Cooling Protocol Compliance of Restaurants in Carson City and Douglas County NV

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Abstract

This study examined the compliance of full-service restaurants in Carson City and Douglas County, Nevada with the two-stage cooling process required by the Nevada Food Code (Nevada Administrative Code 446.176) in order to increase regulator understanding of the degree of compliance and barriers to compliance. The improper cooling of foods is a foodborne risk factor closely associated with foodborne pathogens such as *Clostridium perfringens* and *Bacillus cereus*. A common source of *C*. *perfringens* and *B. cereus* poisoning is from improper cooling procedures after large batch cooking in foodservice operations. This study developed and pilot tested a survey based on the Nevada Food Code that was used to measure operator knowledge of large batch cooling procedures at 91 of 121 regulated restaurants in the two-county region. The surveys were completed by inspectors during routine inspections and noncompliant operators were provided educational materials. Over 65% of surveyed facilities were not compliant with the cooling protocols. Barriers to compliance were lack of knowledge (96.7%); time constraints (56.7%); lack of space (25%); lack of proper equipment (23.3%); and indifference (5%). The study concluded that noncompliance with cooling protocols is a major threat to restaurant food safety in the two counties. Recommendations include increasing inspection attention to cooling protocols as well as increasing outreach education to restaurant operators.

Keywords: cooling protocols, compliance, batch cooking, *Clostridium perfringens*, *Bacillus cereus*, food code, rapid cooling

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Background

Improper cooling and reheating of potentially hazardous foods is a foodborne illness risk factor strongly correlated with the presence of foodborne pathogens *Clostridium perfringens* and *Bacillus cereus*. The Centers for Disease Control and Prevention (CDC) estimates that in the United States over one million people become infected by *Clostridium perfringens* and over 60 thousand people become ill from *Bacillus cereus* annually (Scharff, 2012). *C. perfringens* poisoning is estimated to account for more than 26% of all bacterial foodborne illnesses, making this pathogen one of the most prolific food poisoning agents (Scharff, 2012). Those figures are likely to be understated as many individuals that fall ill with *C. perfringens* or *B. cereus* poisoning do not seek medical attention because the symptoms are generally mild, self-limiting, and diminish within 24 hours (Stenfors Arnesen, Fagerlund, & Granum, 2008).

The Gram-positive bacterium *C. perfringens* is predominantly found in soil and the intestinal tracts of humans and animals. This organism can also be found in dust, thus giving it ample opportunity to contaminate foods during storage, handling, and processing (Garcia & Heredia, 2009). *C. perfringens* spores can be inoculated onto animal carcasses and various cuts of meats by exposure to dust, soil, and animal feces during processing, which is why the organism is common in poultry and beef products (Garcia & Heredia, 2009). Prolonged cooling and improper storage of stews, gravies, beans, and meats are strongly correlated with *C. perfringens* poisoning. The vegetative cells can grow rapidly during prolonged cooling as the temperature range for growth is 59°F to 131°F (Albrecht,

n.d.b). The symptoms of *C. perfringens* infection include abdominal cramps, diarrhea, and in some rare cases, fatal necrotizing colitis (Bos et al., 2005).

B. cereus outbreaks are strongly associated with the improper cooling and storage of starchy foods, most notably in rice dishes that are cooked in large batches for future consumption (Cronin & Wilkinson, 2009). The *B. cereus* endospores that can be present in rice are highly resistant to heat during the cooking process. *B. cereus* endospores will germinate very rapidly while exposed to favorable temperatures between 50°F to 91°F, during prolonged cooling (Albrecht, n.d.a). The *B. cereus* bacterium can cause both emesis and diarrhea. The causative agent for the vomiting is a cytotoxin called cereulide, and the toxin is produced in foods prior to ingestion (Stenfors Arneson et al., 2008).

In addition to the health impacts of *C. perfringens* and *B. cereus*, there are significant economic burdens associated with illnesses from either of these two pathogens. On average, the total cost of *C. perfringens* infections in the United States is estimated to be $382 million, with a per-case cost of $395 (Scharff, 2012). For *B. cereus*, the average annual cost of infection in the United States is $11 million, with a per-case cost of $166. These estimates use medical costs including hospital services, both inpatient and outpatient physician care costs, lab costs, medication costs, loss of productivity due to an individual's own illness or illness of the individual's children, and costs associated with chronic disease due to the acute illness. Estimates that incorporate costs due to pain and suffering are even higher (Scharff, 2012).

Proper cooling protocols are not always carried out consistently by food handlers and are frequently overlooked by regulators during routine inspections. This discrepant handling of food, in conjunction with temperature abuse, is a key contributing factor for

many foodborne illness outbreaks (Bryan, 1988). Regulatory evaluations can be difficult to achieve due to infrequency of inspections and inspectors not being present during times when cooling activities are carried out as these cooling practices are often conducted during various times such as evenings and weekends when regulators are not on duty (Bryan, 1988).

