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Restaurant Food Cooling Practices†

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ABSTRACT

Improper food cooling practices are a significant cause of foodborne illness, yet little is known about restaurant food cooling practices. This study was conducted to examine food cooling practices in restaurants. Specifically, the study assesses the frequency with which restaurants meet U.S. Food and Drug Administration (FDA) recommendations aimed at reducing pathogen proliferation during food cooling. Members of the Centers for Disease Control and Prevention's Environmental Health Specialists Network collected data on food cooling practices in 420 restaurants. The data collected indicate that many restaurants are not meeting FDA recommendations concerning cooling. Although most restaurant kitchen managers report that they have formal cooling processes (86%) and provide training to food workers on proper cooling (91%), many managers said that they do not have tested and verified cooling processes (39%), do not monitor time or temperature during cooling processes (41%), or do not calibrate thermometers used for monitoring temperatures (15%). Indeed, 86% of managers reported cooling processes that did not incorporate all FDA-recommended components. Additionally, restaurants do not always follow recommendations concerning specific cooling methods, such as refrigerating cooling food at shallow depths, ventilating cooling food, providing open-air space around the tops and sides of cooling food containers, and refraining from stacking cooling food containers on top of each other. Data from this study could be used by food safety programs and the restaurant industry to target training and intervention efforts concerning cooling practices. These efforts should focus on the most frequent poor cooling practices, as identified by this study.

Improper cooling of hot food by restaurants is a significant cause of foodborne illness. In the United States between 1998 and 2008, improper cooling practices contributed to 504 outbreaks associated with restaurants or delis *(1)*. These findings suggest that improvement of restaurant cooling practices is needed. The U.S. Food and Drug Administration (FDA) Food Code, which provides the basis for state and local food codes that regulate retail food service in the United States, contains guidelines for food service establishments, aimed at reducing pathogen proliferation during food cooling *(4)*. Specifically, the Food Code states that cooked potentially hazardous food (foods that require time-temperature control to keep them safe for consumption) should be cooled ''rapidly,'' i.e., from 135 to 70°F (57.2 to 21.1°C) in 2 h or less, and from 70 to 41°F (21.1 to 5°C) in 4 additional h or less. Thus, according to the FDA, proper cooling is cooling that minimizes the amount of time that food is in the temperature ''danger zone'' of 41 to 135°F (5 to 57.2°C), the temperature range in which foodborne illness pathogens grow quickly.

The Food Code also states that procedures in the food preparation process that are critical to food safety (critical control points), such as cooling, should be tested and verified and then monitored to ensure that they work properly *(5)*. Testing and verification occurs during initial development of the cooling process; it involves measuring time and food temperatures throughout the process to ensure that the process cools effectively. Monitoring involves measuring time and temperature during the cooling process on a routine basis—again to ensure that the process continues to cool effectively. The Food Code also recommends that thermometers used to measure food temperatures be calibrated as necessary to ensure their accuracy. Finally, the Food Code recommends that temperature data obtained from monitoring critical control points be recorded so that managers can verify that cooling processes are cooling effectively.

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Further, the Food Code recommends the use of one or more of the following methods to facilitate cooling: (i) placing food in shallow pans and refrigerating it at the maximum cold holding temperature of 41°F [5°C]; (ii) separating food into smaller or thinner portions and refrigerating it at the maximum cold holding temperature of 41°F [5°C]; (iii) stirring the food in a container placed in an ice water bath; (iv) using rapid cooling equipment, such as ice wands (containers filled with ice and placed inside food) and blast chillers (a type of rapid cooling equipment); (v) adding ice as an ingredient to the food; and (vi) using containers that facilitate heat transfer. The Food Code also states that cooling food should be arranged to provide conditions for maximum heat transfer through food container walls (e.g., by not placing containers of cooling food close to each other) and be ventilated (e.g., uncovered, if protected from overhead contamination, or loosely covered) during the cooling period to facilitate heat transfer from the surface of the food. The Food Code also recommends that the person in charge of the food service establishment (e.g., manager) ensure that food is being properly cooled through routine monitoring of food temperatures during cooling.

