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Is Time Since Food Safety Training Associated With Inspection Score?

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Is time since food safety training associated with inspection score?

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Abstract

Objective: To determine if the time since food safety training is associated with inspection scores in class III and IV kitchens in Connecticut

Methods: Ledge Light Health District, which represents five towns in southeastern CT, provided 2011 inspection records and qualified food operator (QFO) training certificates for licensed kitchens in its jurisdiction. Establishments were included in analysis if they were class III or IV and had one identifiable QFO present at the time of inspection, with the corresponding QFO training record on file. Data was collected on establishment type, QFO certifying exam, inspection score, and risk factor violations. A linear regression model was used to examine the effect of time since training on inspection score. Secondary analyses examined the association between time since training and likelihood of incurring risk factor violations in four categories: food protection, cleanliness of personnel, cleanliness of equipment and utensils, and handwashing facilities.

Results: There was no association between the primary variable of interest, time since training, and overall inspection score, or between time since training and likelihood of incurring risk factor violations in any of four categories.

Conclusions: For the health district under study, time since QFO training was not associated with inspection performance. This should be reassuring to managers, because it suggests that it's not necessary to invest money and time in retraining, and to inspectors, because it indicates that their model of frequent, educational inspections is an effective way to maintain food safety standards.

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Introduction

Foodborne illness causes an estimated one thousand annual outbreaks in the United States (33). Most of these diseases are diarrheal in nature, and can lead to complications like hemorrhagic colitis, meningitis, bloodstream infections, joint infections, and kidney failure. Each year these pathogens are responsible for over 125,000 hospitalizations, 3,000 deaths, and a loss of approximately 61,000 quality adjusted life years (33). Financial consequences include direct medical costs in the hundreds of millions of dollars (16, 27) and substantial productivity losses (27).

In the United States, our affinity for dining out is a contributing factor to these outbreaks (25). In 2010, nearly 48% of food dollars were spent on meals outside the home (32), and a telephone survey of more than 1,000 US adults revealed that over 40% eat at a restaurant one to two times per week, and 18% eat out several times a week or every day (18). These statistics underscore the importance of targeting food service venues when developing approaches to combat foodborne illness.

Restaurant inspections, in which kitchens are examined for adherence to safe food handling practices and penalized for noncompliance, can be an important tool in the control and prevention of foodborne pathogens. Sanctions include mandatory re-inspections, fines, and, in extreme cases, restaurant closure. Studies have found that overall inspection score, frequency of violations, and specific violations such as presence of vermin, incorrect food storage, and reuse of food, are all associated with outbreaks (4, 10, 18, 21). The weight of evidence indicates that proper training of employees is an important factor in ensuring food safety (25).

States vary greatly in their training requirements; sixteen have obligatory food safety certification for restaurant workers and 34 have voluntary programs, although local jurisdictions may impose additional requirements. Among those that mandate training, some require recertification every two to five years, while in others a certification is indefinitely valid (28). Typically, managers or other senior level staff are trained and are then responsible for ensuring that other employees practice safe food handling procedures. These individuals are usually referred to as qualified food operators (QFOs).

Prior studies have shown an association between having a QFO on staff and inspection performance (5, 6, 9, 21, 24). Restaurants with QFOs are less likely to incur certain food safety violations (5), and have higher mean inspection scores (21). A 2009 FDA report concluded that the presence of a QFO is correlated with the “in compliance” percentages for full service restaurants (12). Establishments without a QFO see a significant improvement in their inspection scores after a manager undergoes food safety training (9), and restaurants with a QFO are significantly less likely to be the source of a foodborne illness outbreak (14). In short, the presence of a QFO is a significant predictor of inspection scores and food safety violations, which in turn are predictors of foodborne outbreaks.

