

**Food Inspection Reports of Philadelphia:  
Assessing the Importance of Certified Food Handlers**

By

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May 2010

A Community Based Master's Project presented to the faculty of Drexel University School of Public Health in partial fulfillment of the Requirement for the Degree of Master of Public Health

## ACKNOWLEDGEMENT

I am especially grateful for the support and collaboration from my preceptor at OFP for the past year, Brian Shon.

Dr. Zekarias Berhane, my advisor at Drexel University School of Public Health, has been a constant source of support and guidance for my thesis and other endeavors at Drexel.

I would also like to acknowledge the following OFP colleagues who have made this project both enlightening and enjoyable: Dr. Palak Raval-Nelson, Rodney Rice, Stephan Belo, Lillian Phillips and a special thanks to, Terry Roberts.

Finally, the continued support from family and friends near and far – too many to name here – means the world to me. Thank you to all.

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## Abstract

Food Inspection Reports of Philadelphia: Assessing the Importance of Certified Food Handlers

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**Objectives:** The overall purpose of the project was to analyze restaurant inspection reports and draw conclusions on whether the presence of a Certified Food Handler (CFH) during routine inspections improves the outcome of the inspection,

**Methods:** A longitudinal study using restaurant inspection reports done by sanitarians of OFP. We analyzed 8,416 inspections reports that were conducted in 2007 and 2008 for retail restaurants (Mobil, Take-Out, Eat-In, Private Club) in Philadelphia county. Using the Generalized Estimation Equation (GEE) based approach, we modeled the outcome variable (0 = no critical violations (CVs); 1 = one or more CVs) as a function of presence or absence of a CFH while adjusting for potential confounders.

**Results:** Statistical analysis reveals that overall the presence of a CFH decreased the odds of CVs by 83 % ( $P < 0.0001$ ) relative to those without CFH. We also looked at the top 3 violation categories that were most reported in 2007 and 2008, where CFH relative to those without CFH decreased the odds of all three categories ('Vermin Control', 'Food protection', and 'Employee Health, Hygiene') by 54 % ( $P < 0.0001$ ), 50 % ( $P < 0.0001$ ), and 68 % ( $P < 0.0001$ ), respectively.

**Conclusions:** A CFH has a significant protective effect in preventing CVs for restaurants in general and seems to interact with what quarter year and which health district (HD) the

inspection was conducted. CFH also had a protective effect against all three violation categories that were most reported during routine inspections. Further research is need to look at the characteristics of CFHs and establishments as well as a comparison between the new risk-based inspections and the old inspections to see if there is any improvement in overall food safety. The results from this study will not only add further evidence to the literature but will also evaluate Philadelphia's food protection program as well as help city policy makers with their decision on assigning budgets.



## **Introduction**

### ***Statistics on Restaurants and Food-Borne Illnesses***

In the United States, an estimated 76 million food-borne illnesses occur annually, resulting in an estimated 325,000 hospitalizations and 5000 deaths every year<sup>1</sup>. The cost of the most common food-borne illnesses is estimated at \$ 6.5–34.9 billion annually<sup>2</sup>. Among these incidences, there is a large body of evidence showing that food prepared outside of the home is a significant source<sup>3</sup>, namely restaurants. According to the National Restaurant Association (NRA), in 2009 restaurants in the United States provided over 70 billion meal and snack occasions, Americans are projected to contribute \$566 billion in restaurant sales, and of all the money spent on food 48% was spent in restaurants<sup>4</sup>. Four in 10 Americans eat in restaurants on any given day, and 1 in 6 eats more than 5 meals per week in restaurants<sup>5</sup>. Because restaurants are such a significant part of our everyday lives, it is no surprise that many of the food-borne outbreaks are caused by them. Of the 9,040 food-borne disease outbreaks reported to the Centers for Disease Control and Prevention (CDC) from 1998 to 2004, 52% were associated with food service establishments, including restaurants, delicatessens, cafeterias, and hotels<sup>6</sup>. Therefore, it is clear that restaurants play an important role in food safety.

### ***Previous restaurant studies***

The reports from the CDC are backed by many other studies. According to a study done in 1998–1999 among Food-Net sites using a large population based telephone survey, there was a positive association between the frequency of dining in restaurants and the frequency of gastroenteritis<sup>4</sup>. This study has been supported by other studies that have identified risk factors that may potentially cause food borne illnesses in food preparation practices in restaurants. The



most commonly reported was improper holding temperature; the second most commonly reported practice was inadequate cooking of food<sup>7</sup>. An EHS-Net study that did a telephone survey among food service workers showed that many risky food preparation practices were being reported by the respondents; a quarter of workers said they did not always wash their hands, a third said they did not always change their gloves between touching raw meat or poultry and Ready-To-Eat food, more than half of the respondents indicated that a thermometer was not the method they used most often to check the doneness of cooked foods, and a small percentage of workers reported working while sick with vomiting or diarrhea<sup>8</sup>.

### ***Food safety and Certified Food Handlers***

However, there have been studies that have identified several factors that have a positive impact on food safety, especially among the restaurants<sup>9</sup>. The current method used to prevent such outbreaks from happening at restaurants is routine inspections through a local or state regulatory agency along with proper and adequate training of food handlers<sup>10</sup>, also known as food safety certification. While the FDA food code does not mandate food safety certification, it does recognize certification by an accredited program as a way for a food handler to demonstrate knowledge of performing food safety measures<sup>11</sup>.

In several studies, the relationship between Certified Food Handlers (CFHs) and restaurant inspection scores as a proxy measure for food safety have been examined. In these studies, inspection scores were compared before and after the implementation of a training and certification program. Some studies suggested that the presence of a CFH improves restaurant inspection scores<sup>12-14</sup>, where as others found no relationship<sup>15-17</sup>. However, these studies have certain limitations. 1) All of these studies were conducted at least ten years ago, and thus the

results may prove to be less valid and relevant to current restaurant inspection practices<sup>12-17</sup>. 2) Some of the studies experimental designs did not include a control group, making it difficult to determine whether the positive impact was due to training or to other factors<sup>12, 14</sup>. 3) For most of these studies, the sample size was very small, limited to a specific area of a county, city, or restaurant chain<sup>13-16</sup>.

In a more recent study, using a year's worth of data, EHS-Net conducted systematic environmental evaluations, by comparing restaurants in which outbreaks had occurred and restaurants in which outbreaks had not occurred they were able to find that the presence of a CFH had a protective effect with respect to food-borne illness outbreaks<sup>18</sup>. Another recent study looked at the relationship between the occurrence of critical violations (CVs) and the presence of a CFH, which suggested that the presence of a CFH was protective for most types of CVs<sup>11</sup>. Thus, the presence of a CFH may help to improve food safety practices among food workers and ultimately reduce food-borne illnesses.

