did not take place; therefore, no impact was seen on inspection scores (9). The transfer of training refers to the degree to which the knowledge, skills, behavior and attitudes gained in training are applied to the job (27). Barriers to transfer of training may include, but are not limited to, a lack of feedback and encouragement from supervisors, insufficient time to complete tasks, and the lack of opportunity to put skills acquired into practice (27).

Several of the studies that found a positive correlation between certification of food handlers and improved inspection scores involved the certification of managers only, as opposed to both management and staff (6, 12). Taylor states that in the US, many programs focused on the certification of management as opposed to staff, because of the belief that manager certification had a greater influence on food-handling practices in the workplace (22). Similarly, McElroy and Cutter concluded that “the commitment of managers to food safety directly affects how employees transfer their train-

ing” (16). Also, in the study by Mathias et al., certification of both management and staff was recommended in order to obtain better inspection scores in restaurants (15). Our study presents a good argument for all management and staff to be certified in a food premise, since the frequency of infractions was lower in the NPC, where certification was mandatory for all food handlers.

Conversely, the Frash et al. study focused on certification of managers and did not observe any significant improvement in inspection scores (9). Therefore, the question arises as to whether the certification of management or of staff is more effective. Perhaps the certification of one person in charge (regardless of job descriptions) is sufficient to improve inspection scores. In the US, one state program that mandates the certification of more than one person (including management) is the South Carolina program, the Food Safety Seal of Commitment program. This program requires the certification of at least 75% of employees in addition to one manager on duty (9). In contrast, the US Food and Drug Administration Food Code 2001 requires

only that the person in charge receive Food Handler Certification (1). The same holds true in Canada, where the City of Toronto requires only one person per shift in a supervisory position to be certified (2). It has yet to be determined which type of certification program is most effective.

The average infractions/inspection ratio for all premises in the City of Toronto for 2001–2005 was 1.4 infractions/inspection (26). The majority of the infractions included in this ratio calculation were classified as minor. The ratio of infractions/inspection was highest in 2001 (1.7) and decreased during 2002–2005 (26). The decrease in the ratio between 2002 and 2005 may be attributed to the implementation of the City of Toronto’s Food Premises Inspection and Disclosure Program in 2001 (26). This is a standardized inspection program that involves the posting of inspection results in food premises and on the City of Toronto Web site (23). The ratio of infractions/inspection subsequently decreased with this program’s progression and a heightened awareness of food safety (26). Both study groups had ratios that were

lower than the City of Toronto average of 1.4 for 2001–2005; 0.4 for the NPC and 0.9 for the RSPs, respectively (Table 2). In the case of the NPC, it was 1.97 times less likely to receive notice of infractions during inspections (Table 3). Therefore, the low ratio of infractions/inspection observed for the NPC is consistent with this odds ratio. These ratios (infractions/inspection) were used to compare the two study groups because the number of inspections per year was not the same for all study groups. Thus, the ratio served as the method of standardization for comparison.

Type of infractions

The RSPs had more infractions in the top three categories than the NPC (Table 4). Results similar to these were also seen with inspection reports examined from the Toledo Health Department, 1998–1999. In restaurants without certified food handlers, more infractions were noted for food safety and hygiene, compared with restaurants with certified food handlers (14). In fact, 97% of premises without certified food handlers had one or more critical violations, in comparison to only 3% of restaurants with certified food handlers (14).

The NPC had a lower frequency of infractions in all of the top three infraction categories: maintenance and sanitation of non-food contact surfaces; employee hygiene and handwashing; and maintenance and sanitation of washrooms. These categories are topics that are covered extensively in the NPC Food Handler Certification Program. Perhaps the NPC were able to achieve better inspection scores because their staff were trained in these areas. Harris et al. conducted a study comparing the training materials provided in Food Handler Certification to food safety inspection results and found that the amount of information included in the Food Handler Certification training manual impacted on inspection scores (10). In fact, it was suggested that the Food Handler Certification course should cover the main areas highlighted during an inspection. In Harris' study, critical infractions were observed in areas that were excluded from the training materials. In this study, the NPC's Food Handler Certification Program was, in fact, modelled after

the inspection categories in the Toronto Public Health Food Safety Inspection Report. As Harris suggests, infraction categories that are highlighted on the inspection form can be used to guide training for food handlers (10). Therefore, if the RSPs had certified food handlers, it may have been possible to reduce the frequency of infractions.

