

Impact of Restaurant Hygiene Grade Cards on Foodborne–Disease Hospitalizations in Los Angeles County

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Abstract

Although health departments routinely inspect restaurants to assess compliance with established hygienic standards, few data are available on the effectiveness of these efforts in preventing foodborne disease. The study reported here assessed the impact on foodborne-disease hospitalizations in Los Angeles County of a restaurant hygiene grading system that utilized publicly posted grade cards. The grading system was introduced in January 1998. Hospital discharge data on foodborne-disease hospitalizations were analyzed for Los Angeles County and, as a control, for the rest of California during the period 1993–2000. Ordinary least-squares regression analysis was done to measure the effect of the grading program on these hospitalizations. After baseline temporal and geographic trends were adjusted for, the restaurant hygiene grading program was associated with a 13.1 percent decrease ($p < .01$) in the number of foodborne-disease hospitalizations in Los Angeles County in the year following implementation of the program (1998). This decrease was sustained over the next two years (1999–2000). The results suggest that restaurant hygiene grading with public posting of results is an effective intervention for reducing the burden of foodborne disease.

Introduction

Foodborne disease causes an estimated 325,000 hospitalizations and 5,000 deaths each year in the United States (Mead et al., 1999). Although the proportion of food-related illnesses attributable to restaurant dining is unknown, national surveillance data indicate that nearly 50 percent of foodborne-disease outbreaks reported in 1993–1997 were associated with food consumed in restaurants and other commercial food establishments (Centers for Disease Control and Prevention [CDC], 2000).

In most states, local health departments are charged with the responsibility of inspecting restaurants to ensure compliance with established hygienic standards. Despite the general acceptance of these programs as standard public health practice, their effectiveness in preventing foodborne disease remains unclear. Several studies have found an association between low inspection scores and foodborne-disease outbreaks (Buchholz, Run, Kool, Fielding, & Mascola, 2002; Irwin, Ballard, Grendon, & Kobayashi, 1989),

while others have found no such association (Cruz, Katz, & Suarez, 2001; Jones, Pavlin, LaFleur, Ingram, & Schaffner, 2004; Penman, Webb, Woernle, & Currier, 1996). Improved inspection scores on cruise ships have been associated with reductions in diarrheal-disease rates and outbreaks (Cramer, Gu, Durbin, & the Vessel Sanitation Program Environmental Health Inspection Team, 2001), but similar findings have not been reported for restaurants.

The use of numeric scores and grades for communicating restaurant inspection results to the public has been the subject of considerable debate (Seiver & Hatfield, 2000; Wiant, 1999). In January 1998, the Los Angeles County Department of Health Services (DHS) implemented a new inspection program that required public posting of inspection scores by restaurants and other commercial food establishments located in unincorporated areas of the county and in cities that adopted an ordinance for the program (Fielding, Aguirre, Spear, & Frias, 1999). Numeric inspection scores were translated into letter grades (90–100 = A, 80–89 = B, 70–79 = C), and establishments were required to post their grade (or numeric score if below 70) within 5 feet of the point of entry. To further increase public access to this information, a searchable Web-based database also was established, providing information on inspection grades, numeric scores, a listing of specific violations at last inspection, and restaurant closures.

TABLE 1**Number of Foodborne-Disease Hospitalizations by Infectious Agent, Los Angeles County Versus the Rest of California, 1993–2000**

Infectious Agent	Los Angeles County		Rest of California	
	Number	(%)	Number	(%)
<i>Salmonella</i>	1,353	(46.2)	2,501	(38.8)
<i>Campylobacter</i>	451	(15.4)	1,448	(22.5)
<i>E. coli</i>	103	(3.5)	387	(6.0)
<i>Listeria</i>	119	(4.1)	321	(5.0)
<i>Yersinia</i>	13	(0.4)	53	(0.8)
Staphylococcal food poisoning	62	(2.1)	99	(1.5)
Other bacteria	826	(28.2)	1,640	(25.4)
Total	2,927	(100.0)	6,449	(100.0)

TABLE 2**Number of Foodborne-Disease Hospitalizations by Year, Los Angeles County and the Rest of California, 1993–2000**

Year	Los Angeles County		Rest of California	
	Number	% Change	Number	% Change
1993	358	NA	828	NA
1994	463	29.3	912	10.1
1995	406	-12.3	853	-6.5
1996	431	6.2	871	2.1
1997	382	-11.4	784	-10.0
1998	311	-18.6	775	-1.2
1999	296	-4.8	694	-10.5
2000	280	-5.4	732	5.5

NA = not applicable.