In one of the few existing studies containing information on restaurant food cooling, the FDA found that improper cooling was a frequent foodborne illness risk factor observed in full-service restaurants. In 79% of observations, food was not cooled to the proper temperatures quickly enough to meet FDA recommendations *(6)*. Although this study provides valuable information on the prevalence of restaurants' failure to meet cooling time and temperature guidelines, it does not provide any data on restaurants' cooling practices, such as whether cooling processes are tested and verified. It also does not provide any data on the methods restaurants use in their attempts to cool food (e.g., shallow pans). Knowledge about these issues is essential to the development of effective cooling interventions. For this reason, the purpose of this study was to collect data on these topics. This study focuses on describing restaurants' food cooling practices and on the methods restaurants use to cool food (e.g., refrigeration, ice baths). Where appropriate, the study assesses the frequency with which restaurants meet FDA recommendations concerning cooling practices.

MATERIALS AND METHODS

This study was conducted by the Environmental Health Specialists Network (EHS-Net), a network of environmental health specialists and epidemiologists focused on the investigation of factors contributing to foodborne illness. EHS-Net is a collaborative project of the Centers for Disease Control and Prevention, the FDA, the U.S. Department of Agriculture (USDA), and state and local health departments. At the time this study was conducted, the EHS-Net sites were in California, Connecticut, New York, Georgia, Iowa, Minnesota, Oregon, Rhode Island, and Tennessee.

Data were collected from July 2009 through March 2010. The study protocol was cleared by the CDC Institutional Review Board and the appropriate institutional review boards in the participating sites. All data collectors (EHS-Net environmental health specialists) participated in training designed to increase data collection consistency.

Data collectors collected data in approximately 50 restaurants in each EHS-Net site. ''Restaurants'' were defined as establishments that prepare and serve food or beverages to customers but that are not institutions, food carts, mobile food units, temporary food stands, supermarkets, restaurants in supermarkets, or caterers. Data collectors contacted randomly selected restaurants in predefined geographical areas in each site via telephone to request their participation in the study and arrange for an on-site interview with a ''kitchen manager'' (defined as a manager with authority over the kitchen) and an observation of cooling practices. Data collectors attempted to schedule restaurant visits to coincide with the beginning of the restaurants' cooling processes, although this was not always possible. Only one restaurant from any given regional or national chain was included per EHS-Net site. For example, if chain A had three restaurants in an EHS-Net site, only one of those restaurants would be eligible to participate in the study in that site. Only English-speaking managers were interviewed. Data collection was anonymous; that is, no data were collected that could identify individual restaurants or managers.

Restaurant visits lasted an average of 80 min. Data collectors interviewed the manager about restaurant characteristics (e.g., chain versus independent ownership, number of meals served daily), food handling and cooling policies and practices (e.g., whether thermometers were used to check temperatures, whether temperatures of cooling food were monitored), and local regulations concerning cooling.

When possible, data collectors also recorded observation data on cooling practices occurring during their visit. For each food being cooled during the observation, data collectors recorded data on the type of food being cooled, the number of cooling steps involved in the cooling of the food, and the method used in each step to cool the food (refrigerating food at or below 41°F [5°C], ice bath, ice wand, blast chiller, ice or frozen food as an ingredient, room temperature cooling). For example, if a cooling food was first observed in an ice bath and was moved to a refrigerator later in the observation, the data collector would record an ice bath step and a refrigeration step. Additional observation data were collected on the methods of refrigeration, ice bath, and ice wand (Table 1).

In some restaurants, multiple food items were being cooled, and as described above, the cooling process for some of these food items involved multiple cooling steps. We collected data on each food item being cooled and each cooling step involved in the cooling process of each food item. Thus, the denominators for the observation data vary, and are described in the ''Results'' section.

Data collectors also recorded whether workers monitored the temperatures of the cooling foods during the observation period and took temperatures of cooling food at the beginning and at the end of the observation period. These temperature data are not discussed here.

RESULTS

Restaurant demographics. Four hundred twenty restaurant managers agreed to participate in the study. The restaurant participation rate was 68.4% (this rate is based on data from eight of the EHS-Net sites; participation rate data were unavailable for one site). According to interviewed managers, most restaurants were independently owned and served an American menu (see Table 2). The median number of meals served daily in these restaurants was 150 (25th percentile = 80, 75th percentile = 300, minimum = 7, maximum = 7,700).

