Using Health Inspection Scores to Assess Risk in Food Services

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Abstract

This study gathered health inspectors' opinions about appropriate weightings of critical, noncritical, and repeat violations under the current food inspection system, and developed a classification of violations for high-, medium-, and low-risk restaurants. Results showed that health inspectors thought that the appropriate weights were five points for a critical violation, one point for a noncritical violation, and double points for a repeat violation. In addition, health inspectors thought that the maximum numbers of critical violations for a high-, medium-, and low-risk category were 2.05, 3.02, and 4.83, respectively, and for noncritical violations, 4.59, 7.30, and 10.37, respectively. A paired t-test was used to compare these values with estimations based on the traditional health inspection scoring system. Results indicate that the maximum number of critical violations for medium risk and maximum numbers of noncritical violations for low-, medium-, or high-risk restaurants were significantly different between health inspectors' opinions and mathematical estimations. Health inspectors appear to be stricter than the traditional health inspection scoring system about violations, particularly repeat violations, and their importance in enforcement of food safety.

Introduction

Consumers are dining out more often and spending greater amounts on away-from-home foods. Researchers (Mauer et al., 2006; Stewart, Blisard, Bhuyan, & Nayga, 2004) have reported that Americans spend over 46% of their total food dollars on food away from home. In addition, consumers and the media have become more interested in and concerned about food safety and sanitation in dining establishments. According to Worsfold (2006), consumers believe that they have the right to know the results of a restaurant sanitation inspection. In addition, if they were able to access this information more easily, they say they would dine out more often.

"Risk" in the food service industry is defined as "the likelihood that an adverse health effect will occur within a population as a results of a hazard in a food (U.S. Food and Drug Administration [FDA], 2005)." In order to minimize the public's foodborne illness risk, restaurant sanitation inspections are conducted by the Department of Health. Two additional purposes of sanitation inspection are to exchange information between food service establishments and health departments and to regulate the food service industry (Almanza, Nelson, & Lee, 2003).

In an effort to inform consumers about inspections, results have been posted in front of restaurants or reported through various media, such as newspapers, magazines, television, and the Internet. Because jurisdictions use different inspection systems, the format for reporting restaurant inspection results also varies as scores, grades, symbols, colors, or descriptions of violations (Consumer Health Division of the Fort Worth Public Health Department, 2008; Los Angeles County Department of Public Health, 2000; Louisiana Department of Health and Hospitals, 2005; Public Health Seattle & King County, 2005; Tennessee Department of Health, n.d.; Tippecanoe County Health Department, 2005; Toronto Public Health Department, 2001). The format and amount of information provided can impact a report's usefulness for consumers. Consumers need simple, fast, and easily accessible information to understand the results of restaurant inspections. Inspection results are difficult to understand, and it is doubtful whether restaurant managers, health inspectors, and consumers interpret them in the same way (Seiver & Hatfield, 2000).

According to the 1997 FDA *Food Code*, the score, which is the number of items in a violation, is used for the establishment of compliance strategies and overall control of the causes of foodborne illness. An example of such a strategy would be monitoring the number of critical violations and adjusting the follow-up inspection progress. According to the *Food Code*, a critical item (or violation), by definition, "is more likely than

TABLE 1

Demographic Profiles of Respondents

Age ($N = 52$)	*n*	%
25-30	6	11.5
31-35	3	5.8
36-40	6	11.5
41-45	6	11.5
46-50	8	15.4
51-55	5	9.6
56-60	7	13.5
>61	11	21.2
Years of experience ($N = 54$)		
<1	2	3.7
1-5	15	27.8
6-10	12	22.2
11-15	10	18.5
16-20	5	9.3
21-25	3	5.6
25-30	5	9.3
>31	2	3.7

TABLE 2

Health Inspectors' Opinions on Average Weight for a Violation ($N = 54$)

Critical Violation			Noncritical Violation		
Points	*n*	%	Points	*n*	%
0	2	3.7	0	2	3.7
2	1	1.9	1	24	44.4
3	2	3.7	2	21	38.9
5	41	75.9	3	2	3.7
6	1	1.9	4	1	1.9
10	5	9.3	5	3	5.6
15	1	1.9	20	1	1.9
25	1	1.9			
Mean	5.7		Mean	2.1	
SD	3.5		*SD*	2.7	

other violations to contribute to food contamination, illness, or environmental health hazard (FDA, 2005)." One example of a critical violation is that potentially hazardous food does not meet temperature requirements during storage, preparation, display service, and transportation (FDA, 2005). By contrast, a noncritical violation is defined as one that is less likely than other violations to contribute to food contamination, illness, or environmental harm. Noncritical violations do not pose a direct health hazard to the public. One example of a noncritical violation is not wearing hair restraints.