In Philadelphia, there have been many published studies that investigated food-borne illness outbreaks for a specific disease (Ex. Norovirus, Salmonella, E.coli, etc). However, very little has been published that evaluates or studies food inspections in Philadelphia. One study available was published by the current director of the Philadelphia Environmental Health Services, Dr. Palak-Raval Nelson. The study evaluated the significance of food safety certifications and knowledge of CFHs using telephone surveys by randomly selecting 10 establishments from each of the 10 geographical districts in the city<sup>19</sup>. The conclusion of the study was that the initial survey indicated that the training courses were having a positive impact but was limited and required a follow up study. The initial study was done ten years ago and

there have been no follow up studies to further evaluate the significance as suggested by the study.

### **Specific Aims**

- To determine if Certified Food Handlers (CFHs) change the outcome of Critical Violations (CVs) during routine inspections.
- Finding any interactions with CFH and the other explanatory variables.
- To determine if CFHs have an effect on particular violation categories.

The contribution of the CBMP is that it will act as a follow up to the study that was conducted by Dr. Raval-Nelson. With the abundance of data (from 2007 to 2008) and difference in approach (evaluating CFHs and their relation to CVs from a longitudinal stand point), the conclusions drawn will have more reliability and will highlight the progress on Philadelphia's food inspection program as well as adding to the body of evidence in the literature.

### **Materials and Methods**

#### ***Philadelphia Inspection Agency<sup>20</sup>***

The local food safety agency for Philadelphia County is the Office of Food Protection (OFP), which is a section of the Environmental Health Services (EHS) in the Department of Public Health. OFP's mission statement is,

*“To reduce food borne illness by regulating food handling practices and educating food handlers about the causes of food borne diseases, which can lead to the prevention of such diseases and improve public health.”*

The OFP achieves its’ mission statement by:

- Conducting frequent and thorough inspections of all food establishments as part of a food surveillance program to promote healthful environmental conditions and safe food handling practices to protect public health and safety.
- Immediately investigate all reported incidents of food disease outbreaks, try to identify the source and curtail the continuation of any outbreak.
- Promptly and comprehensively review plans for new or renovated food establishments to ensure that food service areas are properly designed for sanitation and maintenance.
- Educate food service managers and food handlers in safe food handling, public health standards, and food sanitation practices in order to improve the overall environmental conditions of food establishments.

Food establishments regulated by the OFP include restaurants, retail food markets, food processing plants, mobile food vendors, caterers, special event food service operations, food donation and community based feeding programs, and food service activities within childcare establishments, shelter operations, schools and other institutions. The number of establishments that OFP regulates, based on 2008 data, is about 15,572 restaurants - 8,118 quick service and 7,454 full service<sup>21</sup>.

### ***Philadelphia Inspection Procedures***

#### ***Pre 2009 inspections***

The Philadelphia Food Code requires that every food establishment be inspected at least once every year. Inspections reports are done by trained sanitarians that inspect their designated health district (HD) in Philadelphia. Most sanitarians have been on the job for a few years so the reports are well documented. During a routine inspection, inspectors will assess whether the establishment is in compliance with the Philadelphia Food Code based on CVs. Philadelphia's Food Code was established in 1996 as a city code. There are 23 categories that cover the safety of the food source, preparation, and storage along with the general maintenance and cleanliness of the establishment as well as the health and hygiene of the employees. Within each category, violations associated with different items are designated as CVs or non-CVs. Of the 23 categories, there are 127 CVs and 262 non-CVs. However, depending on the severity or situation of the establishment, an inspector can deem a non-CV to be a CV (Ex. Code 7-01 (M) 'Exterior openings are not vermin proof. Entry door is not tight fitting to prevent vermin entry.' is a non-CV but if severe vermin infestation, which is a CV, is observed then this can become a CV). In some cases, the Code is updated and a non-CV will be considered a CV in the new Code (Ex. In 2007, Code 19-01.1 'Personnel, no certification.' meaning the absence of a CFH during inspection was now considered as a CV whereas it wasn't in the past). Establishments receiving any kind of CV will have a re-inspection after 30 days. If the establishment fails to be in compliance after re-inspection, a third enforcement inspection is performed. Should the establishment fail enforcement inspection, then the case goes to court where a judge will decide whether the establishment should be closed or not. Closure of establishments, in some cases, can be done by the sanitarian if there is an imminent health hazard during inspection, such as sewage overflow, broken refrigeration unit, no hot water, etc.

For routine inspections, an inspection report is prepared that indicates whether the establishment has a CV or non-CV and whether or not it is a repeated violation (RV). Inspection reports are collected electronically by each districts supervisor and then sent to the main office. The quality of the inspection report is assured by the district supervisor's approval, which are then recorded on the OFP database that can be accessed by the sanitarians and is also available to the public by request after 30 days from the initial inspection. Before 2009, inspection reports were done on a report sheet (Figure 1, Appendix) with a blank box after the general information of the restaurant was recorded. The sanitarian would record violations on the blank box as the inspection was being conducted.

### ***Food Safety Certification***

As part of the active managerial control, OFP has emphasized the “Food Establishment Personnel Food Safety Certification” program since 1996, which requires food safety training and demonstration of food safety knowledge to qualify for certification. At least one certified person is required to be on-duty during operating hours to provide the necessary oversight that ensures the control of risk factors and the proper implementation of food safety practices<sup>22</sup>.

### ***Internal Review Board***

Because the data was publicly available, the data was considered as exempt with the consent from OFP.

### ***Data Description***

Initially received inspection reports for 2004 – 2008 based on inspection date (n = 45,941). After a preliminary analysis, we decided to only keep 2007 and 2008 data, since not having a CFH present became a CV starting 2007. We limited the food establishments to four types of retail food service establishments because these food services prepare the food on-site and are open to the general public. The four types are; i) Mobile (Food carts and trucks); ii) Take-Out (Restaurants with a seating area less than 10. Ex. Pizza delivery places); iii) Eat-In (Restaurants with a seating area of more than 10. Ex. Diners); iv) Private Clubs (Privately owned clubs that serve food).