TABLE 1. *Description of additional observation data collected on the cooling methods of refrigeration, ice bath, and ice wand*

Refrigeration
Type of cooling unit (walk-in coolers, reach-in coolers, freezers)
Ambient temperature of cooling unit
Whether food depth was shallow (no more than 3 in. [7.6 cm] deep)
Whether the food was ventilated (uncovered or loosely covered)
Whether the containers of cooling food were arranged to allow maximum heat transfer through container walls (containers not stacked on top of one another; at least 3 in. [7.6 cm] of open-air space provided around the top and sides of the containers)
Ice bath
Whether ice was present in the ice bath
Whether ice and water were filled to level of the cooling food
Whether food was stirred
Ice wand
Whether ice wand was inserted into the food
Whether ice and/or liquid was present in the ice wand
Whether food was stirred

TABLE 2. *Data on restaurant demographics obtained from interviews with 420 kitchen managers*

Demographic	*n*	%
Restaurant ownership		
Independent	290	69.0
Chain	130	31.0
Menu description		
American	252	60.0
Italian	47	11.2
Mexican	34	8.1
Chinese	21	5.0
Other	66	15.7

Manager interview data on general food safety practices. According to interviewed managers, over 90% of restaurants provided food safety training to managers and workers, and over 75% employed at least one food safety certified manager (Table 3). Over 95% of managers said that they used thermometers to check the temperature of food being prepared in their restaurant. Thermometers used included bimetallic probe thermometers, digital–thermocouple probe thermometers, and infrared–laser thermometers. Over 80% of managers said that someone was trained to calibrate (i.e., check the accuracy of) these thermometers. Of those who said they used thermometers to check food temperatures, about 40% said that they calibrated thermometers at least once a week; others said that they calibrated at least once a day, at least once a month, less than once a month, never, or they were unsure how often thermometers were calibrated.

Twenty percent (20.2% [85]) of managers said the cooling time and temperature regulation in their jurisdiction was the same as the FDA's—135 to 70°F (57.2 to 21.1°C) in 2 h or less and then 70 to 41°F (21.1 to 5°C) in 4 additional h or less. Ten percent (9.5% [40]) said they had a two-stage regulation like the FDA's, but the temperatures differed (140°F [60°C] rather than 135°F [57.2°C]). Two percent (1.7% [7]) said their regulation had the same temperatures as the FDA's but required a single-stage process (135 to 41°F [57.2 to 5°C] in 4 h or less). Ten percent (9.7% [41]) said their regulation had a single-stage process with temperatures that differed from the FDA's (140 to 41°F [60 to 5°C] in 4 h or less: 8.3%; 140 to 45°F [60 to 7.2°C] in 4 h or less: 1.4%). Twenty-three percent (22.6% [95]) said they had some other regulation, and 36.2% (152) did not know their jurisdiction's cooling regulation.

Manager interview data on cooling practices. Over 90% of managers said that food safety training for managers and workers covered proper cooling (Table 4). Over 85% said that their restaurant had formal processes (methods of cooling that have been established by the restaurant as a standard practice) for cooling potentially hazardous foods. In these restaurants with formal cooling processes, a third of managers said that the processes were written, and 89% said that food workers had been trained on them. Of managers in restaurants with formal cooling processes, over 60% said their processes had been tested and verified.

Sixty percent of all managers said that food cooling times or temperatures were monitored during routine cooling of foods. Of those managers who said that food cooling times or temperatures were monitored in their restaurants, most said that cooling foods were ''always'' or ''often'' monitored. Most managers who said that they monitored food cooling times or temperatures said that they used thermometers to do so. Others reported using time to monitor cooling, both thermometers and time to monitor cooling, the look or feel of the food, or some other method to monitor cooling. Of those who said they used thermometers to monitor cooling, about 50% said that they calibrated thermometers at least once a week; others said that they calibrated at least once a day, at least once a month, less than once a month, never, or they were unsure how often thermometers were calibrated. A quarter of managers said that monitored time or temperature measures were recorded.

