

A Study on Food Code Violations in a Food Desert

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ABSTRACT

The right to adequate food is recognized by the International convention on economic, social and cultural rights. However, access to adequate and healthy food still remains a challenge. In the United States, over 23 million people live in areas designated as food deserts, which have limited access to healthy food. Consequently, restaurants in food deserts struggle to provide affordable and healthy food options. One other challenge faced by restaurants is the adherence to food regulations. Restaurants that violate health regulations may be cited for a critical or noncritical violation. Persistent citations for critical violations could lead to a temporal or permanent shutdown which adds to the scarcity of food in food deserts. This paper studies the food code violations in Montgomery county, a food desert in Ohio. The objective is to determine whether the time sanitarians spend during an inspection, the public perception of services and the frequency of inspections are associated with the occurrence of a critical violation. Out of 3,482 citations in 2017, it was observed that the number of inspections does not significantly impact the occurrence of a critical violation. However, the duration of the inspection was a significant factor in predicting the occurrence of critical violations. Thus, from resource utilization point of view, a public health department with limited number of health inspectors must focus on spending adequate time during each inspection as opposed to focusing on higher inspection frequencies.

Keywords: Food desert; Foodborne illness; Critical violations, Public health

INTRODUCTION

In recent years, Americans are dining out more frequently than ever before. On average, a household spends over \$3000 per year dining out. There are several factors contributing to this pattern. According to Diaz-Mendez and Garcia-Espejo, a stronger economy and an increase in wages are the driving force for this increase. People are more comfortable and are able to afford to eat at restaurants and fast-food joints. Another reason attributed to this phenomenon is the increase in time spent outside of the home due to work-related activities, which in turn limits the time available to prepare and eat food at homes. They also concluded that the current generation generally perceives cooking to be a complicated task, leading to the loss of cooking skills which is one of the reasons for eating outside of the home. According to The Nielson company, the total amount of money spent outside of the home on food (2003-2016) rose from about \$850 billion to \$1600 billion (from 2003-2016).

The increase in patronage of restaurants and fast-foods leads to an interesting inquiry concerning the types of food are being eaten, the restaurant types observing the increase in patronage and the general implications of eating away from home on foodborne illnesses? One will not be surprised to know that there has been an increase in the number of restaurants and fast food chain openings in the last several years, which capitalizes on the growing demand for their services. This trend has been projected to continue increasing significantly in the next decade.

Restaurants are major contributors to the hospitality sector of the United States economy. In 2018 alone, the restaurant industry accounted for \$825 billion in sales in over 1 million locations. The sector also employs over 15 million people. The number of restaurant openings is forecasted to grow and revenue from this sector of the economy is expected to rise steadily [1]. The growth observed also brings challenges about food safety. Restaurants and fast-food joints must always maintain healthy

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standards to avoid food poisoning and prevent hefty fines through food safety violations.

Restaurants are classified into two categories: an independent and chain restaurant. Chain restaurants have a reputation for having high calorie and unhealthy foods. Generally, people perceive independent restaurants to provide healthier meals, personalized services and innovative menus. With innovative menus which may be new to workers, the opportunities for the occurrence of food safety violation could increase if employees are not well trained. Innovative menus, which help to create unique taste and texture, may require a departure from traditional food preparation methodologies that restaurant employees may not be used to. As such, the unfamiliarity and other constraints could lead to mishandling of ingredients which could cause critical or noncritical violations. Studies have shown that chain restaurants have fewer critical violations compared to non-chain restaurants [2]. Critical violations are violations that pose an immediate threat to food safety and are more likely to directly contribute to food contamination and/or foodborne illnesses. A restaurant cited for critical violation could be made to shut down if these violations are not corrected immediately in Montgomery County, Ohio. Restaurants are sometimes also cited for noncritical violations. The conditions that could lead to noncritical violations include dirt build up on equipment, food stored directly on the floor, and lack of proper hair restraint. At the Montgomery county, repeated noncritical violations for three consecutive inspections lead to the establishment (restaurant) entering into the Enhanced Enforcement Program (EEP). In this program, the Environmental Health Director of the county will conduct the fourth inspection and if the violations are not corrected, the establishment will be scheduled to appear and explain to the health commissioner the reason(s) why the violations are not corrected. After that, the establishment is given a reasonable timeframe (depending on the depth of the violations) to correct the violation. If it is not correct, it will be scheduled for a Board of Health hearing in which case the establishment's license can be suspended or revoked. These protocols have been instituted to minimize the occurrence of foodborne diseases.