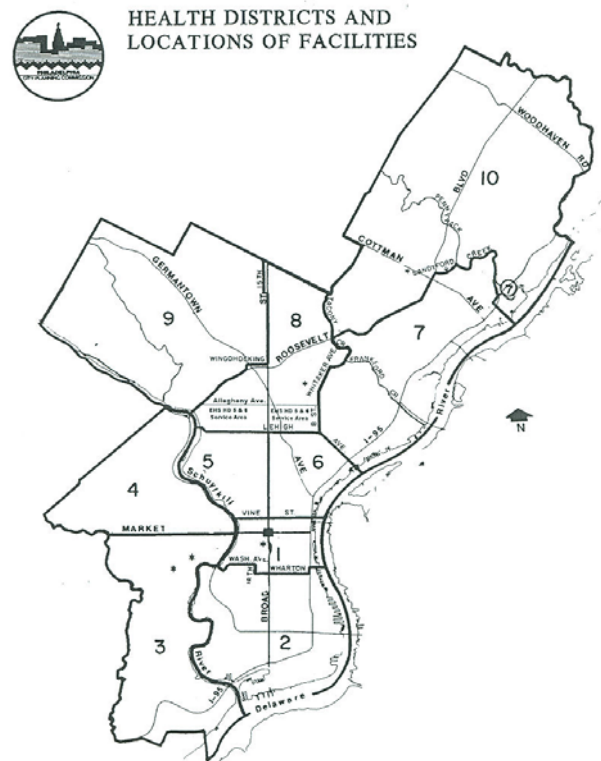
Excluded establishments that were missing reports (n = 270), zip codes or health district (HD) or address (n = 93), non routine inspections (Complaint, enforcement, re-inspections, etc) (n = 22,778), duplicate or re-inspections that were mislabeled (Inspections that were done as a quick follow up) (n = 961), and 2004 to 2006 inspection data (n = 13,423). A total of 8,416 inspection reports were used for the analysis.

### *Statistical Analysis*

A preliminary analysis was done to look at the descriptive frequencies of the variables of interest. Based on these results, we realized that a simple logistic regression would not work because the data consisted of multiple inspections for the same establishment and the model would not be able to take into these correlations into consideration. Therefore, a Generalized Estimation Equation (GEE) based approach was used as the primary means of assessing the association between the outcome and the variables. We studied a series of GEE models in which we defined the outcome for the analysis as a dichotomous variable; 0 = no CVs and 1 = at least

one CV. We modeled the variable of interest as whether the establishment had a CFH present during a routine inspection on the outcome variable.

To assess potential confounding effect, we included the following explanatory variables in the analysis: inspection year by quarters (First – Fourth quarter for 2007 and 2008), retail food establishment type (Mobile, take-Out, Eat-In, Private Club), and HD (1 through 10, Figure 2). Additional interaction terms were added for CFH with inspection year by quarter and CFH with HD. We also looked at the association between CFH and the top 3 CV categories that were most reported as an outcome by adjusting the final model accordingly. All analyses were conducted using SAS 9.1.3 Service pack 4.



(Figure 2. Health District Map)



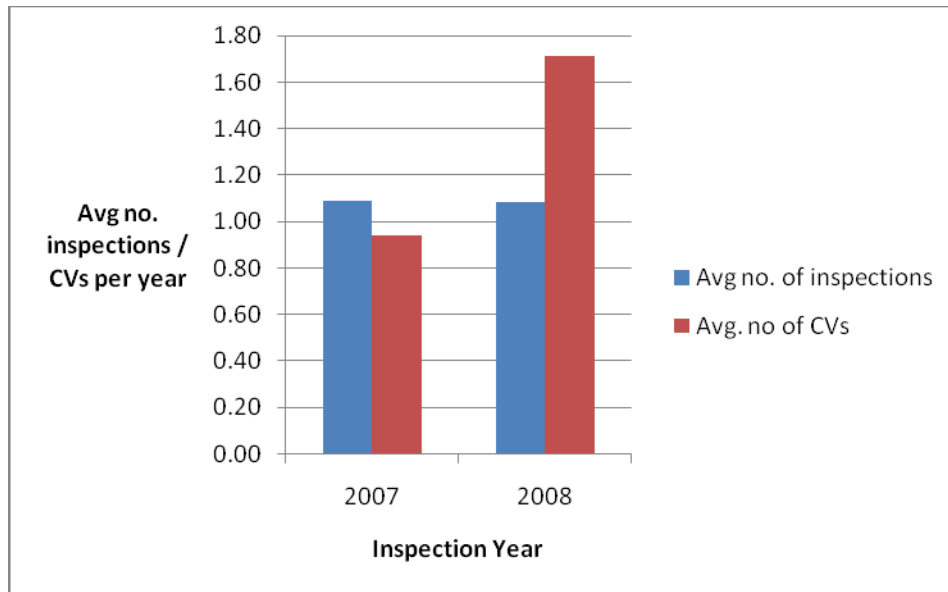
## **Results**

Table 1 provides a summary of the Philadelphia inspection data (2007 and 2008) by retail food type and by year. The number of retail establishments shows that there are more Eat-in establishments and therefore have more inspection reports. There are slightly more inspections for 2007 (55.62 %) than 2008 (44.38 %). The number of inspections per establishment is relatively the same for each retail type and for each year. The number of CVs per establishment among the retail type is greatest with Take- out (1.9 CVs per establishment) and Eat-in (1.84 CVs per establishment) while among the inspection years 2008 (1.71 CVs per establishment) was greater than 2007 (0.94 CVs per establishment). This is also reflected on the percentage of inspections with at least one CV, where Take-out (61.03%) and Eat-in (60.96%) within retail type, and 2008 (61.61%) within inspection year are relatively higher. The percentage of inspections with CFH indicates that there might be a potential association between CVs and the presence of CFH during inspection, as Take-out (62.56%) and Eat-in (59.10%) within retail type, and 2008 (59.89%) within inspection year are now relatively lower.