Past research supports the assertion that food safety training is public health protective. However, little has been done to examine the association between time since training and inspection performance. Specifically, does more recent training

correlate with better inspection scores? Research in many public health and healthcare settings has demonstrated the unfavorable effect of elapsed time on knowledge retention. For example, a literature review of CPR training studies concluded that refresher courses are needed every 3 to 6 months to “prevent deterioration of skills and knowledge” (13). In another study, community health workers who received refresher training and supervision received higher functional status scores compared to a control group at 3 and 6 months post intervention (2). A study of respiratory therapists who had been trained in intubation one year earlier found that regularly performing the procedure did not necessarily mean that the skill would be retained (3). This implies that for QFOs, having to implement food safety practices on a daily basis may not be sufficient for preservation of knowledge. Indeed, a review of 46 food hygiene training studies revealed that a decline in skills can be observed in food workers just a few months post-training (11). The next step, then, is to examine whether inspection scores decrease as time since training increases.

Methods

Inspections

The Connecticut health code mandates that all food service establishments are regularly inspected (7). The frequency is dependent on a kitchen’s classification (I-IV). All food service establishments must be inspected by the director of health, an authorized agent of the director of health, or a registered sanitarian. Inspectors must have a bachelors’ degree or minimum three years’ experience in a food safety or protection program, and cannot participate in the management or ownership of an establishment in their jurisdiction. All inspectors complete classroom and practical training (7).

A restaurant receives an inspection score out of a possible 100 points. Violations result in deductions of one to four points. If an establishments scores below 80, or receives one or more four-point violations, it has failed inspection and must be re-inspected within two weeks (7). Certain infractions are considered “risk factor violations,” meaning they have the potential to cause foodborne illness. A risk factor violation can fall into one of six categories: personnel, cleanliness of personnel, cleanliness of equipment and utensils, sources of food, handwashing facilities, and food protection (*Figure 1*).

Figure 1. Six categories of risk factor violations

RISK FACTOR VIOLATIONS IN RED

SOURCES OF FOOD		
1	Approved source, wholesome, nonadulterated	4
2	Original container, properly labeled	1

FOOD PROTECTION		
3	Potentially hazardous food meets temperature requirements during storage, preparation, display, service, and transportation	4
4	Adequate facilities to maintain product temperature, thermometers provided	2
5	Potentially hazardous food properly thawed	2
6	Unwrapped or potentially hazardous food not re-served	4
7	Food protected during storage, preparation, display, service & transportation	2
8	Food containers stored off floor	
9	Handling of food minimized	2
10	Food dispensing utensils properly stored	1
11	Toxic items properly stored, labeled, used	4

PERSONNEL		
12	Personnel with infection restricted	4

CLEANLINESS OF PERSONNEL		
13	Handwashing facilities provided, personnel hands washed, clean	4
14	Clean outer clothes, effective hair restraints	1
15	Good hygienic practices, smoking restricted	2

EQUIPMENT & UTENSILS: CLEANLINESS		
21	Preflushed, scraped, soaked and racked	1
22	Wash water clean, proper temperature	
23	Accurate thermometers provided, dish basket, if used	
24	Sanitization rinse (hot water - chemical)	2
25	Clean wiping cloths	1
26	Food-contact surfaces of utensils & equipment clean	2
27	Nonfood-contact surfaces of utensils & equipment clean	1
28	Equipment/utensils, storage, handling	1

HANDWASHING FACILITIES		
38	Suitable hand cleaner and sanitary towels or approved hand drying devices provided, tissue waste receptacles provided	1

Adapted from the LLHD inspection form; risk factor violations in are in red

QFOs

As of 1997, all Class III and IV kitchens in CT must have a QFO employed full time in a supervisory position (7). As defined by the CT health code, class III restaurants carry potentially hazardous foods that are prepared by hot processes and served within 4 hours, and must be inspected at least every 120 days. Class IV restaurants carry potentially hazardous foods that are prepared by hot processes and held for more than 4 hours, and are inspected at least every 90 days (7).

A person becomes a qualified food operator after satisfactory completion of food safety training. Three organizations offer certification exams that are accepted in the state of CT: ServSafe, a National Restaurant Association program that is available nationwide, and is the primary training program in most states that mandate training; the National Registry of Food Safety Professionals (NRFSP), an examination program developed by Florida-based company Environmental Health Testing LLC; and the Food Protection Certification Program by Prometric, a subsidiary of the Educational Testing Service (8, 22, 23, 28). The director of health can choose to accept other training on a case-by-case basis if (s)he believes that it satisfactorily attests to the trainee's food safety knowledge (7).