According to the center for disease control, 48 million Americans experience foodborne illness each year. In the last decade, the number of foodborne disease outbreaks continued increasing with the increase in the number of restaurants. More than half of foodborne illnesses are attributed to food from restaurants. Foodborne illness is defined as an infection or irritation of the gastrointestinal tract caused by food or beverage that contain harmful bacteria, parasites, viruses or chemicals. In the foodservice industry, these viruses can come into the food in various ways.

Regulatory health inspections in the United States routinely examine the factors that contribute to foodborne illness [3]. Regan, et al. stated the following factors as significant contributors to foodborne illness include:

- Poor personal hygiene: The situation where a cook or waiter/waitress who has direct contact with the food fails to maintain good personal hygiene.

- Improper food holding/time and temperature: Failing to maintain food or produce at the appropriate temperature.
- Contaminated equipment/protection from contamination: Preparing and/or serving food with contaminated silverware.
- Inadequate cooking: Serving food that could carry disease-causing organisms at inadequate cooking settings.
- Food obtained from unsafe sources: Patronizing food produce from sources that utilize unsafe farming practices and unacceptable chemicals which could impact food safety.

Strict adherence to standards has shown to significantly prevent or reduce the number of foodborne disease outbreaks. The two most infectious bacteria causing foodborne outbreaks are *E. coli* and Salmonella, and health inspectors have strengthened their efforts to reduce or eliminate outbreaks caused by these bacteria [4]. In 2016 there was an *E. coli* outbreak involving popular Mexican Grill (Chipotle) which infected 55 people in the United States including three people from the State of Ohio.

In order to prevent or reduce foodborne illness, the Montgomery Public health-which governs the health and safety of Montgomery county in Ohio, conducts regular inspection of food service locations. In 2017 it conducted more than 9000 inspections in over 3600 locations. Sanitarians conduct unannounced inspections to monitor whether the standards in Ohio's Uniform Food Safety Compliances (OUFSC) are met. In some of Ohio's counties, if an establishment meets all of the requirements, it is given a green sign, otherwise, it gets a yellow sign or white sign. When a yellow or white sign is given (for partial or total violation of code respectively), the inspector keeps following up until the establishment corrects the violation. In 2016, the Montgomery County Public Health (MCPH) inspectors forced a restaurant to close due to a salmonella outbreak [5].

There is the perception that public health inspectors disproportionately visit restaurants that are perceived to have higher chances of code violations, leading to a higher rate of a citation for such restaurants. In addition, the duration of inspection, as well as the public ratings of the restaurants, have been suspected to impact the rate of citation. Restaurants that constantly receive negative reviews about their environment or food safety could be prioritized by the health inspector [6]. Consequently, the goal of this study is to determine whether the number of inspections, public ratings, and the duration of the inspections are associated with the occurrence of critical violation citations. Samples of restaurants were randomly selected from different cities in Montgomery County of Ohio to forecast the probability of critical violation.

MATERIALS AND METHODS

Restaurants play a major role in fighting common foodborne illness. Angulo and Jones found that from 1998 to 2004 in the United States, food service restaurants were responsible for over half of all foodborne illnesses. 52% of all reported outbreaks were related to restaurants. However, the exact cause of 72% of the restaurant-related outbreaks had unknown etiology. The study concludes that those unknown outbreaks might be due to the preparation and storage of the food. Angulo and Jones

explain some of the reasons why restaurants are associated with a higher percentage of foodborne outbreaks. The article asserts that restaurant employees have high turnovers, in which case, new employees must be trained and taught the latest food handling practices and codes, and the transfer of knowledge doesn't happen fast enough. Secondly, the article emphasizes restaurant employees handling and preparing food while they are ill. Sumner, et al. found that 12% of food workers stated they worked while they were vomiting and experiencing diarrhea. This study also suggests ill workers come to work because of managerial pressure due to understaffing or managers not knowing of the illness [7]. For some employees, especially employees in food desert neighborhoods, their livelihood depends on being present at the job and cannot afford to lose payment.

