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Effect of a Manager Training and Certification Program on Food Safety and Hygiene in Food Service Operations

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Abstract: Food safety is an important public health issue in the U.S. Eating at restaurants and other food service facilities increasingly has been associated with food borne disease outbreaks. Food safety training and certification of food managers has been used as a method for reducing food safety violations at food service facilities. However, the literature is inconclusive about the effectiveness of such training programs for improving food safety and protecting consumer health. The purpose of this study was to examine the effect of food manager training on reducing food safety violations. We examined food inspection reports from the Toledo/Lucas County Health Department (Ohio) from March 2005 through February 2006 and compared food hygiene violations between food service facilities with certified and without certified food managers. We also examined the impact on food safety of a food service facility being part of a larger group of facilities.

Restaurants with trained and certified food managers had significantly fewer critical food safety violations but more non-critical violations than restaurants without certified personnel. Institutional food service facilities had significantly fewer violations than restaurants, and the number of violations did not differ as a function of certification. Similarly, restaurants with many outlets had significantly fewer violations than restaurants with fewer outlets, and training was not associated with lower numbers of violations from restaurants with many outlets. The value of having certified personnel was only observed in independent restaurants and those with few branches. This information may be useful in indicating where food safety problems are most likely to occur. Furthermore, we recommend that those characteristics of institutional and chain restaurants that result in fewer violations should be identified in future research, and efforts made to apply this knowledge at the level of individual restaurants.

Keywords: food safety, food service facilities, public health, certification

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Introduction

Food borne disease remains a significant problem in the United States, annually affecting millions of people. For example, the latest data reported by the Centers for Disease Control and Prevention (CDC) reveal that in 2007 there were 1096 outbreaks and 21,201 cases throughout the United States.¹ These outbreaks reflect only those data reported to the CDC and so must underestimate the total number of food related outbreaks. In fact a study published in 1999, not dependent exclusively on reports to the CDC, found that approximately 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths occurring annually in the U.S. are attributable to food-related diseases costing an estimated \$6.5–34.9 billion.² Unfortunately, nothing has been published more recently allowing a current evaluation of the trend of food borne outbreaks in the U.S. However, existing data are sufficient to conclude that food borne disease presents an important public health problem to the nation.

The most commonly reported contributing factors for food borne disease outbreaks are poor personal hygiene of food workers, contamination of potentially hazardous foods with pathogens, leaving food at room temperatures for an extended period of time, and insufficient time and/or temperature during initial cooking or reheating.³ The cause of the majority of these outbreaks (88%) are microbial pathogens contaminating food items prepared at licensed facilities, mainly from restaurants, school cafeterias, and nursing homes.³

Routine inspections of food service facilities long have been employed as regulatory tools to enforce sanitary codes and reduce the risk of food borne outbreaks.^{4,5} Failure to meet regulatory standards are assumed to increase the risk of food borne disease. Certainly it is not uncommon to find food borne outbreaks associated with facilities with a history of regulatory failure.⁶ Poor food safety practice also has been identified as one of the reasons for an increase in food borne disease outbreaks found in schools, colleges, and universities in the U.S.⁷ In addition to enforcing regulatory inspection programs, many health departments try to ensure appropriate food safety practices through the use of mandatory or voluntary food safety and hygiene training and certification programs for food personnel. However, the literature is

inconclusive about the effectiveness of such training programs for improving food safety and protecting consumer health.

Cotterchio et al. evaluated the effectiveness of a food manager training and certification program to increase compliance with sanitary codes in Boston.⁸ Their study clearly showed a significant improvement in mean inspection scores in restaurants after training managers compared to restaurants not receiving this training. They also found a significant decrease in critical violations in restaurants with trained managers compared to restaurants without trained managers one year after training, but after two years there were deficiencies in some critical food safety elements in both types of restaurants. Training had limited long-term impact in some important critical food safety elements.