The Nevada Food Code provision for cooling (Nevada Administrative Code 446.176), which is derived from the Food and Drug Administration (FDA) Food Code, stipulates that potentially hazardous foods which are cooked in large batches for future consumption must undergo a two-step cooling process. The Nevada Food Code requires hot foods to be cooled from 135˚F to 70˚F within 2 hours, and then from 70˚F to 41˚F within an additional 4 hours. In order to abide by the stipulated time and temperature parameters for safe cooling, food service operators must understand these critical control points and they must utilize proper equipment to successfully execute the process.

Although the cooling requirements for full service restaurants are clearly spelled out by the Nevada Food Code, food safety regulators in Carson City and Douglas County, NV had never measured the degree of compliance or the barriers to compliance with the cooling requirements of the food code.

Problem Statement

The rate of compliance and barriers to following cooling protocols stipulated in the Nevada Food Code for full-service establishments in Douglas County and Carson City, NV are relatively unknown to food safety regulators.

Research Questions

1. Do the full-service restaurant operators in Carson City and Douglas County understand the proper steps in the cooling protocols that are stipulated in the Nevada Food Code?
2. What barriers do full-service restaurant operators in Carson City and Douglas County encounter in complying with the cooling protocols that are stipulated in the Nevada Food Code?

Methodology

Data was collected by regulators via in-person surveys with restaurant operators during routine inspections in Carson City and Douglas County, NV. The survey was developed by the author to determine the level of operator knowledge of, and adherence to, proper cooling protocols. After approval from the agency management, the survey was peer reviewed by three Environmental Health Specialists. The survey included the following topics: articulation of the operators' cooling process, if any; equipment used to cool cooked foods; and any barriers to following cooling protocols.

After review, three Environmental Health Specialists were standardized in the use of the survey instrument by the author. The standardization process included instructions about how to introduce the survey to the operator; asking the open-ended survey questions to elicit unbiased responses; and if possible, using certain reference points to observe and record cooling processes. In order to encourage frank answers from operators, inspectors were instructed to emphasize that the survey was not punitive and that responses would not impact their inspection score or records.

Inspectors used the survey instrument to gather data during routine inspections of full-service restaurants that cooked foods in batches and then cooled the food for use at a later time. The agency identified a total of 121 facilities that require cooling in their food service operations in the two counties. Regulators then conducted a total of 91 surveys: 42 in Carson City and 49 in Douglas County. Compliance was measured by food handlers' ability to articulate proper cooling protocols from beginning to end. When possible, visual evidence of prolonged cooling such as condensation on lids, time and temperature logs, and the usage of deep containers were observed to determine compliance. If the operator was not in compliance, information about barriers to compliance was collected within the survey. Educational handouts containing visual aids were given to all operators to encourage a better understanding of cooling requirements.

The data gathered from the surveys was placed in a spreadsheet and each record was examined for completeness. Statistics were compiled based on the frequency of each response to give total percentages of compliance and noncompliance. Barriers to compliance were analyzed based on the number of responses for each category; respondents could select as many barriers as applied; therefore, the responses were not mutually exclusive.

Results

Sixty out of 91 (65.9%) surveyed facilities were not in compliance with the Nevada Food Code cooling protocols, as shown in Table 1. All operators who were not compliant were unable to articulate the time and temperature parameters that are stipulated in the Nevada Food Code. Of the 31 (34.1%) establishments that were compliant, operators identified appropriate equipment utilized and articulated clear steps in their cooling

process, including all critical control points. Compliant operators utilized methods such as placing metal stockpots in ice baths while stirring with cooling paddles; placing shallow metal pans over ice baths while stirring; using fully functional blast-chillers; or preparing foods in closely monitored cook-chill systems.

Table 1

Breakdown of Compliance in Surveyed Establishments

Compliance	Establishments (n)	Establishments (%)
Noncompliant	60	65.9
Compliant	31	34.1
Total	91	100.0

Over half of noncompliant operators either immediately placed cooked foods in the refrigerator regardless of temperature (15%), or left cooked foods out at ambient temperatures for long periods of time before placing in the refrigerator (38.3%). Both of these methods constituted temperature abuse, and operators were automatically deemed out of compliance if they did not demonstrate the use of thermometers in their cooling processes.

Operators of noncompliant establishments identified several factors interfering with compliance as shown in Table 2. Almost all operators (96.7%) recognized lack of knowledge as a barrier to compliance; in some cases, operators were conducting cooling using proper equipment, but not adhering to time and temperature parameters. For example, one operator started cooling at 180°F and ended the process when the food reached 70°F. This insufficient practice was carried out due to the operator's lack of knowledge and inability to identify the critical control points. Over half (56.7%) of the noncompliant establishments reported time constraints as a barrier to compliance,

because staff must engage in other activities such as cooking and cleaning rather than actively cooling.