Table 1. Summary of Philadelphia Inspection data for 2007 and 2008

<b>Factor</b>	<b>Mobile</b>	<b>Take-out</b>	<b>Eat-in</b>	<b>Private club</b>	<b>2007</b>	<b>2008</b>
<b>No. of establishments (N = 7752) (100%)</b>	894 (11.53)	2720 (35.09)	4044 (52.17)	94 (1.21)	4312 (55.62)	3440 (44.38)
<b>No. of routine inspections (N = 8416) (100 %)</b>	943 (11.20)	3018 (35.86)	4354 (51.73)	101 (1.20)	4686 (55.68)	3730 (44.32)
<b>No. of inspections per establishment</b>	1.05	1.11	1.08	1.07	1.09	1.08
<b>Total no. of CVs (N = 9950) (100 %)</b>	198 (1.99)	4034 (40.54)	5646 (56.74)	72 (0.72)	4054 (40.74)	5896 (59.26)
<b>No. of CVs per establishment</b>	0.32	1.90	1.84	1.15	0.94	1.71
<b>Inspections with at least one CV (N = 3578) (%)</b>	103 (10.92)	1453 (48.14)	1991 (45.73)	31 (30.69)	1699 (36.26)	1879 (50.38)
<b>No. of inspections with CFH (N = 5383) (%)</b>	857 (90.88)	1888 (62.56)	2573 (59.10)	65 (64.36)	3149 (67.20)	2234 (59.89)

As a preliminary analysis, we plotted a graph to see if there was any visible association between CFHs and CVs. Graph1 shows that the number of inspections for each establishment per year has been relatively consistent for 2007 and 2008 (Approx. 1.1) while the number of CVs for each establishment per year has been increasing ( in 2004 to 2.15 in 2008). A potential explanation can be seen with graph 2, where the percentage of inspections with at least one CV has been rising at a similar rate to the number of CVs for each establishment in graph 1, the percentage of inspections with a CFH have been at a decreasing trend. Thus the two graphs suggest that there is a potential association between CFH and CVs.



Graph 1. Average number of inspections and CVs for all retail establishments from 2007 – 2008



Graph 2. Percentage of inspections with at least one CV and inspections with CFH for all retail establishments from 2007 – 2008

Table 2 shows the values for the variables included in the GEE based approach model. A CFH was present for approximately 64% of the inspections in 2007 and 2008. Among the inspections with CFH presence the first quarter of 2007 had the greatest (13.68%) and among the

inspections with CFH absence the second quarter of 2007 had the greatest (7.31%). CFH absence was roughly the same for 2007 and 2008 (~12 %). For 2007 the inspection numbers in general decreased toward the later quarters (First quarter 16.40% to fourth quarter 8.95%) while the inspection numbers stayed relatively consistent in 2008 (~11%). HD 1 had the most for total inspections (22.30%), CFH presence (13.68%), and CFH absence (7.94%). The majority of the inspections were done from Eat-Ins (51.73%). The presence of a CFH was the most, therefore, for Eat-Ins (30.57 %). Mobile, while it only had 10 % of the total inspections, the difference between the CFH presence is quite different (10.18 % for present and 1.02 % for not present).

Table 2. Distribution of inspections for model variables and stratified by CFH

Variables		No. (N = 8416)	%	CFH Present	%	CFH Not Present	%	
				5383	63.96	3033	36.04	
<b>Retail Food Type</b> (p <0.0001)	<b>Mobile</b>	943	11.2	857	10.18	86	1.02	
	<b>Take-Out</b>	3018	35.86	1888	22.43	1130	13.43	
	<b>Eat-In</b>	4354	51.73	2573	30.57	1781	21.16	
	<b>Private Club</b>	101	1.2	65	0.77	36	0.43	
<b>Inspection Year By Quarters</b> (p <0.0001)	<b>2007</b>	<b>1<sup>st</sup> Quarter</b>	1380	16.40	1151	13.68	229	2.72
		<b>2<sup>nd</sup> Quarter</b>	1570	18.65	955	11.35	615	7.31
		<b>3<sup>rd</sup> Quarter</b>	983	11.68	581	6.90	402	4.78
		<b>4<sup>th</sup> Quarter</b>	753	8.95	462	5.49	291	3.46
	<b>2008</b>	<b>1<sup>st</sup> Quarter</b>	945	11.23	554	6.58	391	4.65
		<b>2<sup>nd</sup> Quarter</b>	945	11.23	629	7.47	316	3.75
		<b>3<sup>rd</sup> Quarter</b>	915	10.87	507	6.02	408	4.85
		<b>4<sup>th</sup> Quarter</b>	925	10.99	544	6.46	381	4.53
<b>Health District</b> (p <0.0001)	<b>1</b>	1877	22.30	1209	14.37	668	7.94	
	<b>2</b>	727	8.64	529	6.29	198	2.35	
	<b>3</b>	951	11.30	662	7.87	289	3.43	
	<b>4</b>	698	8.29	435	5.17	263	3.13	
	<b>5</b>	550	6.54	431	5.12	119	1.41	
	<b>6</b>	686	8.15	489	5.81	197	2.34	
	<b>7</b>	860	10.22	480	5.70	380	4.52	
	<b>8</b>	711	8.45	407	4.84	304	3.61	
	<b>9</b>	751	8.92	396	4.71	355	4.22	
	<b>10</b>	605	7.19	345	4.10	260	3.09	

Table 3 gives the number of inspections stratified by the outcome, at least one CV or no CV, for each variable. The most inspections in at least one CV were CFH absence (53.83 %), Eat-In (55.65 %), and Health District (HD) 1 (18.98 %). As for inspection year by quarters, the distribution is relatively even. For inspections without CVs, CFH presence is 77.12 %, opposite relation to inspections with at least one CV. For inspection year by quarters, 2007 has the majority of inspections. HD 1 (24.76 %) has the most inspections with no CV. For retail type, Eat-In (48.84 %) is the highest but we also noted the increase for Mobile (17.36 %).

Table 3. Distribution of inspections by model variables and stratified by outcome

Variable		Inspections with at least one CV				P-value	
		Yes		No			
		No. (N = 3578)	%	No. (N = 4838)	%		
<b>Certified Food Handler</b>	<b>Present</b>	1652	46.17	3731	77.12	<0.0001	
	<b>Not Present</b>	1926	53.83	1107	22.88	---	
<b>Retail Food Type</b>	<b>Mobile</b>	103	2.88	840	17.36	<0.0001	
	<b>Take-Out</b>	1453	40.61	1565	32.35	0.0026	
	<b>Eat-In</b>	1991	55.65	2363	48.84	0.0084	
	<b>Private Club</b>	31	0.87	70	1.45	---	
<b>Inspection Year By Quarters</b>	<b>2007</b>	<b>1<sup>st</sup> Quarter</b>	414	11.57	966	19.97	<0.0001
		<b>2<sup>nd</sup> Quarter</b>	567	15.85	1003	20.73	<0.0001
		<b>3<sup>rd</sup> Quarter</b>	402	11.24	581	12.01	<0.0001
		<b>4<sup>th</sup> Quarter</b>	316	8.83	437	9.03	<0.0001
	<b>2008</b>	<b>1<sup>st</sup> Quarter</b>	442	12.35	503	10.40	0.0002
		<b>2<sup>nd</sup> Quarter</b>	402	11.24	543	11.22	<0.0001
		<b>3<sup>rd</sup> Quarter</b>	518	14.48	397	8.21	0.6539
		<b>4<sup>th</sup> Quarter</b>	517	14.45	408	8.43	---
<b>Health District</b>	<b>1</b>	679	18.98	1198	24.76	<0.0001	
	<b>2</b>	298	8.33	429	8.87	<0.0001	
	<b>3</b>	427	11.93	524	10.83	<0.0001	
	<b>4</b>	278	7.77	420	8.68	<0.0001	
	<b>5</b>	159	4.44	391	8.08	<0.0001	
	<b>6</b>	226	6.32	460	9.51	<0.0001	
	<b>7</b>	458	12.80	402	8.31	0.0454	
	<b>8</b>	400	11.18	311	6.43	0.5772	
	<b>9</b>	304	8.50	447	9.24	<0.0001	
	<b>10</b>	349	9.75	256	5.29	---	