The QFO is expected to have knowledge of the identification and prevention of foodborne illness, methods for prevention of food contamination, and correct sanitization procedures. (S)he is also responsible for ensuring that employees engaged in food preparation have been properly trained and that the establishment is in compliance with CT state regulations. In the case of the QFO's brief absence from the kitchen, a designated alternate (DA) is responsible for food safety and hygiene. This individual has undergone some food safety training, but not necessarily the same length or depth of instruction as the QFO (7).

Data

Ledge Light Health District (LLHD), which represents five towns in southeastern Connecticut (Ledyard, East Lyme, Waterford, Groton and New London), provided inspection records and QFO certificates for my study. Connecticut was selected because the state health code mandates food safety training but does not require refresher courses, so it was possible to observe a wide range of values for the variable of interest, time since training. The last inspection report from 2011 was accessed from an electronic filing system for all class III and IV establishments.

The electronic filing system provided data on establishments' inspection scores, QFO training records, class (I-IV) and type. Type included religious, school, franchise, long term care facility, retail grocery, daycare, and farm. If the field was left blank or filled in "N/A", the establishment was designated as "other" for analysis purposes. This category included mostly independent (non-franchise) restaurants, although daycares (N=1) and farms (N=1) were also aggregated into this classification. The inspection reports provided data on the QFO, overall score, and risk factor violations.

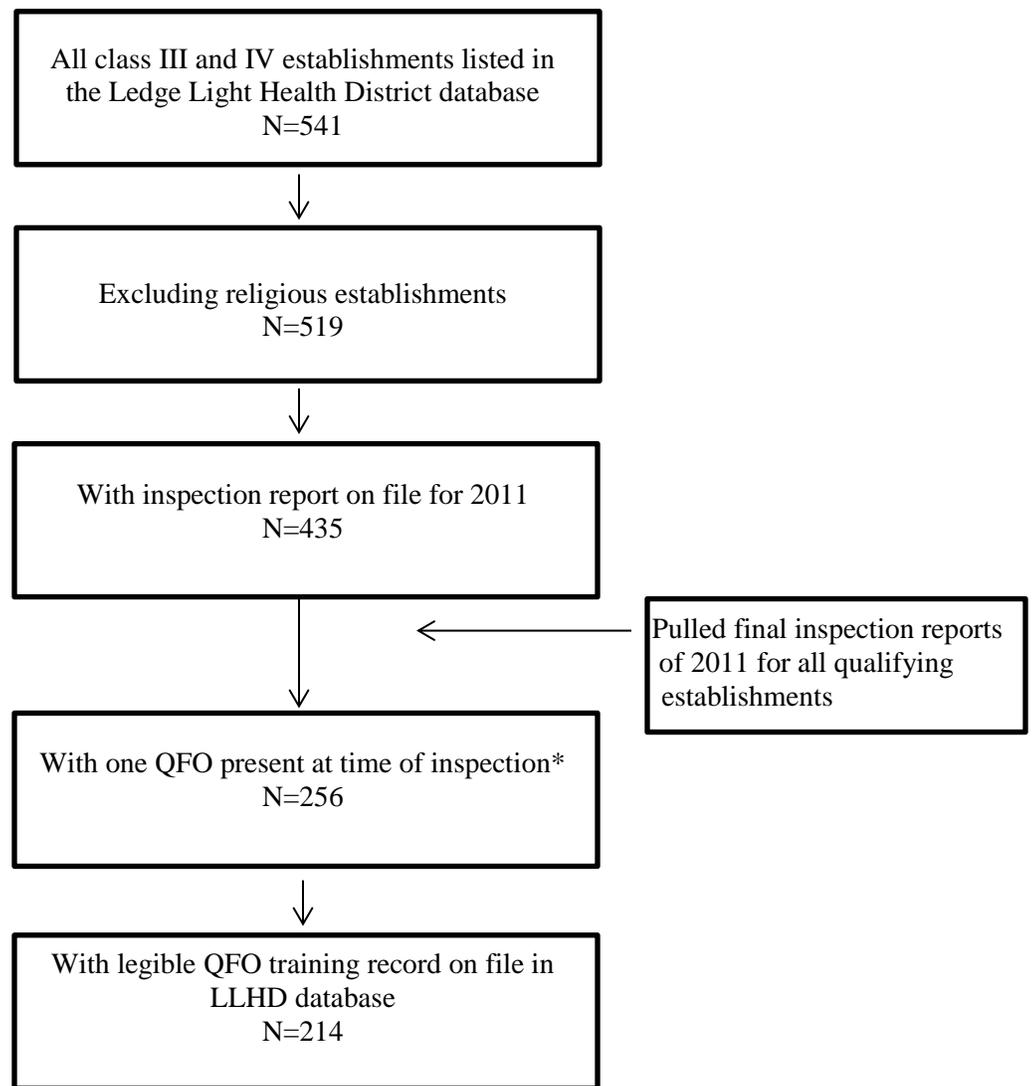
Inclusion and Exclusion Criteria (Figure 2)