The notion that one can decrease the incidence of food-related illness through provision of increased restaurant hygiene quality information to consumers (as through posting of grade cards) is based on an economic argument. In the absence of grade cards, consumers lack information on the hygiene quality of individual restaurants. Grade cards allow consumers to include information on food safety practices when they choose restaurants. Restaurants with A-grade hygiene would be expected to realize a higher consumer demand than restaurants with B- or C-grade hygiene, all else being equal. The public availability of this information can,

therefore, create an economic incentive for restaurants to maintain good hygiene, which should lead to fewer foodborne illnesses.

Early data on the impact of the county's new program suggest that the program increased compliance with recommended food safety practices in commercial food establishments, improved inspection scores, and influenced consumers' restaurant choices (Fielding, Aguirre, & Palaiologos, 2001; Jin & Leslie, 2003). In addition, one study suggested a decrease in foodborne-disease hospitalizations in the county following implementation of the program (Jin & Leslie, 2003). This study had only one year of follow-up, however, and

included a very broad definition of foodborne illness. The objective of the study reported here was to assess the impact of the grading program on foodborne-disease hospitalizations, extending the earlier study by including more recent hospitalization data and refining the definition of foodborne disease.

Methods

Data on all California hospital discharges between January 1993 and December 2000 were obtained from the Office of Statewide Health Planning and Development. The database included a principal discharge diagnosis and 23 additional diagnosis fields, all coded according to the International Classification of Diseases, 9th Revision (ICD-9). The database also included information on the date of discharge, the patient's date of birth, and zip code of residence. Zip code was used to identify hospitalizations of Los Angeles County (LAC) residents versus other California residents.

A foodborne-disease hospitalization was defined as any hospitalization with an ICD-9-coded principal discharge diagnosis of nontyphoidal *Salmonella* (ICD-9 = 003), *Campylobacter* (ICD-9 code = 008.43), *Escherichia coli* (ICD-9 codes = 008.00–008.04 and 008.09), *Listeria* (ICD-9 code = 027.0), *Yersinia* (ICD-9 code = 008.44), staphylococcal food poisoning (ICD-9 code = 005.0), and other bacterial food poisoning (ICD-9 codes = 005.1–005.4 and 005.8–005.9). These conditions were selected because they are associated with an estimated 70 percent or greater probability of foodborne transmission (Mead et al., 1999). Infections with *Salmonella* Typhi and *Vibrio cholerae* were excluded because these infections are most often associated with acquisition abroad. Hospitalizations of children less than five years of age also were excluded because children in this age group are likely to have other non-foodborne-related risk factors for these infections (e.g., person-to-person transmission in child care and preschool settings).

As a first step to assessing the impact of restaurant hygiene grade cards, the authors compared the annual numbers and rates of foodborne-disease hospitalizations in Los Angeles County before and after the implementation of grade cards (1993–1997 versus 1998–2000). Census-based annual population estimates for the rate calculations were obtained from the California Department of Finance. To account for time trends, the authors compared temporal trends in foodborne-disease hospitalizations in Los Angeles County with trends in the rest of California

(where no similar program changes occurred during the period of the study). As a further control, trends in foodborne-disease hospitalizations were compared with trends in all hospitalizations (all causes combined).

To quantify the impact of restaurant hygiene grade cards on the incidence of foodborne illnesses, the authors employed an ordinary least-squares multivariate regression. The dependent variable was the natural log of the number of people admitted to a hospital with a foodborne disease in a particular month in a particular three-digit zip code. The key independent variable was *Grade Cards*, which captured the introduction of restaurant hygiene grade cards. For the zip codes that were entirely inside Los Angeles County, the variable *Grade Cards* equaled 1 in the months following the introduction of grade cards in Los Angeles County (January 1998), and 0 otherwise. For the zip codes that were entirely outside of Los Angeles County, *Grade Cards* equaled 0 in every period. For zip codes that straddled the boundary of Los Angeles County, the authors used census data to compute the fraction of people residing inside LAC. Specifically, in the months following the introduction of the grade cards, *Grade Cards* equaled the fraction of the population inside the county and equaled 0 in the periods prior to the grade cards.

The authors included year and month dummy variables to control for the statewide time trend in the incidence of foodborne disease, and zip code–fixed effects to control for differences across zip codes in the average level of foodborne-illness hospitalizations. After these controls, the impact of grade cards was identified by the percentage changes in the number of foodborne-disease hospitalizations in Los Angeles County before and after grade cards, net of the average percentage changes over the same period in the rest of California.