Table 4 reports the odds ratios (ORs) and the significance for the variable for the GEE using a univariate analysis and the final model. An OR less than 1 indicates that the odds of an establishment having a CV decreased, whereas an OR greater than 1 indicates that the odds of an establishment having a CV increased.

Through discussions with OFP and from the initial descriptive statistics described earlier, we suspected that there was an interaction between CFH and the other explanatory variables

(Inspection year by quarters, HD, and retail food type). During the preliminary analysis, the interaction terms that showed at least one of the interacting variables to be significant were CFH with inspection year by quarters and CFH with HD. CFH with retail food type did not show any significance, therefore, was no longer considered for interaction and the term was dropped. The significance of the remaining two interactions terms were further confirmed when we performed a global test (CFH with inspection year by quarters  $p = 0.026$ , CFH with HD  $p < 0.0001$ ). Due to their significance, the two terms were included in the final model along with the other explanatory variables. Because of the interactions terms the variables cannot be explained alone without considering the interacting variable. Therefore, for the final model table 4 divides the presence of a CFH for inspection year by quarters and HD. In both cases, the presence of a CFH dramatically decreases the odds of getting a CV (~90 % decrease in odds) while the effect is less dramatic or increases the odds when a CFH is not present, indicating the effect of the corresponding interaction variable.

In the univariate analysis, most of the variables were globally significant. For each individual variable though, 2008 third quarter had the highest odds of risk, HD 7 and 8 were less at risk compare to the reference (HD 10) but they were not significant. Among the significant variables, only Take-Out (2.04) and Eat-In (1.86) were at higher odds of risk.

Table 4. Odds ratios from the Univariate and Final Models of the covariates on the outcome (inspections with at least one CV)

Variable		Odds Ratios			
		Univariate	Final Model		
<b>Certified Food Handler</b>	<b>Present</b>	0.26 <sup>***</sup>	0.17 <sup>***</sup>		
	<b>Not Present</b>	---	---		
<b>Retail Food Type</b>	<b>Mobile</b>	0.27 <sup>***</sup>	0.31 <sup>***</sup>		
	<b>Take-Out</b>	2.04 <sup>**</sup>	1.81 <sup>**</sup>		
	<b>Eat-In</b>	1.86 <sup>**</sup>	1.62 <sup>**</sup>		
	<b>Private Club (Ref.)</b>	---	---		
<b>Inspection Year By Quarters</b>			<b>CFH Present</b>	<b>CFH Not Present</b>	
	<b>2007</b>	<b>1<sup>st</sup> Quarter</b>	0.34 <sup>***</sup>	0.05 <sup>***</sup>	0.48 <sup>***</sup>
		<b>2<sup>nd</sup> Quarter</b>	0.47 <sup>***</sup>	0.06 <sup>***</sup>	0.59 <sup>***</sup>
		<b>3<sup>rd</sup> Quarter</b>	0.56 <sup>***</sup>	0.08 <sup>**</sup>	0.62 <sup>**</sup>
		<b>4<sup>th</sup> Quarter</b>	0.57 <sup>**</sup>	0.08 <sup>**</sup>	0.62 <sup>**</sup>
	<b>2008</b>	<b>1<sup>st</sup> Quarter</b>	0.71 <sup>**</sup>	0.10 <sup>**</sup>	0.69 <sup>**</sup>
		<b>2<sup>nd</sup> Quarter</b>	0.6 <sup>***</sup>	0.15	0.94
		<b>3<sup>rd</sup> Quarter</b>	1.04	0.16 <sup>**</sup>	1.35 <sup>**</sup>
		<b>4<sup>th</sup> Quarter (Ref.)</b>	1.00	0.17 <sup>***</sup>	1.00
<b>Health District</b>			<b>CFH Present</b>	<b>CFH Not Present</b>	
		<b>1</b>	0.42 <sup>***</sup>	0.08 <sup>***</sup>	0.53 <sup>***</sup>
		<b>2</b>	0.50 <sup>***</sup>	0.06 <sup>*</sup>	0.76 <sup>*</sup>
		<b>3</b>	0.60 <sup>***</sup>	0.17 <sup>**</sup>	0.71 <sup>**</sup>
		<b>4</b>	0.48 <sup>***</sup>	0.09 <sup>***</sup>	0.48 <sup>***</sup>
		<b>5</b>	0.31 <sup>***</sup>	0.06 <sup>***</sup>	0.40 <sup>***</sup>
		<b>6</b>	0.37 <sup>***</sup>	0.06 <sup>***</sup>	0.53 <sup>***</sup>
		<b>7</b>	0.81 <sup>*</sup>	0.15 <sup>*</sup>	0.78 <sup>*</sup>
		<b>8</b>	0.94	0.14	1.11
		<b>9</b>	0.49 <sup>***</sup>	0.06 <sup>**</sup>	0.57 <sup>**</sup>
	<b>10 (Ref.)</b>	1.00	0.17 <sup>***</sup>	1.00	