The database was restricted to Class III and IV establishments, since classes I and II do not need to have a QFO on staff. Religious establishments were excluded because they use their kitchens irregularly, and nearly all inspections took place when they were not being utilized, so it was not possible to observe food safety practices. Only establishments that had at least one report on file for 2011 were included. If there were multiple 2011 reports, as was generally the case, the last one of the year was used.

Establishments were included in the analyses if there was one QFO present at the time of inspection. The on-site QFO was identified through the inspector's notes, and the corresponding training certificate was pulled from the LLHD records to identify date and type of training exam. If a QFO had taken more than one training course, the most recent date was entered in the database; if a QFO had no training certificate on file, or if the certificate was illegible, the establishment was excluded.

If the inspection report listed both a QFO and a designated alternate (DA) as being employed at an establishment, but did not explicitly state which was present at the time of inspection, the assumption was made that it was the QFO. The rationale for this assumption is that a QFO is a full time worker, so it is likely that (s)he would be at his/her place of employment on a given weekday during inspection hours. However, it is acknowledged that this assumption may have resulted in some misclassification. If a DA was present at the time of inspection, but no QFO, the establishment was excluded. This is because a DA does not have same training requirements as a QFO, so a kitchen's performance may be different under a DA's supervision, potentially confounding the results.

Figure 2. Inclusion and exclusion criteria



**excluded: no QFO or DA present; DA, but no QFO, present; more than one QFO present; multiple QFOs employed, unable to determine which was present*

Analyses

Using SAS 9.2 software, a linear regression model was used to examine the effect of time since most recent training on the inspection score. The primary model also included covariates for establishment class, establishment type, and certification exam. Secondary analyses were performed using logistic regression models to examine the association between time since training and four categories of risk factor violations: food protection, cleanliness of personnel, cleanliness of equipment and utensils, and handwashing facilities. Two additional categories (sources of food and personnel) were excluded from analysis due to an insufficient number of occurrences (0 and 1, respectively). Establishment class, establishment type, and QFO qualifying exam were coded with dummy variables, while time since training and inspection score were continuous variables. Missing data was minimal (<1%).

Results

A total of 214 establishments were included in the final analyses. The majority was class IV (75.7%), the most common type was independent/other (61.7%), and the most popular qualifying exam was ServSafe (61.21%) (*Table 1*). Class III restaurants had a higher mean inspection score than class IV, and schools had a higher mean inspection score than any other establishment type (*Table 2*).