Food deserts are areas that lack access to affordable healthy and nutritious foods. This phenomenon can negatively impact the efforts of the foodservice industry to obtaining quality and affordable food for their local community. In 2010, the former first lady of the United States launched an effort aimed at eradication food deserts. However, the phenomenon still exists with over 23.5 million people living in food deserts. Even though \$400 million were devoted to this project, a lot still remains to be done. Walker, et al. observed that ethnic and minority neighborhoods are usually more likely to be classified as a food desert due to their lower socioeconomic status. These neighborhoods are more likely to also suffer from restaurant-related foodborne diseases. Beaulac et al. found that because of the lack of access, communities in food deserts also observe prevalent higher food prices compared to affluent neighborhoods. This lack of access to healthy foods has implications for restaurants and communities [8]. Vince and Michele suggest there is a link between limited access to healthy food and long term individual health. Higher rates of diabetes, cardiovascular disease, and other dietary health-related disease are very common food communities. The access to healthy and affordable food in food deserts could be negatively impacted if restaurants in these communities are unable to prevent food safety violations that could lead to temporal of total shutdown. However, there has not been a lot of studies exploring health code violations of restaurants in areas designated as food desert areas.

Another important factor associated with a foodborne outbreak is the geographical location. McCabe-Sellers and Beattie alluded that food establishments in large institutions (such as schools) and other large food services providers have the highest foodborne outbreaks impacts. If an outbreak occurs in these institutions, it will turn out to be a large scale involving several individuals. The article also explains that because of the number of people present at a moment for service at these institutional food establishments, employees rush services and therefore fail to follow critical behaviors that mitigate for the potential for foodborne illness. Harris, et al., explain that the location of a restaurant is critical in determining restaurant health code violation in the state of Florida. Locations that serve as tourist centers and others that serve a larger number of customers per day are prone to having higher violation rates.

Some studies have evaluated whether there is any difference in compliance between the chain and non-chain restaurants. Harris, et al. found significant differences between restaurant types and their tendency to getting cited for critical violations. From 2009-2011, non-chain restaurants had more critical violations than chain restaurants in Florida. Han, et al. mention that chain restaurants have internal control from the farm to plate ensuring all the chains are serving similar food in terms of quality and aesthetics, therefore, lowering critical violation citations. Independent (non-chain) restaurants are stand-alone and usually have a single or groups of owners. According to Murphy, et al., these restaurants have higher critical violations due to limited resources. Harris, et al. looked at ethnic and non-ethnic restaurants and observed that ethnic restaurants performed below average with respect to inspection scores [9]. They also found that in the United States, Asian and Hispanic restaurants have the highest number of critical violations. Ridderstaat and Okumus concluded that the occurrence of non-compliance, leading to health code violation depends on the time an inspector visits the food establishment, length of inspections, and the leniency of the inspector.

Restaurant inspection data was obtained from the officials at the office of the Montgomery county public health department. The department posts yearly inspection data online which then are archived after two years. For this research January 1, 2017, to December 31, 2017 inspection was chosen because it was the immediate period where all the complete inspection reports are recently archived and readily available. The inspection data was stored in 11 different Comma Separated Values (CSV) files without titles or headings but accompanied by a metadata word document file. Python which is a free open-source software was used to combine and match-up the data. The data that was used from the health department includes the time a health inspector spends in a facility during each inspection and the total number of critical and noncritical violations per facility.

Each restaurant's Google ratings were also obtained by researching on the restaurants and obtaining twenty randomly selected reviews for the study year. Google review ratings were included because we wanted to test if there is any correlation between critical violations and customer satisfaction. Customer satisfaction, for this research, was deduced from the public ratings of the restaurants. Since the highest recorded critical violation was 11, Google reviews were collected for all the restaurants with critical violations [10].

RESULTS AND DISCUSSION

The Montgomery County in the southwest of Ohio had an estimated population of 532,331 in 2018 with an ethnic makeup of 73.3% white, 21.4% black, 2.3% Asian, 2.9% Hispanic, and 0.1% Native Hawaiian and other Pacific Islander. Montgomery county has 18 cities with Dayton as its capital. Dayton has the largest number of food establishments and food services in the County. The number of food establishments and the total time spent on inspections per city are shown in Figure 1 [11]. Figure 2 also shows the number of critical and noncritical violations per city. For 2017 Montgomery county food services had 1,457 critical violations and 2,025 noncritical violations.