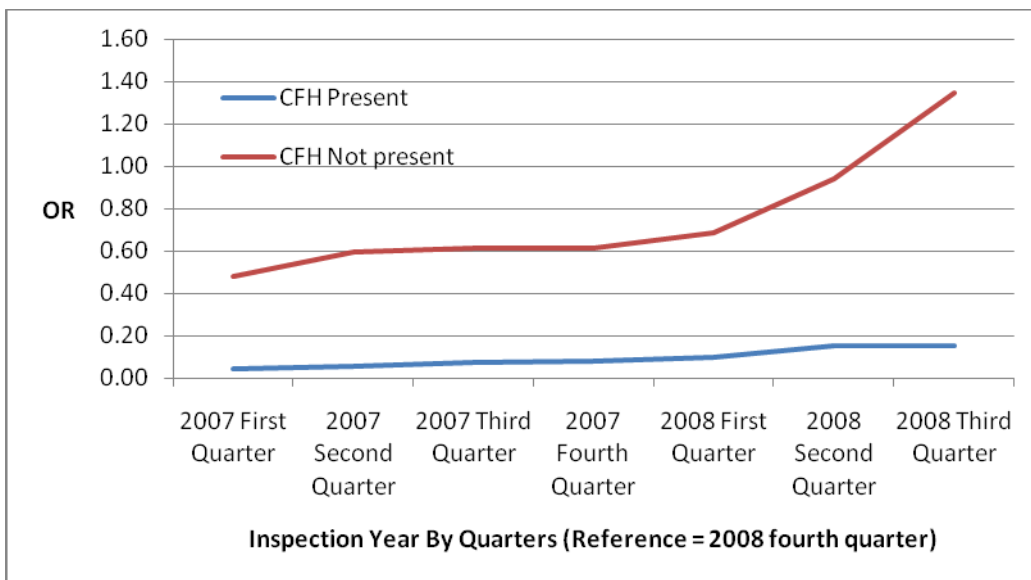
\*\*\* : P < 0.0001    \*\* : P < 0.05    \* : P < 0.10

In the final model, for the most part the odds increase compared to the odds from the univariate model, with the exception of CFH and for most of the retail food type (Take-Out and Eat-In). The presence of a CFH during inspection showed that an establishment was less likely to have a CV (OR = 0.17, P < 0.0001). For inspection year by quarters, 2007 remained consistent

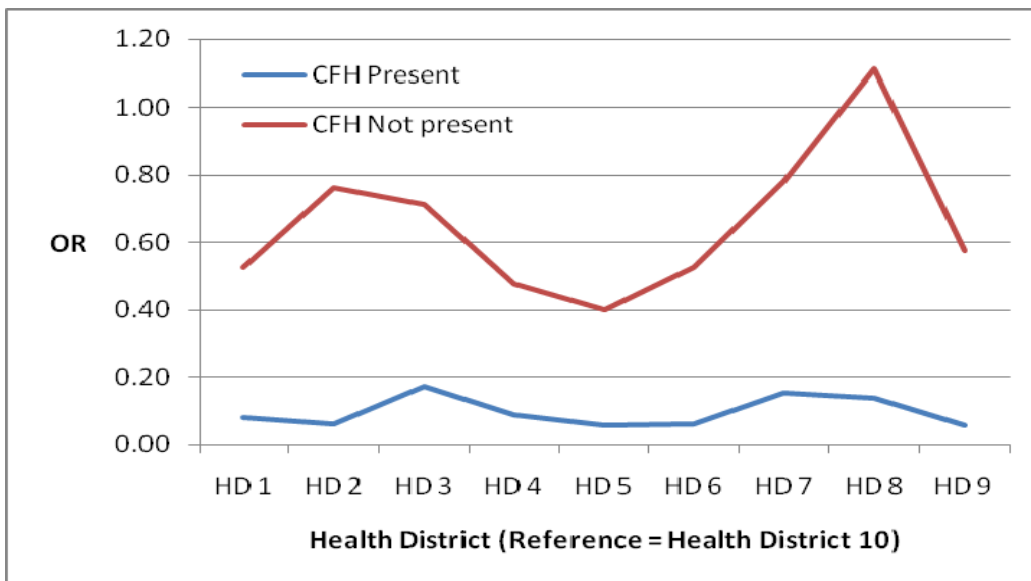


among the quarters as being significant. For the third quarter of 2008, in the univariate model the variable wasn't significant but as the interaction terms were applied it became significant in the final model (OR = 1.35, P = 0.0227). Both the univariate and final model show that there is an increasing trend in the odds of having inspections with at least one CV as time progresses. Retail food type stayed relatively consistent as far as which type was at highest risk (Take-Out). However as mentioned earlier, there is a decrease in odds compared to the univariate model suggesting that one or more of the additional variables is having an influence on retail food type.

To further assess the interaction among the variables CFH with inspection year by quarter and CFH with HD, the ORs from table 4 were plotted as shown in graph 3 for CFH with inspection year by quarters and graph 4 for CFH with HD. In graph 3, 2007 second quarter to 2007 fourth quarter the lines are parallel between the presence and absence of CFH, suggesting that institutions with CFH had lower odds of having inspections with at least one CV than those without and this difference in risk remained the same during this period. However, the plot also suggests this difference in odds to be slightly lower during the first quarter of 2007 while it increased during the period of 2008. In graph 4, we see deviances among the lines between the presence and absence of CFH for all the HDs, which suggest interaction among the two variables further. The two graphs further assure us that including the two interaction terms in the final model was the correct choice. This graph also shows that the odds of having inspections with at least one CV is relatively the same for those establishments with CFH present across the districts, but varies if CFH is not present. In the latter, HD 8, 10, 2 and 3 have higher odds in descending order.



Graph 3. Interaction CFH with Inspection Year



Graph 4. Interaction CFH with Health District

Table 5 gives the number and percentage of inspections of total inspections and total CVs by the top 3 violation categories that were most reported in 2007 and 2008; ‘Vermin Control’,

‘Food Protection’, and ‘Employee Health, Hygiene’. The most prevalent was ‘Vermin Control’ among total inspections (22.69 %) and among the total number of appearances (24.24 %).

Table 5. Frequencies and percentages reported by total inspections and appearances for the top 3 violation categories in 2007 and 2008.

<b>Inspection category</b>	<b>No. appeared</b>	<b>By Total Inspection (%)</b>	<b>By number of appearances (%)</b>
Vermin Control	1910	22.69%	24.24%
Food Protection	999	11.87%	12.68%
Employee Health, Hygiene	921	10.94%	11.69%

Table 6 gives the ORs and p-values for the top 3 violation categories used above. Because the outcome is different from the ‘final model’ (At least one CV vs. No CV), the interaction terms were reconsidered depending on the violation category. While keeping all the variables, the significance was globally verified. ‘Vermin Control’ and ‘Food Protection’ showed no significance for both interaction terms, while ‘Employee Health, Hygiene’ showed significance for the interaction term CFH with HD. Based on these results, the appropriate models were applied. Restaurants with a CFH present during inspection were less likely to have a CV for ‘Vermin Control’ (OR = 0.46,  $P < 0.0001$ ), ‘Food Protection’ (OR = 0.50,  $P < 0.0001$ ), and ‘Employee Health, Hygiene’ (OR = 0.32,  $P < 0.0001$ ). Within retail food type, only Mobile for ‘Vermin Control’ had the lowest risk odds that was significant (OR = 0.10,  $P < 0.0001$ ) in reference to Private Clubs. For inspection year by quarters, there is an increasing trend in risk for all three categories. Health District 3 (OR = 1.44,  $P = 0.0039$ ) and 8 (OR = 1.18,  $P = 0.2264$ ) are the only districts that show an increase in risk, particularly for ‘Vermin Control’.