Similarly inconclusive results have been obtained in other studies. Kassa et al. reported that restaurants in Toledo, Ohio with trained and certified food managers had significantly higher visual inspections scores than restaurants without trained and certified food managers. However, there were no significant differences in the presence of fecal bacteria on food contact surfaces as a function of manager training and certification.⁹ Hammond et al. compared the number of food borne outbreaks and the number of cases by contributing factors before and after training was mandated in Florida. Although the overall number of food borne outbreaks associated with contributing environmental factors declined significantly after the training, a significant increase in violations was found in 59% of the contributing-factor categories.¹⁰

In a literature review of the effectiveness of public health intervention in food safety in Canada and elsewhere, Campbell et al.¹¹ found some studies reporting improvement in inspection scores and in food safety knowledge after food safety training and certification, and others not finding such improvements after similar training and certification. A more current review of studies also found that the reported effectiveness of training and certification in improving inspection scores was inconsistent among studies.¹²

Similarly, mixed results have been reported in other studies conducted outside of the United States. One study conducted in Ireland concluded that better general formal training in food safety and hygiene practices was not significantly linked to better food



safety practices.¹³ Two studies conducted in the United Kingdom also concluded that food safety training and certification did not significantly improve hygiene standards of food premises.^{14,15} However, a study in Canada and another in the United Kingdom reported improvement in food safety following training and certification of food handlers.^{16,17} A paper published in 2009 also found restaurants with certified kitchen managers had significantly reduced critical violations compared to restaurants without certified kitchen managers.¹⁸

Clearly, it is important to know if manager training and certification decrease the risk of food borne disease. If certification is not an effective tool, its use would be wasteful and may provide a false sense of security. Yet, recommending against such programs might be viewed as a draconian response to an uncertain situation. Before the cessation of such programs could be recommended, there would need to be great assurance that these programs were not helpful.

To address this issue we conducted a large-scale study comparing the sanitary code violations of restaurants with and without trained and certified food service facility managers. Our results should add to the literature by examining specific food code violations and selected food service facility attributes with respect to training and certification. Ultimately, we hope that our results help shed additional insight regarding the value, or the wastefulness, of food service facility manager training programs. Thus, our overall objective is to help guide the use of certification and training programs to help minimize the risk of food borne disease.

Materials and Methods

In this study, we examined food inspection reports from the Toledo/Lucas County Health Department (Ohio) from the one-year period March 2005 through February 2006 to explore the relationship between certification training of personnel and food safety violations. We focused on those types of facilities offering the highest level of risk, further separated into restaurant and institutional categories. Institutional facilities included hospital cafeterias, nursing home cafeterias, school cafeterias, daycare facilities, workplace cafeterias and similar establishments. Grocery stores and carry-outs were not included in this study.

In Ohio, registered sanitarians conduct walk-through inspections of licensed food service facilities for compliance with sanitary codes.¹⁹ Following each inspection, a Standard Inspection Report is provided to the facility manager documenting written violations and allowing for additional comments. The required inspection frequency of each facility is based on a risk categorization of food service operation.

There are four licensing categories, ranging from category one (low risk-operations) to category four (high-risk operations). Category four food service facilities prepare and serve food to high risk clientele and/or reheat and serve bulk quantities of cooled or leftover foods. We limited our review to category four food service operations because this group presents the highest risk for food borne outbreaks. Category four facilities are inspected a minimum of four times each year; two-standard inspections and two critical control point inspections (CCP). Food service operations may be re-inspected as often as necessary to ensure compliance with inspection orders to correct violations. Additionally, they may be inspected to investigate consumer complaints, particularly if the complaint item is a critical food-safety element with a substantial potential to cause or contribute to a food borne disease outbreak. We limited our study to the information provided in standard inspection reports.

Food safety violations were categorized as critical or non-critical. Critical violations carry a higher risk of food borne illness than do non-critical violations. In this study, we defined any violation in any of these four categories as critical: (1) time and temperature, (2) poor hygiene practices by food handlers, (3) cross-contamination, and (4) food from unapproved sources. Violations in other categories were considered non-critical. These non-critical violations do not present any immediate threat to food safety, and include such items as lack of cleanliness of non-food contact surfaces, inappropriate handling of facility wastes, and the use of non-industrial grade equipment.

We compared results, using t-tests for equality of means to establish statistical significance, from category four facilities employing personnel who had been certified through coursework in food safety and hygiene with facilities without certified employees. We distinguished between facilities on the basis of at least one person (usually the manager, but occasionally a chef or a food handler) having been certified as



successfully completing a food-safety training course from a provider recognized by the Ohio Department of Health. We also compared violations between restaurants and institutional facilities. ANOVA was used to determine if differences existed between the number and types of violations as a function of a food service facility being part of a larger group of facilities.