Fifteen out of sixty (25%) noncompliant establishments identified lack of space as a factor interfering with the implementation of proper cooling techniques; regulators observed cooking of large batches that exceeded facility capacity, and lack of counter space to carry out cooling using ice baths. Fourteen out of sixty (23.3%) operators did not have the necessary equipment to achieve efficacy. Many operators failed to utilize thermometers during the cooling process. Plastic containers were often used to cool foods in lieu of shallow metal containers, which are better alternatives to facilitate heat transfer. Most noncompliant operators engaged in passive, prolonged cooling instead of active cooling or passive, but rapid cooling. Many noncompliant operators' perception of their compliance was not in line with the food code due to improper execution of the process.

Table 2

Barriers to Compliance Reported by Noncompliant Establishments

Barriers	Establishments (n)	Noncompliant Establishments (%)*
Limited Knowledge	58	96.7
Time Constraints	34	56.7
Lack of Equipment	14	23.3
Lack of Space	15	25.0
Other (Indifference, Refusal)	3	5.0

**Percentages do not total 100% because operators could select multiple barriers to compliance.*

While conducting this research many foodservice operators were found to be unaware of the risks that are associated with the improper cooling of potentially

hazardous foods. Compliance rates for this study may have varied had more operators been previously aware of the correlation between prolonged cooling and foodborne illness risk.

Operators admitted prioritizing other duties such as cleaning, prepping, and cooking over the active monitoring and documenting of cooling processes. Failure to conduct active cooling was in part due to their lack of knowledge of the inherent risk involved with passive, prolonged cooling. Some operators were observed preparing an overabundance of food that exceeded the capacity of counter space, numbers of shallow pans, and cooling paddles. When pressed for time, some employees stated that they "wanted to get home to their families" and were not given permission to work overtime hours. The challenges with time constraints also points at possible issues related to insufficient workloads and understaffing of kitchens.

Conclusions

The high level of noncompliance (65.9%) with cooling protocols required by the Nevada Food Code among almost all full-service restaurants in Carson City and Douglas County represents an immediate and serious food safety risk.

Noncompliance with cooling protocols by full-service restaurants in Carson City and Douglas County appears overwhelmingly due to a lack of knowledge.

The study was somewhat limited regarding compliance as second-hand recollection of the cooling protocol is only an indication of whether or not the operator is properly following through with the process, rather than a measure. However, given the results of the study overall, this limitation was regarded as insignificant.

Recommendations

1. Full-service restaurant operators should be subject to a comprehensive education program that includes proper cooling protocols and the health risks associated with noncompliance. These education campaigns can include various compliant methods for cooking and cooling to assist operators that may have other barriers to compliance such as time or space constraints. The Association of Food & Drug Officials (AFDO) should communicate the results of this study to other agencies who should proactively address these same cooling issues and/or repeat this methodology in their jurisdictions.
2. Visual aids and handouts that illustrate the proper use of equipment and time and temperature parameters should be prepared and used by inspectors in visits to full-service restaurants.
3. Inspections should be carried out at various times of the day, such as early morning or late in the evening, to observe operators' processes for batch cooking and cooling of foods. These inspections should examine the volume of food that operators are preparing in advance for future meal services.
4. Inspections should ensure that all full-service restaurant plan reviews include questions about the type of foods that will be cooked in the facility and take cooling into consideration when determining space and equipment requirements.
5. Inspections should include how foods are stored in refrigerators and indicators of improperly cooled foods e.g., taking temperatures of food stored in large stockpots in walk-in refrigerators, or looking for condensation on lids of containers and pans to determine whether or not food was covered during cooling. Food items should not be cooled in plastic containers due to their inability to facilitate proper heat

transfer. From a regulatory standpoint, these unsafe practices must be identified during inspections and not tolerated.

6. The Nevada Food Code might be modified to adopt alternate cooling methods that are easier for operators to implement and easier for inspectors to regulate, such as those outlined in the Washington State Retail Food Code, Chapter 246-215 WAC. That code in general terms calls for continuous cooling in a shallow pan of two inches or less, uncovered, protected from cross contamination, at 41°F (5°C) or less; or continuous cooling of intact pieces of meat that is not comminuted and is no greater than four inches thick, uncovered, unwrapped, not touching other pieces of food, and protected from cross contamination, at 41°F (5°C) or less. (p. 43)
7. AFDO should communicate the results of this study to other agencies who should proactively address these same cooling issues and/or repeat this methodology in their jurisdictions.

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