It can be seen from Figure 1 that cities with a larger number of food establishments, as expected, observed higher inspection time. 70% of the cities, as seen in Figure 2 had more noncritical violations than a critical violation. 58% of all (3,482) citations in 2017 were noncritical as shown in Figure 3. Thus, approximately, 81 critical violations and 112 noncritical violations per city. 31.3% and approximately 56% of all noncritical and critical violations respectively were issued to restaurants in Dayton. In Addition, Dayton, the most populous city in the County, on average had 4 minutes of inspection time per food establishment. For the study year, the time spent during an inspection ranged from 10 minutes to 120 minutes, of which there was approximately 1 critical violation per every 10 minutes in Dayton.

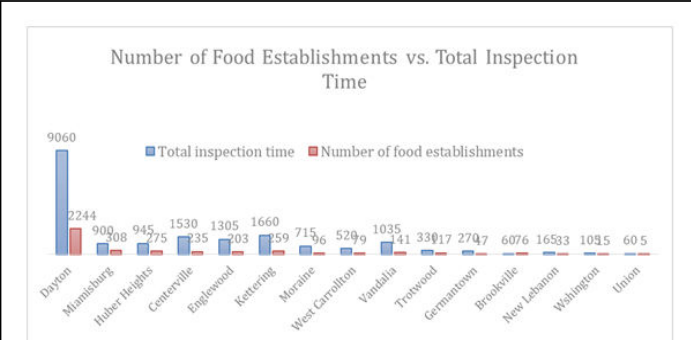


Figure 1: Total inspection time vs. the number of food establishments.

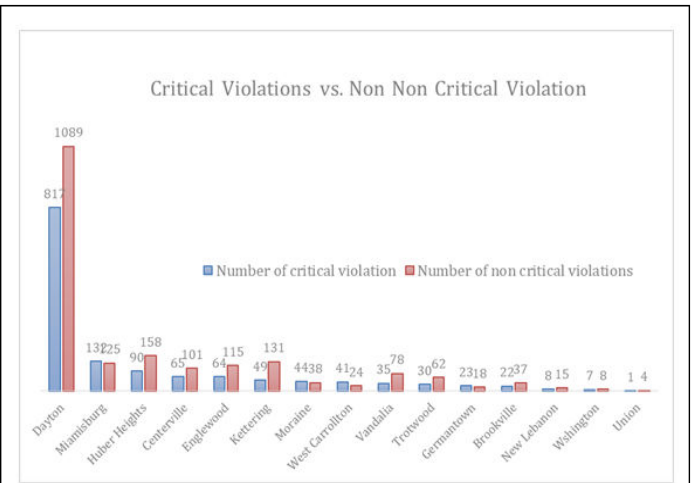


Figure 2: Number of critical and noncritical violations.

Table 1: Logistic regression output.

Source	DF	Adj dev	Adj mean	Chi-square	P-value
Regression	3	30.672	10.224	30.67	0
Inspection time	1	22.72	22.72	22.72	0
Number of inspections	1	1.191	1.191	1.19	0.275
Public ratings	1	3.177	3.177	3.18	0.075

The only variable that was statistically significant ($p < 0.05$) was the total inspection time spent on an inspection. With an odds

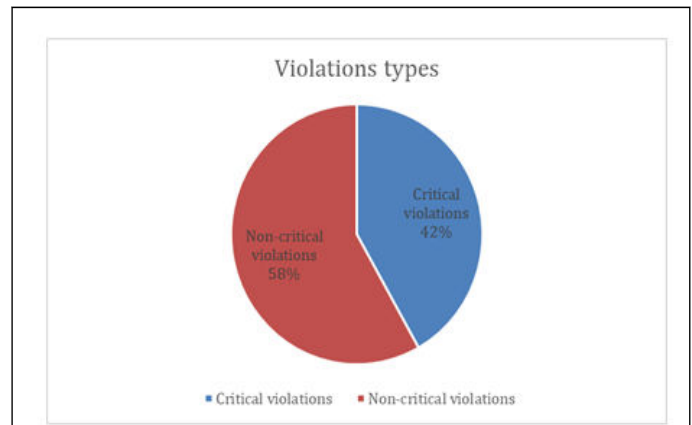


Figure 3: Proportions of critical and noncritical violations.