Table 6. Odds ratio of variables with top 3 violation categories

Variable		Odds Ratios			
		Vermin Control <sup>\$</sup>	Food Protection <sup>\$</sup>	Employee Health, Hygiene <sup>\$\$</sup>	
Certified Food Handler	Present	0.46 <sup>***</sup>	0.50 <sup>***</sup>	0.32 <sup>***</sup>	
	Not present (Ref.)	---	---	---	
Retail Food Type	Mobile	0.10 <sup>***</sup>	1.07	0.49	
	Take-Out	2.44 <sup>**</sup>	17.17 <sup>**</sup>	2.32 <sup>*</sup>	
	Eat-In	2.30 <sup>**</sup>	11.94 <sup>**</sup>	1.93	
	Private Club (Ref.)	---	---	---	
Inspection Year By Quarters	2007	1 <sup>st</sup> Quarter	0.61 <sup>***</sup>	0.49 <sup>***</sup>	0.31 <sup>***</sup>
		2 <sup>nd</sup> Quarter	0.66 <sup>***</sup>	0.47 <sup>***</sup>	0.29 <sup>***</sup>
		3 <sup>rd</sup> Quarter	0.91	0.46 <sup>***</sup>	0.40 <sup>***</sup>
		4 <sup>th</sup> Quarter	0.75 <sup>**</sup>	0.52 <sup>***</sup>	0.34 <sup>***</sup>
	2008	1 <sup>st</sup> Quarter	0.66 <sup>**</sup>	0.71 <sup>**</sup>	0.64 <sup>**</sup>
		2 <sup>nd</sup> Quarter	1.12	1.05	0.84
		3 <sup>rd</sup> Quarter	1.47 <sup>**</sup>	1.22	0.31 <sup>*</sup>
		4 <sup>th</sup> Quarter (Ref.)	---	---	---
Health District	1	0.68 <sup>**</sup>	0.23 <sup>***</sup>	0.77 <sup>***</sup>	
	2	0.61 <sup>**</sup>	0.18 <sup>***</sup>	0.29 <sup>***</sup>	
	3	1.44 <sup>**</sup>	0.39 <sup>***</sup>	0.15 <sup>***</sup>	
	4	0.74 <sup>**</sup>	0.30 <sup>***</sup>	0.10 <sup>***</sup>	
	5	0.54 <sup>**</sup>	0.28 <sup>***</sup>	0.12 <sup>***</sup>	
	6	0.63 <sup>**</sup>	0.47 <sup>***</sup>	0.13 <sup>***</sup>	
	7	0.93	0.98	0.26	
	8	1.18	0.64 <sup>**</sup>	0.93	
	9	0.58 <sup>***</sup>	0.28 <sup>***</sup>	0.87 <sup>***</sup>	
	10 (Ref.)	---	---	---	

\*\*\* P < 0.0001    \*\* P < 0.05    \* P < 0.10

\$: No interaction terms, only variables

\$\$: All variables plus CFH with HD interaction term

## Discussion

According to a paper published in 2004, the oldest known mandatory certification regulation started in the 1950s in the state of Washington. There are at least 17 states that have passed legislation to make certification mandatory; California, Connecticut, Washington, D.C.,

Florida, Idaho, Illinois, Indiana, Louisiana, Massachusetts, Minnesota, Mississippi, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, and the state of Washington<sup>23</sup>. As for the remaining states, some are developing legislations, some have codes requiring the person in charge to "demonstrate knowledge of food safety"<sup>23</sup>. In the present analysis the presence of a CFH decreases the odds of CVs compared with no CFH. The presence of a CFH also had a decreased the odds of CVs for all three violation categories that were reported the most in 2007 and 2008 ('Vermin Control', 'Food Protection', and 'Employee Health, Hygiene'). These finding suggest that food handlers who have gone through an accredited certification training program in Philadelphia were knowledgeable about preventing food-borne risk illness risk factors and applying safe food handling and preparation practices, thus having less CVs.

Although all these violation categories are covered in the food certification training program, sometimes what has been learned doesn't necessarily translate to practice, making these CVs hard to completely eliminate. Other studies have reported similar findings<sup>24, 25</sup>. Additional studies need to be done at the establishment level to see how food safety knowledge is being practiced in order to better understand what methods of training need to be improved in order to effectively apply food safety measures among CFHs.

Our results suggest that the inspection year by quarters, HD, and retail type may also affect the occurrence of CVs and for the top 3 violation categories during inspections.

For retail type, mobile was the only one to show a decrease in odds while Take-Out and Eat-In showed an increase in odds for CVs with reference to Private Clubs. This most likely has to do with the size of the establishment as well as the number of employees. Mobile establishments are small and have only a handful of employees, making the CFH's job of conducting food safety easier compared to Take-Out and Eat-In establishments. This is also most

likely applicable as to why only Mobile had a decrease in odds for 'Vermin Control' and 'Employee Health, Hygiene' (although it wasn't significant'). As for 'Food Protection', relatively Mobile is at lower risk than Take-Out or Eat-In, the risk is still increased. Although size does seem to be the main factor, seeing that Mobile is still at an increase in risk, there also seems to be the responsibility from the food handler's part that contributes, since this category mainly is concerned with preventing contamination of food.

With the exception of the 2008 third quarter, most quarters had a protective effect relative to the 2008 fourth quarter (reference quarter). 2007 showed significance for all quarters while 2008 wasn't always consistent with significance. There is also an increasing trend in risk as the quarter's progress from 2007 to 2008. This might be due to the fact that OFP was in a transition period. Applying new technologies (electronic report) and the addition of new sanitarians might have led to more reporting of CVs. The lack of significance might be explained because OFP was transitioning from a CV based inspection to a risk based food inspection. The new technology might have added better reporting but might have also contributed in this lack of significance as this new technology required debugging software and hardware along with the adjustment for the sanitarians to become familiar with the new technology. This is also the most likely explanation to the results obtained for the violation categories. The reasoning is most evident when looking at the ORs for later quarters of 2008, the year before the transition to risk-based inspections.