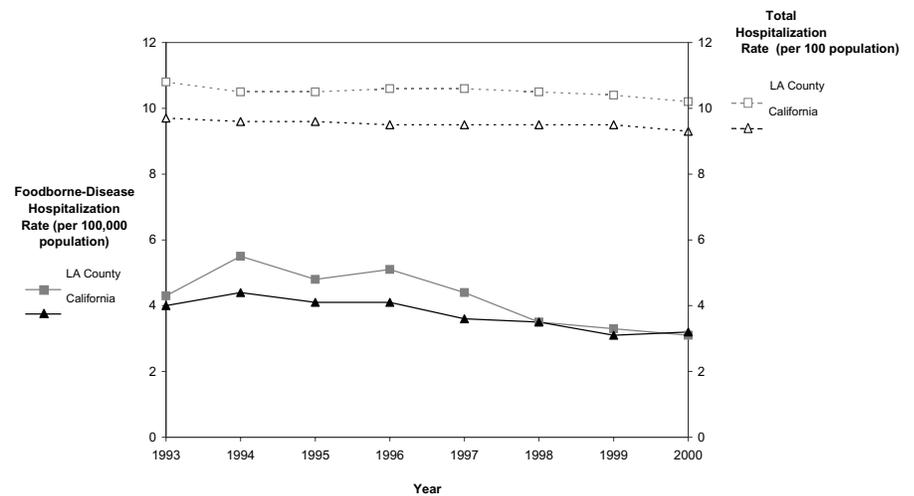
Results

A total of 2,927 foodborne-disease hospitalizations were identified in Los Angeles County, accounting for 31 percent of all foodborne-disease hospitalizations in California during the period 1993–2000. In both Los Angeles County and the rest of California, the most frequently reported foodborne-disease discharge diagnosis was *Salmonella* infection, followed by *Campylobacter* (Table 1).

Overall, the annual number of foodborne-disease hospitalizations decreased between 1993 and 2000 in both Los Angeles County and the rest of the state (Table 2). During the period 1993–1997 (preceding implementa-

FIGURE 1

Rates of Foodborne-Disease Hospitalization and All-Cause (Total) Hospitalization in Los Angeles County and in the Rest of California, 1993–2000



tion of the program), the number of hospitalizations in Los Angeles County increased slightly with substantial year-to-year fluctuation, followed by an 18.6 percent decline in 1998 (the first year of program operation), a 4.8 percent decline in 1999, and a 5.4 percent decline in 2000. This pattern was not observed in the rest of the state.

Figure 1 shows the foodborne-disease hospitalization rates and total (all-cause) hospitalization rates for Los Angeles County and the rest of the state in 1993–2000. The total hospitalization rate was approximately 20 percent higher in Los Angeles County than in the rest of the state throughout the study period. The foodborne-disease hospitalization rate in Los Angeles County was approximately 20 percent higher in 1994–1997 and then decreased in 1998 to the same level observed in the rest of the state. This decrease was sustained in 1999 and 2000.

The results from the regression analysis are shown in Table 3. The first column reports estimates for the base specification described above. As robustness checks, the authors also report the results of two alternative specifications in the last two columns of Table 3. Note that all specifications include controls for the time trend and zip code fixed effects, which are not reported. The main result of the study is the estimate for the effect of *Grade Cards* in the base specification: The authors found

that restaurant hygiene grade cards were associated with a 13.1 percent decrease in the number of people hospitalized with foodborne diseases. The estimate is statistically different from 0 with 99 percent confidence.

As reported in the middle column of results in Table 3, the authors modified the specification to include an additional control, namely the number of people with a hospital discharge diagnosis of appendicitis. Appendicitis has some overlapping signs and symptoms with those of foodborne illness, but it is not generally related to food. A temporal impact on appendicitis coincidental with that of the restaurant grades would suggest other changes in hospital admission rates and call into question the causal effect of the grading. The authors defined the variable *Foodborne* to equal 1 for hospitalizations due to foodborne illness, and 0 for hospitalizations due to appendicitis. Hence, the variable *Grade Cards* × *Foodborne* measures the impact of the grade cards on foodborne-disease hospitalizations (estimated at 11.5 percent decrease), while the variable *Grade Cards* captures the potential spurious correlation between the grade cards and the incidence of appendicitis. The reported estimate of -0.016 , which is insignificantly different from 0, indicates that there was no such spurious correlation in the data.

As reported in the final column of results in Table 3, the authors looked for evidence that the effect of the grade cards on foodborne

TABLE 3**The Effect of Grade Cards on the Log of the Number of Hospitalizations by Disease Category**

	Model 1 ^a		Model 2 ^b		Model 3 ^b	
	Coefficient	t-statistic ^c	Coefficient	t-statistic	Coefficient	t-statistic
Constant	0.541	12.47 ^d	2.511	86.17 ^d	2.431	79.11 ^d
Grade Card	-0.131	2.93 ^d	-0.016	0.64	0.039	1.03
Grade Cards × Foodborne			-0.115	2.77 ^d	-0.138	2.23 ^e
Grade Cards × 1999					-0.097	2.05 ^e
Grade Cards × 2000					-0.065	1.36
Grade Cards × Foodborne × 1999					0.076	0.95
Grade Cards × Foodborne × 2000					-0.007	0.09
Observations	3,133		7,972		7,972	
R ²	0.44		0.94		0.94	

^a The dependent variable in Model 1 is the natural log of the number of hospital admissions for foodborne illness in each month in each zip code, for all of California.