Results

We examined 1034 inspection reports from 605 food service facilities. 26 percent of the inspections were of facilities with certified personnel, the remaining 74 percent of the facility inspections had no personnel who had received training for certification. Food service facilities with certified personnel had significantly fewer critical violations than food service facilities without certified personnel ($P \leq 0.05$). The mean number of critical violations per inspection was 1.75 for food service facilities with certified personnel and 2.08 for food service facilities without certified personnel. In comparison, food service facilities with certified personnel had higher, although not statistically significant ($P \leq 0.05$) non-critical violations than food service facilities without certified personnel. The mean number of non-critical violations was 3.97 for food service facilities with certified personnel and 3.60 for food service facilities without certified personnel (Table 1).

When separating the data from all facilities into two categories, restaurants and institutional, the pattern remained that those restaurants with certified personnel had fewer critical violations and more non-critical violations than restaurants without certified personnel (Table 2). The significance of this pattern changed, with certification linked to significantly

more non-critical violations but not significantly fewer critical violations ($P \leq 0.05$). This change may not be very meaningful however, and simply reflect P values very close to 0.05.

In institutional facilities, no difference was evident between facilities with and without certified personnel with regard to either critical or non-critical violations (Table 3). Institutional facilities had a significantly lower number of total violations, critical violations and non-critical violations than restaurants ($P \leq 0.001$) (Table 4). Furthermore, institutional facilities with certified personnel had significantly fewer of all types of violations than restaurants with certified personnel, a difference that was also significant for institutions without certified personnel (Table 5).

The number of total violations, critical violations, and non-critical violations outlets of a food service facility varied significantly as a function of the number of outlets of that particular food service facility chain ($P \leq 0.001$). In general, restaurants with many individual outlets had a smaller number of violations than restaurants operating individually or with only a few facilities in the chain (Table 6). This trend is particularly obvious in comparing the food service facilities with the fewest outlets (e.g. 1–7 facilities) to those with the greatest number of outlets (e.g. 10 to 16 facilities).

The majority of critical violations were in code category 3, with most of these violations being in the categories of time and temperature and cross-contamination of foods during storage and preparation. Food code category 4 was next in importance, with most violations being due to lack of sanitation of equipment and utensils (Table 7). Meaningful differences were not evident with regard to category of violation as a function of certification.

Table 1. Comparison of number of critical violations during inspections of food service facilities with and without certified personnel.

Violation type	Restaurant certification	Number of inspections**	Mean	Std. deviation	<i>P</i> value*
Critical violations	Yes	266	1.75	2.078	0.040
	No	760	2.08	2.304	
Non-critical violations	Yes	266	3.98	3.150	0.067
	No	760	3.59	2.938	
Total violations	Yes	266	5.73	4.488	0.861
	No	760	5.67	4.345	

*(t-test for equality of means).

**8 inspection reports are not included in these results because the nature of the violation was unclear.

**Table 2.** Comparison of number of critical violations during inspections of restaurants with and without certified personnel.

Violation type	Restaurant certification	N	Mean	Std. deviation	P value*
Critical violations	Yes	217	1.88	2.087	0.065
	No	656	2.19	2.368	
Non-critical violations	Yes	217	4.22	3.119	0.047
	No	656	3.73	3.013	
Total violations	Yes	217	6.09	4.331	0.658
	No	656	5.93	4.443	

*(t-test for equality of means).

The majority of non-critical violations were in code category 4. The largest number of non-critical violations was due to problems with operation and maintenance of equipment. Code category 6 was next in importance, with the most numerous violations being due to problems with maintenance and operations of facilities (such as cleanliness of non-food contact surfaces, and unapproved equipment) (Table 6). Again the pattern of violation between facilities with and without certified personnel did not vary in any meaningful way.

Discussion

Certification in our study area did not have a major effect on the total number of violations. However, closer examination of the data reveals that certification may be important. The distribution of critical and non-critical violation varied as a function of the presence of certified personnel. Restaurants with certified personnel had about the same amount fewer critical violations as they had greater non-critical violations, as compared to restaurants without certified employees. It is difficult to envision why certification would lead to an increase in non-critical violations, so suspicion falls on the inspection process. Inspections cannot all be done in an identical way, and inspectors

have considerable latitude in deciding upon an appropriate level of effort. One indicator of inspection completeness (consciously or unconsciously) may be that a sufficiently number of violations has been found. If certification does lead to better food handling practices with fewer critical violations, inspectors may not feel satisfied with their effort until they have identified a sufficient number of violations. Thus, one possible explanation for these data is that a larger percentage of the non-critical violations possible to identify during an inspection are identified for those restaurants for which fewer critical violations are evident. To test this hypothesis would be difficult, as it may reflect simply a sense of accomplishing the given task on the part of individual inspectors.