Table 1. Characteristics of 214 class III and IV establishments in southeastern CT in 2011

Characteristic	N* or mean (% or SD)	
Mean inspection score	91.38	(5.42)
Mean time since training (in weeks)	274.04	(245.50)
Class		
III	51	(23.82%)
IV	162	(75.70%)
Establishment type		
Franchise	28	(13.08%)
School	23	(10.75%)
Retail grocery	17	(7.94%)
Long term care	14	(6.54%)
Independent/ Other**	132	(61.68%)
QFO qualifying exam		
ServSafe	131	(61.21%)
Prometric	24	(11.21%)
National Registry of Food Safety Professionals	55	(25.70%)
Other	3	(1.40%)

*values may not sum to 214 due to missing data

**Independent/Other includes establishments for which the database classification was left blank or designated "N/A," (mostly independent restaurants), one farm retailer, and one daycare

Table 2. Food safety violations by class and establishment type

	Type of Food Safety Violation (N, %)								Mean Inspection Score (SD)	
	Food Protection		Cleanliness of Personnel		Cleanliness of Equipment and Utensils		Handwashing Facilities			
Class										
III	28	(54.9%)	9	(17.6%)	24	(47.0%)	6	(11.8%)	93.8	(4.4)
IV	105	(64.8%)	39	(24.1%)	116	(71.6%)	26	(16.0%)	90.6	(5.5)
Establishment type										
Franchise	16	(57.1%)	5	(17.9%)	11	(39.3%)	4	(14.3%)	92.6	(4.7)
School	7	(30.4%)	3	(13.0%)	9	(39.1%)	0	(0.0%)	96.4	(2.4)
Retail grocery	11	(64.7%)	4	(23.5%)	11	(64.7%)	3	(17.6%)	92.6	(3.9)
Long term care	2	(14.3%)	1	(7.1%)	9	(64.3%)	0	(0.0%)	95.1	(2.5)
Independent/ Other	97	(73.5%)	35	(26.5%)	100	(75.6%)	25	(18.9%)	89.6	(5.5)

A linear regression model, which controlled for establishment class, establishment type, and certification exam, showed that time since training was not significantly associated with inspection score (Table 3). Inspection scores were not significantly different for QFOs who took ServSafe and Prometric exams, but QFOs who took an NRFSP exam scored an average of 2.66 points lower on inspection than those who took Prometric ($p=0.04$). Compared to restaurants in the independent/other category, schools, retail grocery stores, and long term care facilities scored an average of 5.55 ($p<0.01$), 2.97 ($p=0.02$), and 5.99 ($p<0.01$) points higher, respectively. Class IV establishments scored, on average, 2.77 points lower than class III ($p<0.01$).

Table 3. Multivariate analysis of variables associated with inspection score

Characteristic	Unadjusted β (SE)		p	Adjusted β (SE)		p
Time since training (weeks)	<0.01	(<0.01)	0.55	<0.01	(<0.01)	0.74
Class						
III	Reference			Reference		
IV	-3.29	(0.84)	<0.01	-2.77	(0.82)	<0.01
Establishment type						
Independent/other	Reference			Reference		
Franchise	3.00	(1.02)	<0.01	1.90	(1.06)	0.07
School	6.71	(1.11)	<0.01	5.55	(1.16)	<0.01
Retail grocery	2.90	(1.26)	0.02	2.97	(1.26)	0.02
Long term care	5.46	(1.38)	<0.01	5.99	(1.38)	<0.01
QFO qualifying exam						
Prometric	Reference			Reference		
ServSafe	-2.44	(1.19)	0.04	-1.47	(1.25)	0.24
NRFSP	-3.68	(1.31)	<0.01	-2.66	(1.29)	0.04
Other	-0.17	(3.29)	0.96	-1.38	(3.05)	0.65

Time since training was not significantly associated with the likelihood of incurring a risk factor violation in any of the four categories tested (food protection, cleanliness of personnel, cleanliness of equipment and utensils, and handwashing facilities). However, when establishments were categorized as having risk factor violations in 0-3 categories or all 4 categories, a t-test indicated that mean time since training was larger in the latter group (borderline significant, $p=0.057$).