^b The dependent variable in models 2 and 3 is the natural log of the number of hospital admissions for foodborne illness or appendicitis, in each month in each zip code, for all of California. The variable *Foodborne* equals 1 for foodborne illness hospitalizations and 0 otherwise.

^c Reported t-statistics are based on robust standard errors.

^d Statistically different from 0 with 99% confidence.

^e Statistically different from 0 with 95% confidence.

disease may have diminished over time. In this case the authors distinguished the impact of the grade cards in the first year after the introduction (1998) from the effect in the second year (1999) and the third year (2000). As with the second specification, the authors again included appendicitis hospitalizations. The estimated coefficient for the variable *Grade Cards* × *Foodborne* indicates a statistically significant 13.8 percent decrease in foodborne illnesses in 1998 in LAC due to the grade cards. The estimates for the incremental changes in this effect in 1999 and 2000 were both insignificantly different from 0, leading the authors to accept the hypothesis that benefits of the grade cards were sustained.

Finally, in unreported results, the authors repeated the regressions with the inclusion of data on all hospitalizations, as a further control in addition to the appendicitis hospitalizations. There were no significant changes in the findings.

Discussion

The introduction of restaurant hygiene grade cards in Los Angeles County provides a compelling context in which to analyze the effectiveness of grade cards. After controlling for statewide time trends and geographic heterogeneity, the authors found a significant decrease in foodborne-disease hospitalizations in Los Angeles County following the introduction of grade cards. The analysis also indicates that this improvement may be long lasting, with the measured decrease in illnesses lasting for at least three years.

In interpreting these findings, it is important to note that although public posting of grade cards was the central component of the revamped inspection program, several other factors may have contributed to the decline in foodborne-disease hospitalizations. The program was implemented following a hidden-camera exposé of unsanitary restaurants by a local television news program that received

considerable publicity. This exposé may have served as additional incentive for restaurant owners to more aggressively monitor and improve conditions and practices in their establishments. Extensive media coverage also may have influenced county residents to adopt safer food-handling practices in the home. It is unlikely, however, that a relatively brief period of media attention alone would have lasting effects on food hygiene practices at home or in the retail food industry.

The implementation of grade cards in Los Angeles County also was accompanied by an increase in the frequency of inspection of some restaurants, additional training of restaurant inspectors, and enhanced efforts in educating restaurant owners and staff. A number of studies have found that increased inspection frequency and education efforts may improve sanitary conditions in restaurants, although no study has found a reduction in foodborne-illness reports (Allwood, Lee, Borden-Glass, 1999; Bader, Blonder, Henriksen, & Strong, 1978; Cotterchio, Gunn, Coffill, Tormey, & Barry, 1998; Mathias, Sizto, Hazlewood, & Cocksedge, 1995). Nonetheless, it is possible that these other components of the program contributed to the observed reduction in foodborne-disease hospitalizations.

The study reported here had several limitations. First, it was ecologic in design and therefore could not assess restaurant exposures and disease transmission at the individual level. Second, because the authors relied on hospital discharge data to identify foodborne illness, they could not assess the impact of restaurant grade cards on less severe foodborne illnesses that do not require hospitalization. In addition, the analysis utilized the hospitalizations for which the primary discharge diagnosis was a foodborne disease-related pathogen. By using this definition, the study may have missed some hospitalizations that were related to foodborne diseases but recorded as non-foodborne diagnoses. In contrast, the national estimates of foodborne-disease hospitalizations are based on a variety of other data sources and include correction factors for underreporting. This difference explains why the national estimates suggest a much larger number of hospitalizations than identified in this study (Mead et al., 1999).

Despite these limitations, hospital discharge data may provide a reasonable minimum estimate of severe foodborne-disease cases and may be more reliable than some of the other systems currently in place to track foodborne illness. For example, in Los Angeles County,

foodborne-illness reports are accepted from the general public and in most cases are not validated by a health care provider and do not uniformly trigger a health department investigation.

In conclusion, the authors found that the use of restaurant hygiene grade cards as implemented in Los Angeles County was associated with a reduction in foodborne-disease hospitalizations. Further studies are needed

to assess the impact of restaurant grade cards on non-hospitalized foodborne illnesses. To facilitate these studies, efforts are needed to improve surveillance for foodborne disease in local health jurisdictions. These efforts will require educating health care providers to more effectively diagnose foodborne disease and ensure that confirmed cases are reported to local public health authorities (CDC, 2004). 

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