Another possibility that might account for these differences is that certified personnel may be focusing on critical violations to such an extent that they care less about non-critical violations. Perhaps the non-certified personnel give equal attention to all food code issues, while the certified personnel make a decision (consciously or unconsciously) that their time is best spent minimizing critical violations, and so do not spend as much time preventing non-critical violations.

Although the number of critical violations and non-critical violations differed as a function of

Table 3. Comparison of number of critical violations during inspections of institutional facilities with and without certified personnel.

Violation type	Restaurant certification	N	Mean	Std. deviation	P value*
Critical violations	Yes	49	1.16	1.951	0.552
	No	104	1.35	1.677	
Non-critical violations	Yes	49	2.94	3.105	0.560
	No	104	2.68	2.213	
Total violations	Yes	49	4.14	4.865	0.864
	No	104	4.03	3.224	

*(t-test for equality of means).

**Table 4.** Violations as a function of facility type.

Type of facility	Number of inspections	Critical violations		Non-critical violations		All violations	
		Mean number of violations per inspection	Std. deviation	Mean number of violations per inspection	Std. deviation	Mean number of violations per inspection	Std. deviation
Institutional	158	1.29	1.768	2.78	2.552	4.09	3.848
Restaurants	876	2.11	2.302	3.84	3.045	5.96	4.413

Very significant difference (t-test for equality of means, $P = 0.001$) between the number of violations in restaurants and non-restaurants in all three categories, critical, non-critical and all violations.

having certified personnel, the relative amount of specific critical violations and non-critical violations did not change. For example, violations of food temperature, safety, contamination and on premises labeling (category 3) constituted about two thirds of the critical violations in facilities with, and without, certified personnel. Similarly, violations of equipment, utensils and linen (category 4) violations were the predominant non-critical violations in both types of facility.

The reason why certification did not have a major effect on the total number of violation also may be related to the type of food safety training. The type of training that the majority of the certified personnel in this study received focused on theoretical concepts of food safety with little or no emphasis on a “hands-on” food safety training approach. The importance of a “hands-on” approach was shown in comparing a hands-on approach in addition to lecture only approach in food safety training. Food handlers that received “hands-on” interactive training in addition to lecture/video presentation had statistically better test performances after the training and two weeks later than those that only received a lecture/video presentation.²⁰ In addition, training alone may not be sufficient unless it changes trainees’ attitudes and

subsequently their behaviors in food safety practices. The attitude of trainees and their perception of the value of compliance might influence whether or not they change their past food safety and hygiene practice behavior.²¹

Although restaurants showed a pattern of certification affecting their number of violations, this pattern was not detectable in institutional facilities. Reasons for this difference are not apparent from analysis of the data, and can only be conjectured. One reason may be that individual restaurants have a different objective than institutional facilities—with the former being profit and the latter being to provide a service. Of course this is an over-simplification, but nevertheless may have sufficient validity to be expressed in having a different level of incentive to comply with food service regulations. Those restaurants that have invested in certified personnel may have made that investment because they care more about food safety, and thus have fewer critical violations. Institutional (non-restaurants) have a substantially and significantly lower number of violations (both critical and non-critical) than restaurants—it is reasonable to assume that institutional settings are driven more by food safety concerns than are restaurants. Interesting to note is that restaurants with certified personnel

Table 5. Violations as a function of facility type and certification status.

Certified personnel	Type of facility	Critical violations		Non-critical violations		All violations	
		Mean number of violations per inspection	<i>P</i> value	Mean number of violations per inspection	<i>P</i> value	Mean number of violations per inspection	<i>P</i> value
Yes	Institutional	1.16	0.029	2.94	0.011	4.14	0.006
Yes	Restaurants	1.88		4.22		6.09	
No	Institutional	1.35	0.000	2.68	0.000	4.03	0.000
No	Restaurants	2.19		3.73		5.93	



Table 6. Number of violations per inspection and number of facilities outlets (N = number of inspections).