Discussion

The analysis yielded some interesting findings. First, the type of certifying exam was significantly associated with inspection score. QFOs who took the National Registry of Food Safety Professionals test scored significantly lower than those who took the Prometric exam. It is possible that the latter exam is more difficult, and therefore only those with a higher level of knowledge can pass. It may also be an effect of self-selection; people choose what training course and exam they take, and QFOs who are certified through Prometric may be systematically different from those who choose other certifying courses.

As expected, class III designees scored higher than class IV. Class III kitchens are, by definition, preparing and storing food in a manner that is less hazardous than class IV, so there is less opportunity to incur violations. Retail grocery stores, schools, and long term care facilities all scored significantly higher than establishments in the “independent/other” category. The differences in performance were especially striking for the latter two, which both scored, on average, five points higher than independent/other kitchens. It is possible that since these establishments serve vulnerable populations they maintain higher standards regarding cleanliness and adherence to food safety protocol, and/or impose internal requirements regarding food safety education that go beyond state mandates.

Time since training, the primary variable of interest, was not significantly associated with inspection score, or with the odds of having a risk factor violation in any of four categories. This might be due to the nature of the inspection program. Ledge Light Health District strives to make it an educational process, speaking with the owner or manager at the conclusion of each inspection to explain which violations were incurred, why, and what can be done to correct them. These meetings may serve as mini refresher courses for the QFOs by reminding them of proper hygiene and food handling practices. Furthermore, prior research shows that scores only begin to fall if the inspection frequency is less than once per year (21), whereas in Connecticut, class IV and III kitchens are inspected every 3 and 4 months, respectively (7). These findings should be reassuring to district sanitarians because they indicate that the inspection process is effective in maintaining restaurant performance.

Although time since training was not associated with overall score, the data suggest that mean time since training may be longer in establishments with risk factor violations in all 4 categories, compared to those with risk factor violations in 0-3 categories. Only 9 establishments fell into the former group, so it was not possible to run a full multivariate analysis, but in the future this association should be explored with larger datasets. For the present, this finding should be interpreted

with caution, for two reasons: first, it was only borderline significant ($p=0.057$), and second, it was one of multiple comparisons made, so the result may be due to chance alone.

There were a few notable shortcomings of the present study. First, inspector could not be controlled for in the analysis. Inspectors sign, but do not print, their names at the bottom of the inspection forms, and in most cases the signatures were illegible. Confounding may have occurred if some inspectors systematically score more harshly or leniently than others. Second, previous research indicated that outbreak restaurants tend to have larger kitchens and lower inspection scores (4, 26, 17, 21), and that cuisine type is associated with inspection score (19). Due to time constraints it was not feasible to gather information on kitchen size or cuisine, which may have resulted in confounding. Third, the cross sectional nature of this study precludes drawing conclusions regarding causality. The observed lack of association between time since training and inspection score could be due to changes in training courses over time or other period effects. A longitudinal study, that follows how establishments' scores change as time since QFO training increases, might help characterize the association between the variables. Finally, this study had strict inclusion criteria, so the findings may not be generalizable to all food service establishments.

It is also important to note that χ^2 tests showed significant associations between establishment type and QFO qualifying exam, and between establishment type and establishment class (for both, $p<0.01$). This could be why the unadjusted and adjusted regression models had different β values. In the future, it will be important to identify important independent predictors of inspection performance.

It is useful for food service managers and owners to know which factors are associated with inspection score and/or risk factor violations, because poor inspection performance is associated with foodborne illness. Given that 48% of US survey respondents reported thinking about food safety when dining out, and that perception of food safety affects choice of restaurant, establishments could suffer a significant loss of customers if an outbreak or closure were to occur (1, 15, 18). In addition to decreased patronage, other economic repercussions include loss of productivity (if workers are infected), lawsuits from sickened consumers, and fines from the local health department (29, 30, 31).

My findings suggest that certain establishment classes and types tend to receive lower inspection scores than others, and that the QFO qualifying exam also plays a small role. For the health district under study, time since QFO training was not associated with inspection performance. This should be reassuring to managers, because it suggests that it's not necessary to spend money and time on retraining, and to inspectors, because it indicates that their model of frequent, educational inspections is an effective way to maintain food safety standards.

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