One drawback to using the score to establish strategies is that the exact point (based on the number and type of violations) at which a significant health hazard occurs has not been specifically defined. The score may also be used to establish an industry norm or a percentile ranking of the level of risk associated with different types of establishments when health departments determine inspection frequency using risk-based assessment (FDA, 1997). The industry norm is reliably established for the local jurisdiction after the first 50 inspections of food establishments in each category. The norm is subject to change with improvements in compliance and other influences, however. Additionally, the norm can be used to compare restaurants but not to establish actual food-safety risk. Therefore, an objective restaurant sanitation "standard" (passing score) is needed to determine food-safety risk under the restaurant inspection system.

The state of Indiana used the traditional inspection system with a 100-point demerit system until 2000. After that it changed to an inspection system based on critical and noncritical violations. Since 2000, more than 89% of counties in Indiana have been using the new system. One of the counties in Indiana, Tippecanoe County, has been using the system based on critical and noncritical violations since 2000. In 2005 the county started posting the results of inspections and the descriptions of critical and noncritical violations of each food establishment on a Web site. Consumers can see on this Web site the descriptions of violations and count the number of violations. It is difficult, however, for them to determine the seriousness of the violation, the risk posed, and the risk or results compared to other restaurants (Almanza, Nelson, & Lee, 2003). Under the previous or "traditional" inspection system (which used a 100-point demerit scale), receiving less than 75 points was considered a failing score for a restaurant. Although the current system has many advantages over the traditional one, one limitation is that no specific number of violations constitutes a failing score; rather, the evaluation is determined by the health inspectors and health department.

Therefore, the objective of this study was to determine appropriate weights for critical, noncritical, and repeat (recurrent) violations using opinions of health department employees in Indiana. In addition, the study set up a high-, medium-, and low-risk classification scheme for restaurant inspection results, again based on health department opinions. Finally, health department opinions regarding weighting of critical and noncritical violations were compared to weightings that were estimated using mathematical assumptions from the traditional scoring system. This was done to determine if differences existed between the perceived appropriate weighting using the current inspection system and the estimated weighting using the traditional system.

This study was based on comparisons suggested from the previous or traditional 100-point demerit system. Under this system, a critical violation was weighted at four or five points depending on the nature of the violation, and a noncritical violation was valued at one to two points. Therefore, the researchers formulated the value of each violation using the average of four and five points (4.5 points) for a critical violation, and the average of one and two points (1.5 points) for a noncritical violation.

In this study, several assumptions were made. First, the authors assumed that an inspection score of 90 points or above was low risk, 80–89 points was medium risk, and 75–79 points was high risk. Under the traditional scoring system, a failing score was considered less than 75 points in Indiana. Because of this, the score of 75 points was used

TABLE 3

Health Inspectors' Opinions on Additional Points for a Repeat Violation (*N* = 54)

Repeat Critical Violation*			Repeat Noncritical Violation**		
Additional Points	*n*	%	Additional Points	*n*	%
0	1	1.9	0	1	1.9
1	1	1.9	0.5	11	20.9
2	6	11.1	1	32	59.3
3	6	11.1	Other	10	18.5
4	1	1.9			
5	30	55.6			
Other	9	16.7			

* Assuming a critical violation = 5 points.
** Assuming a noncritical violation = 1 point.

TABLE 4

Amount of Risk Associated with a Repeat Violation (*N* = 54)

Value	Critical Nature		Noncritical Nature	
	n	%	*n*	%
1*	14	25.9	27	50.0
1.5**	5	9.3	12	22.2
2***	31	57.4	12	22.2
Other	4	7.4	3	5.6

* Means the same amount of risk as the first time the violation was received.
** Means 1.5 times the amount of risk as the first time the violation was received.
*** Means 2 times the amount of risk as the first time the violation was received.

as a cut-off point for the high-risk category, and cut-off scores for the low- and medium-risk categories were 90 and 80 points, respectively. Conversely, violations totaling 10, 20, or 25 points were the maximum for low-, medium-, and high-risk categories.

To mathematically translate the new scores back to the traditional scores, an assumption was also made that a critical violation would be multiplied by the above mentioned 4.5 point average and noncritical violations by the 1.5 point average. After this multiplication and using the cut-off scores of 90, 80, and 75 points, the maximum number of critical violations for the low-, medium-, and high-risk categories were mathematically assumed to be 2.25, 4.5, and 5.63, respectively. Similarly, for the noncritical violations, the maximum number of noncritical violations was 7.5, 15, and 18.75, respectively, for low, medium, and high risk.

