



# State Health Agency Workforce Shortages and Implications for Public Health: A Case Study of Restaurant Inspections in Louisiana

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**Abstract** The study described in this article evaluated the effects of public health workforce cuts on routine food safety inspections and the occurrence of critical violations. Routine inspection information was collected from two Louisiana databases for permanent food establishments categorized as risk category 3 or 4 in East Baton Rouge Parish, Louisiana, for the years 2005, 2007, and 2009. The length of time between routine inspections nearly quadrupled from 2005 to 2009. For risk category 4 establishments, a significant increase occurred in the proportion of inspections that resulted in a critical violation between the three years. The amount of time between routine inspections was significantly higher for inspections that resulted in a critical violation versus those that did not. Lastly, the amount of time between routine inspections, an establishment's risk category, and history of complaint were found to have significant predictive effects on the incidence of a critical violation during a routine inspection, although results varied by year. Study results indicate that decreased workforce capacity in Louisiana may negatively affect the outcomes of routine food safety inspections.

## Introduction

State environmental health professionals are critical members of the public health workforce, accounting for 10% of public health professionals (Center for State and Local Government Excellence, 2008). Ensuring a safe food supply is a key responsibility of environmental health programs, particularly in state and local health departments. According to a 2006 survey conducted by the

Association of State and Territorial Health Officials, 82% of state environmental health units administer food protection programs (Association of State and Territorial Health Officials, 2007). In Louisiana, the Center for Environmental Health in the Office of Public Health oversees the food safety program and ensures safety for almost 32,000 food establishments, including full service restaurants; fast food businesses; cafeterias in hospitals,

prisons, nursing homes, and schools; concession stands; delis; bars; and grocery stores. Among other functions, the Louisiana food safety program conducts food establishment inspections and responds to consumer complaints and reports of foodborne illness.

Food safety inspections serve as one of the most fundamental public health activities intended to prevent foodborne illness from occurring, but no definitive evidence exists indicating that poor restaurant inspection results accurately predict the potential for foodborne illness. The Seattle-King County (Washington) Health Department performed a study in 1987, which found that "restaurants with poor inspection results were at increased risk of foodborne outbreaks (Irwin, Ballard, Grendon, & Kobayashi, 1989)," and that routine inspections by the health department could help identify restaurants with an increased risk of an outbreak. Florida Department of Health epidemiologists conducted a similar study, however, and found no correlation between lower inspection results and increased outbreak risk (Cruz, Katz, & Suarez, 2001).

The literature is in conflict about how often food establishments should be inspected and whether less frequent inspections result in poorer inspection outcomes. Allwood and co-authors found that restaurant inspection scores were significantly higher (better) when restaurants were inspected four times a year, compared to three times a year (Allwood, Lee, & Borden-Glass, 1991). In con-

trast, a 2008 Canadian study did not find a statistical difference between food safety outcome measures based on inspection frequency, but concluded that “food premise inspections should continue to play an important role in protecting the public from foodborne illnesses by educating workers (Newbold, McKeary, & Hart, 2008).”

The El Paso County (Colorado) health department has lacked staff resources to perform two inspections per year of restaurants and other food providers as required by law (Auge, 2009). A report on the health care infrastructure in Colorado Springs (in El Paso County) revealed complaints about restaurant cleanliness and employee hygiene had increased from 60 in 2005 to 219 in 2007 (Emery, 2008). Although the county had not seen an increase in major foodborne outbreaks, individual complaints of sickness from food poisoning increased nearly threefold from 2005 to 2006 (Limbert & Beard, 2008). Limbert and Beard’s report suggests that decreased restaurant inspections due to workforce shortages may present increased public health risks.

The Food and Drug Administration (FDA) recommends that to sustain an effective risk-based food safety program, state agencies should maintain well-resourced programs; i.e., at least one full-time staff member devoted to every 280–320 food establishments (FDA, 2009). In Louisiana, the ratio of sanitarians to the number of expected food establishments in need of inspection is already much higher than FDA’s recommendation. For example, in the East Baton Rouge area in 2010, approximately 2,775 food establishments were open but only seven sanitarians were employed, creating a ratio of 396 retail food establishments to be inspected per sanitarian. Thus, these sanitarians are expected to perform nearly 25% more inspections than FDA recommends for an effective program. Additionally, food safety inspections constitute only one aspect of the environmental health sanitarian’s overall job duties. Sanitarian inspection responsibilities cover a wide range of program areas, including beach monitoring, building and premises, commercial seafood, disease/vector control, food and drug, infectious waste, milk and dairy control, mollusks and shellfish, onsite wastewater, and retail food establishments.