For HD, only HD 8 didn't show a decrease in risk relative to HD 10 but was not significant. The most likely explanation to this is that during 2007 and 2008, the supervisor for HD 8 was under special circumstances, known as the DROP program; retired yet still active. Given that there were also new sanitarians being introduced in 2007, there potentially might have

been a gap in communication and duty with the new sanitarians and supervisor in HD 8.

Although most likely not a direct cause to the results obtained in this study, it is possible that the circumstances might have influenced our results. Other than that, based on the distribution only HD 1 has the most inspection reports (20.45%) while the other districts are proportionally the same. HD 1 has more inspections because the district represents Center city as seen in figure 3, which despite its' relative size to other districts has the most restaurants and therefore the most routine inspection reports.

Interactions were suspected with CFH for all the variables. With HD, the distribution of the different restaurants throughout the districts would influence the importance of food protection in general and thus the importance of CFHs. With inspection year by quarters, because the presence of a CFH became a CV in starting 2007, this would have taken time for establishments to adjust to the change and therefore influencing CVs. With retail type, because of the size difference between each retail type, Mobile establishments were likely to have the most inspections with CFHs compared to Take-Out's and Eat-In's. In the end, inspection year by quarters and HD were the only significant interactions with CFH.

Our conclusions were consistent with a study done by Cates (2009)<sup>11</sup> when they looked at the effect of CFHs on risk-base categories (equivalent to violation categories of the current study), concluding that CFHs showed a protective effect for certain categories. The difference with their study with ours is they chose the categories based on importance rather than the numbers recorded on the reports. They also use a risk-based system, which goes through a check list rather than recording the violations. Their data is also limited to one year of state data compared to ours, which we used two years worth of county data.

The results from our study were also similar to Hedberg (2006). Hedberg drew conclusions from looking at restaurants with food-borne illnesses and compared to those without. The study drew many conclusions as to what factors prevent food-borne illnesses and the major one was the presence of a CFH. While the method of drawing to the conclusion differs from our study, the conclusions that we found are still relevant to theirs. With the CFHs presence, CVs are prevented and therefore food-borne illness risks are prevented as well. This in turn protects against food-borne illness outbreaks like the Hedberg study suggests.

Limitations of the present study include limited data on CFH characteristics, such as demographics, and the lack of other factors for establishments, such as the type of food that a restaurant serves. Our analysis did not take into account of the bias among inspectors, as some may be more stringent than others with observing CVs. However, because there are a number of sanitarians that do inspections for each health district, the bias of a single sanitarian may not be strong enough to influence our results. There is also the inherent limitation of using inspection data, as it only represents a snapshot of an establishment food safety situation, thus there is the question of whether such a snapshot is representative in general. Although food codes may differ among other states, such difference is very minimal.

Additional research needs to be done to look into more detail at CFHs themselves and the establishments in order to get a thorough understanding of factors that might be contributing to better food inspection outcomes. For Philadelphia, with the recent change to risk-based inspections, comparing the new and old inspection method would yield results that can show the efficacy of such change and address problems as well as ways to reinforce the new method of inspections. Lastly, a State wide analysis would be useful as a reference to see similarities and differences among the counties in Pennsylvania and among the other states.



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## LIST OF REFERENCES

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## **APPENDIX**

# APPENDIX

## Inspection report form example (before 2009)

INSPECTION RECORD						
PHILADELPHIA DEPARTMENT OF PUBLIC HEALTH ENVIRONMENTAL HEALTH SERVICES				www.Phila.Gov/Health/Units/EHS		
TRADE NAME Lisa Seafood		ESTABLISHMENT TYPE Retail Food: Prepared Food Take-Out		LICENSER Sang Don Han		
ADDRESS 1932 E Washington Ln Philadelphia, PA 19138		HDSUB 09-04		LICENSE NO.		
TELEPHONE NO. 215-424-3336		INSPECTION TYPE Reinspection		NO. OF CORRECTIONS 2		
Page 1 of 1		DATE 10/06/2008	ARRIVE 10:50 am	DEPART 11:30 am	REINSPECTION DATE	
CODE	CV	RV	CV = CRITICAL VIOLATIONS RV = REPEAT VIOLATIONS			
7-01 (M)	N	Y	7-01 (M) Exterior openings are not vermin proof. Entry door is not tight fitting to prevent vermin entry.			
7-01 (N)	N	Y	7-01 (N) Proper storage of cleaning equipment/supplies is not provided. Mop rack is not provided for proper storage of cleaning items to prevent insect and rodent attraction/harborage.			
5-01.8	N	Y	5-01.8 Live animals or fowl are not excluded from food establishment preparation areas. There is a cat in the rear prep area.			
9-02.2 (C)	N	Y	9-02.2 (C) Employee does not have suitable head covering or hair restraint.			
10-01.4 (A)	N	Y	10-01.4 (A) Food utensils are improperly stored. Water ice scoops stored inside the water ice.			
10-02.1	N	Y	10-02.1 Food equipment needs cleaning: under the grill			
11-01.1 (A)	N	Y	11-01.1 (A) Food equipment in use does not meet minimum design standards. Domestic freezers, toaster, and microwave present, soda crates observed elevating beverage cases, and cardboard / foil observed lining shelves.			
13-01.1 (A)	N	N	13-01.1 (A) Floor is not clean under the cooking line.			
13-01.1 (B)	N	Y	13-01.1 (B) Floor is not in good repair. Missing tiles throughout establishment.			
13-01.5	N	N	13-01.5 Unapproved floor covering is used. Cardboard present along the cooking line.			
13-02 (B)	N	Y	13-02 (B) Ceiling is not in good repair. Textured ceiling present throughout establishment.			
14-01.1	N	Y	14-01.1 Lighting is inadequate in the beverage display cases and prep / storage areas.			
This inspection has revealed that the establishment is in satisfactory condition and that current management practices meet acceptable public health standards. Please note, however, that violations listed on this report require correction and will be evaluated at our next visit.						
SANTARIAN Derrick High		SANTARIAN NO. 828		PHONE: 215-685-9017		
NAME OF PERSON INTERVIEWED Sang Don Han		TITLE Owner				
NOTICE OF VIOLATION ISSUED: YES						
<small>You are required under Section 6-502 of the Philadelphia Health Code to correct the violations listed as noted above. Your failure to correct these violations may result in the revocation of your health license and other legal action. Reinstatement of a revoked health license will require payment of another license fee. An appeal to these orders may be made to the Board of License and Inspection Review, Municipal Services Building, 1401 BX Boulevard Philadelphia, PA</small>						

(Figure 1. Inspection reports before 2009)