Number of outlets	N	Total violations		Critical violations		Non-critical violations	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
1	685	5.9	4.57	2.2	2.36	3.7	3.04
2	63	6.0	4.12	2.2	2.34	3.9	2.94
3	44	7.1	5.52	2.8	2.75	4.4	3.56
4	44	5.6	3.45	2.0	2.10	3.6	2.43
5	29	6.0	3.26	1.4	1.57	4.6	2.21
7	26	8.0	4.69	1.9	1.62	6.1	4.52
9	29	5.2	3.36	1.6	1.84	3.7	2.38
10	16	3.6	1.93	0.8	0.91	2.8	2.14
13	28	2.8	2.07	0.7	0.67	2.1	1.91
15	39	2.8	1.85	1.0	1.21	1.8	1.49
16	31	3.8	2.50	0.4	0.72	3.4	2.25

had substantially more violations than institutional facilities without certified personnel.

We do not know the reason for this, but it may be related to the customers they serve. Hospital, nursing home, and school cafeterias, daycare facilities prepare food to serve high risk clientele for food borne diseases, although people with lower risk also consume food prepared in these facilities. Host biological factors such as age or presence of other underlying diseases and environmental factors such as being in semi-closed environments for extended periods of time increases the likelihood of secondary food borne disease transmission. Perhaps food managers and administrators of these institutions, being aware of the high risk of their clients for food borne diseases, take extra care to implement food safety guidelines.

Restaurants with a high number of outlets are generally considered chain or franchised restaurants. A number of these franchised or chain restaurants have their own internal food inspectors and guidelines consistent with or more stringent than food safety regulations of local board of health. Many fast-food type restaurants have very standardized practices, often using specialized equipment that minimizes opportunity for user error. This standardization, along with increased training and self-inspections, may account for those facilities with many outlets averaging significantly fewer violations than facilities with few outlets (see Table 5). Interesting future work would be to try to decouple the importance of standardized operation from training and inspections in improving food safety.

Table 7. Comparison of food sanitary code violations between food service operations with and without certified personnel (n = total number of violations).

Food safety code category*	Non-critical violations (%)		Critical violation (%)	
	Non-certified personnel n = 2731	Certified personnel n = 1073	Non-certified personnel n = 1579	Certified personnel n = 470
2	15.1	4.6	2.3	3.4
3	5.7	4.8	64.5	63.3
4	56.3	58.1	19.1	21.9
5	5.1	5.1	5.7	4.0
6	27.1	26.5	4.2	4.5
7	0.5	0.8	3.9	2.8
8	0	0	0.3	0.2
9	0.1	0.1	0.1	0

*2 = Employee health and hygiene practices; 3 = Food temperature, safety, contamination, and on premises labeling; 4 = Equipment, utensils, and linens, such as cleaning and sanitation, laundering, and protection of clean items, operation and maintenance of equipment; 5 = Water plumbing system; solid and liquid waste disposal; 6 = Construction and repair, capacity, location and placement of equipment, maintenance and operation; 7 = Poisonous and toxic materials supplies, use, storage, and safety; 8 = Special requirements such as on site production of juice, custom processing, heat treatment dispensing freezers, facility layout; 9 = Cease use, record keeping, food sample collected, embargo of food/voluntary destruction.



Conclusions

Perhaps the most important finding of this work is that training programs appear to affect most meaningfully those restaurants that are not part of chains or large franchises. Institutional food service facilities and restaurants that are part of a larger unit regularly perform better than individual restaurants, as measured by failure to comply with regulatory food codes. This finding may prove useful to local communities efforts to improve food sanitation may be most productively directed toward individual restaurants (or those with few companion restaurants). Of course, these findings do not directly predict the behavior of an individual facility, but do suggest where future efforts would be most productive. These findings also suggest that regulatory programs requiring uniform inspections of all type of facilities may be improved through directing efforts more toward non-institutional or chain restaurants. Finally, those characteristics of institutional and chain restaurants that result in fewer violations should be identified in future research, and efforts made to apply this knowledge at the level of individual restaurants.

Disclosures

This manuscript has been read and approved by all authors. This paper is unique and is not under consideration by any other publication and has not been published elsewhere. The authors and peer reviewers of this paper report no conflicts of interest. The authors confirm that they have permission to reproduce any copyrighted material.

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