Nationwide, the existing environmental health workforce shortage (Perlino, 2006) and even more severe budgetary constraints

on environmental health programs (Gurwitt, 2009) threaten food safety programs. In Louisiana, budget cuts have directly affected the state’s ability to maintain core environmental health staff. For example, in fiscal year 2010–2011, the environmental health department was required to reduce its budget by 25% to meet state budgetary constraints. To do this, the department removed six environmental health sanitarian staff from payroll, thus reducing the capacity to perform public health inspections and reducing response time by the department for other public health issues. These cuts exacerbated the potential impact of prior year workforce reductions. As state environmental health programs are forced to defend and justify their programs in the face of increased budgetary constraints, they must demonstrate the value of environmental health services. The purpose of our study was to evaluate Louisiana’s electronic food inspection database to assess potential trends in inspection results and inspection frequency over time, as Louisiana Department of Health and Hospitals has faced workforce shortages.

## Methods

Our study compared food safety inspections among 2005, 2007, and 2009 in East Baton Rouge to identify potential predictors of critical violations. A critical violation as defined by the FDA 2001 *Food Code* is a violation “that, if in noncompliance, is more likely than other violations to contribute to food contamination, illness, or environmental health hazard (FDA, 2004a).” Inspection records of establishments in risk categories 3 and 4 (RC3 and RC4) were utilized because they represent sites at most risk for foodborne outbreaks, with RC4 higher than that of RC3 establishments. Risk category designations are generally defined by the types of food served, required preparation steps, volume of food served, population served, and compliance history (FDA, 2004b). Examples of RC3 and RC4 establishments include full service restaurants that have extensive menus and handle raw ingredients, as well as restaurants that involve the cooking, cooling, and reheating of potentially hazardous food. A food establishment may also be rated as an RC3 or RC4 if the primary service population may be at increased risk of foodborne illness, such as schools and nursing facilities. The incidence of critical violations was used as a

surrogate to indicate greater potential risk of foodborne disease.

Two Louisiana Department of Health and Hospitals data systems provided information. The Automated Inspection Records System is used by sanitarians in the field to record inspection results. The Sanitarian Event Tracking System is used by sanitarians to record establishment location, risk category, permit status, etc. These two systems are linked electronically and help inform sanitarians when they need to perform routine inspections.

Variables compiled in an Excel 2007 database were restaurant permit number, date of routine inspection, and previous routine inspection; the number of days between the date of routine inspection and previous routine inspection; number of critical violations received; number of noncritical violations received; history of complaint since last routine inspection; risk category; and year of inspection. A “complaint” occurs when a member of the public contacts the department regarding an issue with a food facility and the environmental health department is obligated to follow up on the complaint by performing an inspection at the facility to verify the validity of the complaint and enforce remediation if necessary. Up to six critical violations per inspection were abstracted.

## Statistical Analysis

SAS 9.1 was used for statistical analysis. Descriptive analyses determined the number of inspections performed each year and within each risk category; the mean number of violations cited during an inspection; the frequencies of inspections resulting in critical violations, noncritical violations, and no violations; the frequency of inspections with a history of complaint; and the average days between routine inspections for establishments of different risk categories and between years. Chi-square tests determined if trends over time and between risk categories were statistically significant. Analysis of variance compared the average days between routine inspections from year to year. One-sided *t*-tests determined whether the average days between inspections resulting in critical violations versus ones that did not were statistically different. One-sided *t*-tests also determined if the average days between inspections with a history of complaint were statistically different from those without such

history. Logistic regression analysis evaluated whether days since last routine inspection, history of complaint, and risk category predicted the incidence of critical violations.