Methodology

In order to test the research hypothesis, a Web survey of health departments in Indiana was conducted. Contact information was obtained from government Web sites. The Web survey program, called the *HostedSurvey* (http://hostedsurvey.ics.purdue.edu), which was provided by the Information Technology Department at Purdue, was used to develop and administer the survey. For content validity and field testing, the questionnaire was reviewed by five staff members from the Tippecanoe County Health Department and three faculty members of Purdue University. The survey was approved by the Purdue University Committee on the Use of Human Research Subjects prior to its dissemination.

The questionnaire was designed to determine health inspectors' perceptions regarding the relative weights of critical and noncritical violations and the added weight or value of a repeat violation. In order to classify inspection results as low, medium, and high risk, health departments were asked their opinion regarding the maximum number of critical and noncritical violations acceptable for each risk category.

Web survey questionnaires were sent to all 93 county health departments as well as the food program manager of the Indiana State Department of Health, resulting in a total of 94. When respondents encountered problems accessing the URL link, the authors called the respondent to provide guidelines, and emailed or faxed a hard copy of the survey questionnaire. The only responses received, however, were submitted electronically. All electronic responses were automatically downloaded into the *HostedSurvey* database and were anonymous. In order to analyze data, simple descriptive analysis and paired *t*-tests were used (SAS 9.1).

Results and Discussion

Fifty-four responses were received. The response rate was 58.7% (54 respondents out of 92). Two counties could not participate in this survey because the health inspectors had never used the traditional system before and could not compare the two systems. Demographically, 55.6% of the respondents were male and 44.4% were female. Their ages ranged from 25 years to 79 years with a mean of 48.6 and a standard deviation of 13.2. Their work experience averaged 12.1 years with a standard deviation of 9.6 (Table 1).

When the health inspectors were asked about the worth of a critical violation, the most frequent answer (41/54, 75.9%) was five points (Table 2). In terms of a noncritical violation, the most frequent answer (24/54, 44.4%) was one point (Table 2). The next most frequent response (21/54, 38.9%) for a noncritical violation was two points.

One surprising result was the weight placed on repeat violations, which were never tracked under the older traditional system. The majority of respondents thought that repeat violations should be worth double the amount they would assign a first-time violation (Table 3).

By contrast, when respondents were asked about the risks associated with repeat violations, a similar emphasis to the weighting of points was not found. Table 4 shows that 57.4% (31/54) of the respondents thought the risk associated with a repeat violation of a critical nature was worth

twice the amount of risk as the first time the critical violation was received. Fifty percent (27/54) of the respondents, however, said that the risk associated with a repeat violation of a noncritical nature was equivalent to the first time the noncritical violation was received (Table 4). Even though more than half of the respondents gave double points for both a repeat critical and noncritical violation, they had different perceptions regarding the nature of the risk associated with a repeat violation: double the amount of risk for a repeat critical violation but the same amount for a repeat noncritical violation. These results imply that health departments appear to consider a noncritical violation as minor in terms of the nature of the risk, but important in terms of compliance and enforcement. Several explanations for this contradiction are possible. Some reasons might include the health inspectors' perception of the importance of the food service establishment's accountability for correcting violations as part of the enforcement process; their perception of a possible larger problem with lack of ability or willingness on the part of the food service establishment to correct violations; or the health inspectors' perception that repeat violations undermine their authority and that they need to be corrected to maintain their authority.

In order to classify food service establishments as low, medium, and high risk, health inspectors were asked the maximum number of critical violations possible for each category of risk, assuming no noncritical violations occurred. In addition, a question about the maximum number of noncritical violations possible for each category of risk in a food establishment was asked, assuming no critical violations occurred. The results showed that the maximum number of noncritical violations was thought to be worth almost double the number of critical violations.

Tables 5 and 6 show the comparison of the maximum number of critical and noncritical violations from health inspectors' opinions and from the mathematical estimation. The paired *t*-test analysis was employed to compare whether health inspectors' opinions and the mathematical estimation were different regarding the maximum number of critical and noncritical violations to classify restaurants as high, medium, or low risk.

The results indicate that the maximum number of critical violations for medium risk, and maximum numbers of noncritical violations for low, medium, and high risk were significantly different between these two values. For instance, if health inspectors find six noncritical violations in a restaurant, they believe that the restaurant should be placed in a medium-risk category. According to mathematical estimation, however, the restaurant would be placed in the low-risk category. The higher weighting value given by health inspectors to violations might suggest that health inspectors are stricter about violations.