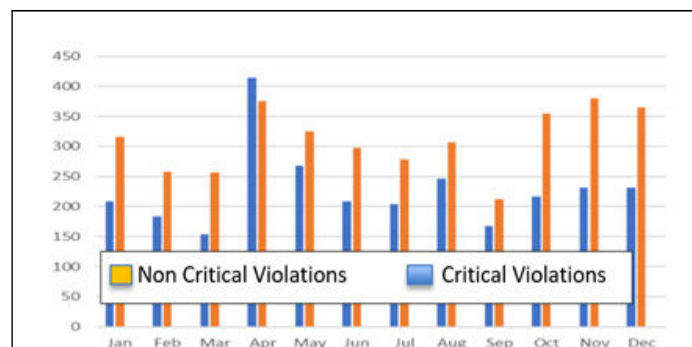


Figure 4: Monthly critical and noncritical violations.

There appears to be no identifiable pattern in the monthly violations as seen in Figure 4. However, April observed the highest number of critical violations, which led to the second quarter (April-June) receiving the highest proportion on critical violations [12]. This may be attributed to the advent of warmer weather after the cold winter. People generally tend to eat more from restaurants during warmer weather.

The results from the logistic regression analysis (Table 1) indicate that the public rating variable was not statistically significant ($p > 0.05$) in predicting the occurrence of critical violations. In this case, the nonoccurrence of critical violation is equivalent to the occurrence of the noncritical violation. Similarly, the number of inspection variable was not statistically significant ($p > 0.05$) in predicting the occurrence of a critical violation [13].

ratio of 1.025, the occurrence of critical violation with is 2% more likely with a unit increase in the time inspectors spend at a

restaurant. Even though the number of inspections was not statistically significant, the odds ratio was 1.518, which means that an increase in the number of inspection, increases the possibility of a critical violation citation by approximately 52% even though not significant. It is not surprising as some restaurants had more visits than others. One of the reasons attributed to the disparities in the number of visits is the follow up visits to check on the status of previously identified incidents [14]. It is worth mentioning that even though the Food and Drugs Board (FDA) recommends four inspections per restaurant per year and a minimum of three, the number of inspections varied from 1-3.

It is not surprising that the public ratings did not significantly predict the outcome. In general, customers rate or comment on food or service quality, cleanliness and often are not exposed to places like the kitchen that a public health inspector can assess. In addition, customers may lack the requisite training and tools to assess conditions that may warrant a citation [15]. Therefore, most of the user-generated ratings indicate a level of satisfaction on the quality and service. This supports Liu and Jang's findings that customers choose to eat at restaurants that provide quality food (in terms of taste), and a clean environment with an affordable price. It is therefore not surprising that establishments that had a higher number of critical violations also had similar positive customer rating as establishments that had zero critical violations.

CONCLUSION

Local Public Health officials regularly inspect restaurants and food retail outlets to ensure adherence to the health code. This study investigated the relationship between the occurrence of a violation (critical or noncritical) and a number of factors including the duration of inspection, frequency of inspections in a year and the public ratings. The results showed that these factors, with the exception of the duration of an inspection, were not statistically significant to the occurrence of a violation. The more time a health official spends inspecting a facility the more likely a critical violation will be found. This is intuitive since having more time to conduct an inspection provides the opportunity to identify violated situations that would have otherwise remained secluded. Thus, from a resource utilization point, a public health department with limited number of health inspectors can prioritize spending adequate time during each inspection as opposed to higher inspection frequencies.

It is worth mentioning that the time spent during the inspections was not normalized for the number of inspectors on-site, restaurant layout, time of day, the size of the restaurants, and the inspector's experience level. These are all factors that could impact the amount of time an inspector spends during the inspection and the likelihood of issuing a citation. In this investigation, we noticed that the inspection duration ranged from 10 minutes to over 2 hours. We did not identify a standard operating procedure concerning the determination of inspection duration per visit. Since the duration is a significant factor, it is

critical that establishments and health officials are on the same page in order to prevent unconscious bias in the allocation of the inspection time. Quantifying noncompliance is important especially in a food desert such as Dayton-Ohio, as the impact of a foodborne outbreak could have a devastating effect on people as well as the economy. For the most populous city in the County, every 10 minutes of inspection led to approximately 1 critical and 2 noncritical violations.

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