**Results**

A total of 3,488 (57.3%) inspection records were eligible for study among 6,090 inspection records evaluated. A previous inspection date could not be found for 1,067 records, 670 records collected were risk category 1 or 2, and 865 records were missing risk category information. Routine inspection records were not found for January–April, 2005; thus, this analysis included only May–December 2005. Of all eligible inspections, 1,615 (46.3%) resulted in critical violations, 2,988 (85.7%) resulted in noncritical violations, and 445 (12.8%) resulted in no cited violations (Table 1). Forty-two different types of critical violations were cited across the three years. The most commonly cited were related to equipment cleanliness ( $n = 610$ ), toxic storage ( $n = 452$ ), and employees eating or drinking in a food preparation area ( $n = 341$ ).

A greater proportion of RC4 establishments had a routine inspection resulting in a critical violation. The number of critical violations received by an establishment during an inspection ranged from 0 to 17 with a mean of 0.95, while the number of noncritical violations ranged from 0 to 40 with a mean of 4.37. The total number of violations per inspection ranged from 0 to 48 and averaged 5.32. Chi-square tests for trend showed that the proportion of critical violations varied significantly ( $p < .0001$ ) by year for all inspections as well as for RC4 establishments only (Table 1).

The average number of days between routine inspections (regardless of risk category) was 252 days, ranging from 2 to 1,421 days. The annual means increased over time from about 100 to over 400 days for RC3, RC4, and all establishments combined. Variance  $F$  statistics revealed that the time between inspections increased significantly ( $p < .0001$ ) from 2005 to 2009 for RC3, RC4, and all inspection categories. Table 2 indicates that for RC4 establishments, the average number of days between routine inspections that resulted in critical violations was significantly greater than those that did not ( $p < .0001$ ); RC3 results were not statistically significant.

Chi-square analyses of an establishment's history of complaint, stratified by risk category

TABLE 1

**Violation Details by Year and Risk Category**

Risk Category		Year			Chi-Square ( $p$ -Value)
		2005	2007	2009	
		# of Inspections (% of Total Within Year)			
Risk category 3	No violations cited	45 (13)	49 (8)	77 (13)	
	Only noncritical violations cited	167 (48)	340 (53)	250 (44)	
	Critical violation cited	136 (39)	254 (40)	245 (43)	1.51 (.22)
	Total	348	643	572	
Risk category 4	No violations	85 (17)	107 (14)	82 (13)	
	Only noncritical violations cited	188 (38)	285 (37)	198 (30)	
	Critical violation cited	225 (45)	380 (51)	375 (57)	17.2 (<.0001)
	Total	498	772	655	
All inspections	No violations cited	130 (15)	156 (11)	159 (13)	
	Only noncritical violations cited	355 (42)	625 (44)	448 (37)	
	Critical violation cited	361 (43)	634 (45)	620 (51)	13.5 (<.0001)
	Total	846	1415	1227	

TABLE 2

**Number of Days Between Inspections That Resulted in Critical Violations Versus Those That Did Not, for Each Risk Category and All Inspections**

Risk Category	Resulted in a Critical Violation	#	Mean # of Days Between Inspections (95% CI) <sup>a</sup>	$t$ -Test Statistic ( $p$ -Value) <sup>*</sup>
Risk category 3	No	928	251.9 (238.5–265.3)	-0.92 (.36)
	Yes	635	261.8 (245.4–278.1)	
Risk category 4	No	945	225.9 (213.8–237.9)	-5.08 (<.0001)
	Yes	980	272.0 (258.9–285.2)	
All inspections	No	1873	229.7 (238.8–247.8)	-4.02 (<.0001)
	Yes	1615	257.8 (268.0–278.2)	

<sup>a</sup>CI = confidence interval.

<sup>\*</sup>For all inspections and risk category 4 establishments, the Satterthwaite  $t$  statistic was used. For risk category 3 establishments, the pooled  $t$ -test was used.

and year, demonstrated statistically significant ( $p < .0001$ ) positive trends in complaints for RC3, RC4, and all inspection categories.