TABLE 5

Comparison of the Maximum Number of Critical Violations from Health Inspectors' Opinions and from a Mathematical Estimation

Risk Category	Maximum Number of Critical Violations		Results of Paired *t*-Test	
	Health Inspectors	Mathematical Estimation	*t*-Value	*p*-Value
Low	2.1	2.25	-1.46	.15
Medium	3.0	4.50	-4.75	<.0001
High	4.8	5.63	-0.83	.41

Note. Cut-off scores for the low-, medium-, and high-risk category are 90, 80, and 75, respectively. Thus, the maximum risk score for the low-, medium-, and high-risk categories are 10, 20, and 25, respectively.

TABLE 6

Comparison of the Maximum Number of Noncritical Violations from Health Inspectors' Opinions and a Mathematical Estimation

Risk Category	Maximum Number of Noncritical Violations		Results of Paired *t*-Test	
	Health Inspectors	Mathematical Estimation	*t*-Value	*p*-Value
Low	4.6	7.50	-12.30	<.0001
Medium	7.3	15.0	-10.77	<.0001
High	10.4	18.75	-6.61	<.0001

Note. Cut-off scores for the low-, medium-, and high-risk categories are 90, 80, and 75, respectively. Thus, the maximum risk score for the low-, medium-, and high-risk categories are 10, 20, and 25, respectively.

Conclusion

The purpose of this study was to gather health inspectors' opinions about appropriate weightings of critical, noncritical, and repeat violations under the current inspection system, and to develop a classification of violations for high-, medium-, and low-risk restaurants and then compare these results to mathematical estimations. Health inspectors perceived that the appropriate weights were five points for a critical violation, one point for a noncritical violation, and double points for a repeat violation. The results from comparisons between health inspectors' opinions and mathematical estimations regarding the maximum numbers of violations for the high-, medium-, and low-risk restaurant classification showed significantly higher weighting values given by health inspectors. This suggests that health inspectors appear to be stricter about violations and their importance in enforcement of food safety.

Limitations of this study include the fact that this study analyzed health inspection data from only one state with a small sample size of 93 counties; therefore, the results may not represent the whole population. In addition, this study estimated the maximum number of violations for each category of risk. They were 2.1, 3.0, and 4.8 critical violations for the low-, medium-, and high-risk categories and 4.6, 7.3, and 10.4 noncritical violations. From a practical viewpoint, "partial" violations are not possible. In order to make precise mathematical comparisons, however, fractions were used rather than rounding numbers off to the nearest

violation. One suggestion for a future study would be to use other methods of point estimation, such as rounding up the partial points of a violation.

This study used cut-off scores for the high-, medium-, and low-risk categories based on assumptions made by the authors; however, further research should let health inspectors set the levels for the risk categories for both critical and noncritical violations. In addition, this study classified the high-, medium-, and low-risk categories considering critical and noncritical violations separately. Future studies also need to consider the combination of both types of violations. For example, should a restaurant be in a low- or medium-risk category if it has one critical violation and three noncritical violations?

Furthermore, if researchers were to conduct the same Web survey with consumers, restaurant managers, and health inspectors from other jurisdictions, the results would provide useful information about each group's perceptions regarding the inspection system, interpretation of the inspection results, the value of violations, risk nature, and the utilization of the inspection results. Additional studies might include a comparison of different inspection systems and the impact of different inspection systems on the health inspection results. Lastly, the issue of how best to provide consistent inspections needs further investigation, because the "human factor" in selective enforcement could impact the objectivity and fairness of health inspections.

This study is useful because it provides a system of weighting for critical, noncritical, and repeat violations and helps to categorize their level of risk. This study also provides an indication for the norm for a failing score under the current system, and suggests one method of posting results of inspections using high-, medium-, and low-risk categories. Health departments and academia should develop easier-to-understand inspection results for consumers and the media so that they can compare the results among different food service establishments.

The results of this study may help give managers a clearer understanding of what they need to do to improve their sanitation by providing numeric values for violations and specific risk categories. In addition, this information would likely make it easier for health inspectors to communicate with managers regarding compliance with FDA's *Food Code* and the importance of repeat violations. Assigning a numeric value to violations and a specific risk category for a restaurant may also contribute to consumers' ability to recognize the risks associated with violations noted on restaurant inspection reports. Therefore, this study may contribute to assessing risk of food safety in the restaurant industry using health inspection scores.

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