The maintenance and sanitation of non-food contact surfaces/equipment category was the most common infraction category; this is consistent with Toronto Public Health findings that indicated that this category accounted for the highest percentage of infractions for all food premise types from 2001–2004 (26). The employee hygiene and handwashing category, the second most common infraction category, includes infractions such as “employee failed to wear headgear while working with food” and “employee failed to wash hands when required.” This is important because it relates directly to the safety of food and is emphasized in the NPC Food Handler Certification course because employees may be a source of infection during food preparation and thus cause foodborne illness (24). The maintenance and sanitation of washrooms category, the third most common infraction category, included infractions defined as minor such as “operator failed to clean toilets as often as necessary” and “operator failed to provide washroom supplies.” These infractions are defined as minor because they may impact on the overall condition of the premise, but they do not directly impact on food safety.

Another infraction category, although not in the top three, that warrants discussion is the “food protected from contamination” category. This category includes infractions such as “operator failed to ensure that food is not contaminated and adulterated.” Infractions in this category may be defined as crucial or significant. Protecting food from contamination is a key topic in the NPC Food Handler Certification course. The concept of preventing cross-contamination during food preparation is taught in the course, including the use of separate utensils for raw and cooked foods, hand washing and washing/sanitizing of utensils. This is important because cross-contamination is a risk factor for foodborne illness (5).

The NPC results in the “food protected from contamination” category are interesting; even though all their food handlers were certified they still had infractions in this category. This suggests that the transfer of training did not occur; perhaps food handlers did not put their knowledge into practice even though they were trained. Clayton et al. conducted a study on food-handler beliefs and self-reported practices and found that, despite being aware, food handlers did not practice safe food handling methods because of constraints on time, staff and resources (4). In fact, 85% of respondents who received certification training admitted that they were not putting into practice what they had learned (4).

Another category with results that suggest that the transfer of training may not have occurred is the food temperature and control category. This is the only category in which, although the differences were not statistically significant, the NPC had more infractions than the RSPs during inspections (12 vs. 10) (Table 4). In theory, the NPC should have received better inspection scores, since food temperature control is a key concept taught in Food Handler Certification (24). However, the assumption that the transfer of training did not take place cannot be substantiated, because the Food Safety Inspection Report detailing the specific infraction details (e.g., observed food handlers storing chicken in the danger zone) was not examined in this study.

Although “no deficiency found” is not an official category, it was included for comparison to the other categories. Most of the inspections conducted for both NPC and the RSPs fell into this category. These results may be attributed to the city of Toronto's Food Premises Inspection and Disclosure Program, as a result of which the number of infractions per inspection decreased after 2001 (23) and there was a reduction in the number of crucial infractions for all types of premises (23). Therefore, the impact of this public disclosure program on the results of this study cannot be overlooked.

One establishment from the NPC group was ordered closed by Toronto Public Health because of a pest infestation; pest control is a component of Food Handler Certification. The Food

Safety Inspection Report for the premise that experienced the closure was not examined as part of this study. Therefore, the specific conditions and circumstances surrounding the closure are unavailable.

It should be noted that the *P* values for all the infraction categories did not indicate any statistical significance in regard to the likelihood of their occurrence. Therefore, the occurrence of infractions in each category may be attributed to the intervention of mandatory Food Handler Certification (*P* = 0.0000001) (Table 3).

Limitations

The data were retrieved from reports generated on the Toronto Healthy Environments Information System (THEIS) database. The data collection was limited by the requirement that the establishments had to have been in operation every year between 2001 and 2005. This greatly limited the sample size for both study groups; as a result, the sample sizes were small. Also, for the RSP study group, another additional parameter set in the reports was the absence of certified food handlers; this also may have contributed to the small sample size that the report generated.

Other variables that may have impacted on the infractions noted during inspections included a change in the area Public Health Inspector, changes in regulations, different food suppliers, changes in management, employee turnover and language barriers (10). Although the researchers were aware of these variables, they could not explore them further, because the data for these variables were not available for the study groups selected.

CONCLUSION

The results indicate that having mandatory Food Handler Certification for both management and staff in food service establishments is more beneficial than having no certified food handlers. Mandatory Food Handler Certification has the effect of lowering the frequency of infractions and the number of crucial and significant infractions noted during inspections. In Canada and the US, most Food Handler Certification legislation requires at least one person in charge to be certified (1, 2). Further research comparing the inspection scores of food service

establishments with one certified person in charge to those that have both staff and managers certified is needed. This may provide insight into the differences that may impact on inspection scores. Food Handler Certification is indeed beneficial and should be implemented in all food service establishments, since it has a positive effect on inspection results and ultimately on food safety.

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