Chi-square tests (Cochran-Mantel-Haenszel option) supported ( $p < .0001$ ) the hypotheses that a history of complaint would increase the

TABLE 3

**Mean Number of Days Between Inspections With a Complaint History Versus Those That Did Not, Stratified by Risk Category and for All Inspections**

Risk Category	History of Complaint	#	Mean # of Days Between Inspections (95% CI) <sup>a</sup>	t-Test (p-Value)
Risk category 3	No	1442	239.3 (229.2–249.3)	-9.1 ( $<.0001$ )
	Yes	121	462.9 (430.2–495.7)	
Risk category 4	No	1816	236.0 (227.3–244.7)	-9.67 ( $<.0001$ )
	Yes	109	472.3 (424.6–519.9)	
All inspections	No	3258	237.4 (230.8–244.0)	-13.3 ( $<.0001$ )
	Yes	230	462.9 (430.2–495.7)	

<sup>a</sup>CI = confidence interval.

TABLE 4

**Adjusted Odds Ratios (OR) and 95% Confidence Interval (CI) for Critical Violations—Logistic Regression Analysis for All Inspections and Stratified by Year**

Year	Variable (Effect)	Adjusted OR Estimate*	95% CI		Goodness-of-Fit Chi-Square (p-Value)
All inspections	Date_difference	<b>1.001</b>	<b>1.000</b>	<b>1.001</b>	20.28 (.009)
	Risk category	<b>1.545</b>	<b>1.349</b>	<b>1.77</b>	
	Complaint	<b>1.742</b>	<b>1.309</b>	<b>2.319</b>	
2005 (n = 846)	Date_difference	<b>1.006</b>	<b>1.002</b>	<b>1.009</b>	15.926 (.04)
	Risk category	1.30	0.983	1.723	
	Complaint	0.55	0.16	1.89	
2007 (n = 1415)	Date_difference	0.99	0.998	1.000	7.407 (.493)
	Risk category	<b>1.514</b>	<b>1.244</b>	<b>1.910</b>	
	Complaint	<b>2.688</b>	<b>1.644</b>	<b>4.394</b>	
2009 (n = 1227)	Date_difference	<b>1.001</b>	<b>1.000</b>	<b>1.001</b>	12.61 (.126)
	Risk category	<b>1.835</b>	<b>1.46</b>	<b>2.307</b>	
	Complaint	<b>1.484</b>	<b>1.02</b>	<b>2.159</b>	

Note. Values in bold are statistically significant.

\*Wald confidence interval adjusted OR estimate.

odds of having an inspection that resulted in a critical violation in all (odds ratio [OR] = 1.88) and RC4 (OR = 4.09) establishment categories; RC3 results were nonsignificant. A t-test analysis (Table 3) evaluated history of complaint, and shows that, regardless of risk category, the mean number of days between routine inspections for establishments that had a complaint since their last routine inspection was substantially and significantly ( $p < .0001$ ) longer compared to those that did not.

A logistic regression analysis evaluated predictive factors for the occurrence of a critical violation during a routine inspection. The logistic model included risk category (4 vs. 3), complaint history (yes vs. no), and number of days between routine inspections, and was run for all years combined and for each year separately. Table 4 displays the Wald confidence interval adjusted ORs. For all years, having a history of complaint (OR = 1.74) and being a RC4 establishment

(OR = 1.55) were strong predictors of the incidence of a critical violation, while the number of days between routine inspections was a weaker but still-significant predictor. Every additional day between routine inspections increased the odds of a critical violation by about 0.1%. In other words, if a routine inspection was supposed to occur every 100 days, waiting another 30 days to do the inspection increased the odds of a critical violation by about 3.5%.

When stratified by inspection year, the logistic model results varied substantially. The days between inspections demonstrated a slightly stronger effect in 2005 compared to all years (OR = 1.006). Risk category demonstrated the strongest predictive effect in 2009 (OR = 1.84). A history of complaint was the strongest predictive variable for inspections in 2007 (OR = 2.69). The 2005 analysis was markedly different in that a history of complaint showed no predictive effect (OR = 0.55). The Hosmer and Lemeshow goodness-of-fit test stratified by year revealed good fits for 2007 and 2009, but the odds ratios for 2005 and all years combined should be interpreted with caution.