Fifty-three percent (52.6% [221]) of managers said that they had formal cooling processes and that they were verified; 46.2% (194) of managers said that they had formal cooling processes, that these processes were verified, and that time or temperature was monitored during these processes; 42.9% (180) said that they had formal cooling processes, that these processes were verified, that time or temperature was monitored during these processes, and that they calibrated thermometers used for monitoring. Not quite 15% (14.5% [61]) of managers said that they had formal cooling processes, that these processes were verified, that time or temperature was monitored during these processes, that thermometers used for monitoring were calibrated, and that measurements from time or temperature monitoring were recorded. Thus, 85.5% (359) of managers reported cooling processes that did not incorporate all FDA-recommended components.

Observation data on cooling practices. Data collectors observed 596 food items being cooled during their visit

TABLE 3. *Data on restaurant general food safety practices obtained from interviews with 420 kitchen managers*[a]

Demographic	*n*	%
Kitchen managers receive food safety training		
Yes	401	95.5
No	19	4.5
Food workers receive food safety training		
Yes	390	92.9
No	25	6.0
Unsure	5	1.1
Restaurant has at least one certified kitchen manager		
Yes	321	76.4
No	97	23.1
Unsure	2	0.5
Thermometer is used to check food temperatures		
Yes	400	95.3
No	19	4.5
Unsure	1	0.2
Type of instrument used to check food temperatures ($N = 400$)[b]		
Bimetallic probe thermometer	298	74.5
Digital/thermocouple probe thermometer	184	46.0
Infrared/laser thermometer	16	4.0
Someone is trained to calibrate thermometers ($N = 400$)		
Yes	331	82.7
No	61	15.3
Unsure	8	2.0
Frequency with which thermometer is calibrated ($N = 400$)		
At least once a day	57	14.3
At least once a week	152	38.0
At least once a month	76	19.0
Less than once a month	17	4.3
Never	58	14.5
Other	9	2.2
Unsure	31	7.7

[a] *N* values vary throughout the table because of skip patterns in the interview; $N = 420$ unless otherwise noted.

[b] Participants were able to provide multiple responses to the question; thus, the numbers add to more than the *N*, and percentages add to more than 100%.

in 410 restaurants (10 of the 420 restaurants in the study were not actively cooling foods at the time of the visits). Seventy-one percent (291 of 410) of these restaurants were cooling one food item during the visit, but others were cooling several food items during the visit (the number of food items observed in each restaurant ranged from 1 to 6). Of the 596 food items observed being cooled, soups, stews, and chilis were the most common food items (29.9% [178]), followed by poultry and meat (25.2% [150]), sauces and gravies (15.4% [92]), cooked vegetables (6.7% [40]), rice (5.7% [34]), beans (5.2% [31]), pasta (3.9% [23]), casseroles (3.2% [19]), seafood (1.2% [7]), pudding (1.0% [6]), and other foods (2.7% [16]).

Workers were observed monitoring cooling food time or temperatures by using one or more methods (e.g., time, temperature) in 39.4% (235 of 592; data were missing for four observations) of cooling observations. Probe thermometers were most frequently used for this purpose (82.5% [194]), followed by time estimates (e.g., noting cooling time on a clock, approximating cooling time) (23.8% [56]), touching the cooling food or container (6.8% [16]), and ''other'' methods (3.8% [9]).

Data collectors collected data on 997 discrete cooling steps (the number of cooling steps observed for each food item ranged from 1 to 4). Among these 997 cooling steps, the most common cooling method was refrigeration—46.6% (466) of cooling steps involved refrigeration. Other cooling methods included ice bath (19.4% [195]), ice wand (7.7% [77]), ice or frozen food as an ingredient in the cooling food (2.7% [27]), blast chiller (0.5% [5]), room temperature cooling (16.8% [169]), and ''other'' types of cooling (6.3% [63]).

Table 5 presents data on the cooling unit types and temperatures observed in the 466 refrigeration step observations. Walk-in coolers were the most commonly used cooling unit for refrigeration, followed by reach-in coolers and freezers. Sixteen percent of cooling unit temperatures were above 41°F (5°C), the FDA-recommended maximum food cold-holding temperature. About 10% of walk-in coolers, a third of reach-in coolers, and less than 1% of freezers were above the FDA-recommended maximum temperature of 41°F (5°C).