## Discussion

These results document several very important trends in food safety inspections in East Baton Rouge, Louisiana. From 2005 to 2009, the amount of time between routine inspections almost quadrupled. In 2005, the average time between routine inspections for all establishments was approximately three and a half months. By 2009, however, the average time between routine inspections had increased to over a year. This was most likely a result of decreased workforce capacity within the department from layoffs and hiring freezes caused by state budget cuts. The data also show only minor differences in the days between routine inspections for RC3 versus RC4 establishments.

RC4 establishments tend to have more hazardous food production processes than RC3 establishments and present greater risk of potential foodborne illness. Our study found that a larger proportion of RC4 establishment inspections resulted in critical violations and that risk category demonstrated the most consistent predictive effect on critical violations. These findings support FDA's rationale that RC4 establishments should be inspected more often than other establishments.



While the average days between inspections increased between 2005 and 2009, a significant positive trend also occurred in the proportion of inspections resulting in critical violations. Statistically significant differences were observed in days between inspections that resulted in critical violations versus those that did not, with more time between inspections resulting in critical violations. The logistic regression analysis demonstrated that time between routine inspections was a weak but significant factor in predicting the incidence of critical violations. Thus, the significant increase in the amount of time between inspections from 2005 to 2009 could explain the positive trend in the proportion of inspections resulting in critical violations. Routine inspections provide excellent opportunities for sanitarians to educate restaurant staff and managers on food safety. The three most frequently cited critical violations—equipment cleanliness, toxic storage, and employees drinking and eating in a food preparation area—are all behaviors and circumstances that can be minimized with regular food safety education.

The proportion of inspections with a history of complaint in East Baton Rouge also increased significantly between 2005 and 2009. A significant increased difference occurred in the days between routine inspections that had a history of complaint compared to those that did not. One possible explanation for this association is that with reduced resources, inspections conducted to investigate a complaint are being substituted for routine inspections. Based on the inspection records studied, it appears that when investigating a complaint, sanitarians remark on the purpose of the complaint but also perform the duties of a routine inspection and note any other violations. Thus, the inspection may act as a routine inspection, pushing back the time frame for the next inspection. A history of complaint also proved to be a fairly

strong predictor, however, although not as consistent as risk category, for the incidence of a critical violation during routine inspections. Therefore, while inspections for investigating complaints may serve informally as routine inspections, Louisiana sanitarians should try to prioritize these establishments for more frequent routine inspections.

Our study is one of a few efforts to evaluate a state food safety inspection program and can provide a model for similar evaluations elsewhere. One strength of our study was its large sample size, including nearly 3,500 inspection records. Close to 2,000 inspection records were missing a risk category designation or a previous inspection date, however, and could not be included in the analysis. This could affect the ability of the sample to represent the entire picture in East Baton Rouge.

The unexpected gap in inspection data for 2005 could have affected the results of our study; this gap may have resulted from issues being resolved in the electronic system, which was brought online in 2003. No reason exists, however, to believe that results of inspections from January to April would have been very different from May through December. Nonetheless, the missing data could have introduced unexplained biases that could account for the differences in results between 2005 and the other two years.

Data entry errors in the electronic system could have led to information bias within our study. Further, personnel changes over time could have contributed to differences in inspection result trends. Each region in Louisiana has at least one “standardization officer,” who trains and tests sanitarians in the field to ensure consistency across all inspections (C. Bombet, personal communication, August 18, 2010). For the timeframe of our study, all inspections would have been performed by an inspector who had gone through training with a standardization officer. There-

fore, an inspection by any sanitarian in Louisiana should have similar results. Budget cuts in the past two years have forced the Center for Environmental Health to reduce the number of standardization officers in its central office in Baton Rouge. In the future, it may become more difficult to ensure consistency in inspections among sanitarians without the capacity to do adequate training for sanitarians entering the field.

## Conclusion

Based on our study, decreased frequency of inspections could be responsible for an increasing proportion of routine inspections that result in critical violations, especially among RC4 establishments. Additionally, increased time between inspections from 2005 to 2009 was paralleled by a significant increase in complaints. We recommend that the Louisiana Department of Health and Hospitals prioritize the inspection of RC4 establishments and those establishments with a history of complaint to reduce the risk of foodborne illnesses. 🐷

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