In 39.3% (183 of 466) of these refrigeration observations, the food depth was not shallow; in 34.3% (160) of the observations, the cooling food was not ventilated; in 13.7% (64) of the observations, containers of cooling food were stacked on top of each other; and in 23.8% (111) of observations, open-air space was not provided around the top and sides of the food cooling containers (see Fig. 1).

In 1.0% (2) of the 195 ice bath observations, ice was not present in the ice bath; in 32.8% (64) of the observations, ice and water were not filled to the level of the cooling food; and in 28.7% (56) of observations, the food was not stirred during the observation period.

In 100.0% of the 77 ice wand observations, the wands were inserted into the food. In 2.6% (2) of these observations, ice was not present in the ice wand; in 2.6% (2) of observations, no liquid was in the ice wand; and in 13.0% (10) of observations, the food was not stirred during the observation period.

DISCUSSION

This study identifies multiple shortcomings in restaurant cooling practices. The data collected indicate that many restaurants' cooling practices do not meet FDA recommendations aimed at reducing pathogen proliferation during food cooling.

It is encouraging that most managers reported that they had formal cooling processes and that they provided training to food workers on these processes. Additionally, over 90% of managers in restaurants that monitored cooling said that they calibrated the thermometers used for monitoring. However, many managers reported the absence of several FDA-recommended cooling components. For example,

TABLE 4. *Data on restaurant cooling practices obtained from interviews with 420 kitchen managers*[a]

Cooling practice	n	%
Kitchen manager food safety training covered proper cooling (N = 401)[a]		
Yes	390	97.3
No	7	1.7
Unsure	4	1.0
Food worker food safety training covered proper cooling (N = 390)		
Yes	356	91.3
No	27	6.9
Unsure	7	1.8
Restaurant has formal cooling processes (N = 420)		
Yes	362	86.2
No	57	13.6
Unsure	1	0.2
Cooling processes are written (N = 362)		
Yes	123	34.0
No	231	63.8
Unsure	8	2.2
Food workers have been trained on cooling processes (N = 362)		
Yes	323	89.2
No	36	10.0
Unsure	3	0.8
Cooling processes have been tested and verified (N = 362)		
Yes	221	61.0
No	126	34.8
Unsure	15	4.2
Time or temperature is monitored during cooling processes (N = 420)		
Yes	250	59.5
No	168	40.0
Unsure	2	0.5
Frequency with which cooling processes are monitored (N = 250)		
Always	113	45.2
Often	92	36.8
Sometimes	39	15.6
Rarely	5	2.0
Unsure	1	0.4
Cooling process monitoring method (N = 250)[b]		
Probe thermometer	225	90.0
Data logging thermometer	2	0.8
Time	62	24.8
Thermometer and time	49	19.6
Sight	3	1.2
Touch	11	4.4
Other	16	6.4
Unsure	2	0.8
Frequency with which thermometers used to monitor are calibrated (N = 226)		
At least once a day	38	16.8
At least once a week	111	49.1
At least once a month	40	17.7
Less than once a month	6	2.7
Never	13	5.7
Other	6	2.6
Unsure	12	5.4
Cooling time or temperature measures are recorded (N = 250)		
Yes	66	26.4
No	183	73.2
Unsure	1	0.4

[a] N values vary throughout the table because of skip patterns in the interview.

[b] Participants were able to provide multiple responses to the question; thus, the numbers add to more than the N, and percentages add to more than 100%.

about half of managers said that they did not have tested and verified cooling processes, and 41% did not monitor time or temperature during cooling processes. Eighty percent of those who monitored cooling processes did not monitor both time and temperature, as recommended by FDA, and 6% of those who monitored cooling food temperatures with a thermometer never calibrated their thermometers. Finally, less than a third of restaurant managers said that they recorded temperature data obtained from monitoring. Lack of testing and verification means that the adequacy of the cooling process was not determined prior to implementation; this absence could result in ineffective cooling. Similarly, lack of monitoring of both time and temperature means that the effectiveness of the cooling process is not assessed on a regular basis. Lack of thermometer calibration can lead to inaccurate temperature readings, and consequently, to inadequate cooling. Lack of recording prevents managers from reviewing the data to verify that their cooling processes are working properly. These deficiencies can cause cooling foods to remain in the temperature danger zone for too long, allowing potentially unsafe pathogen proliferation.

All together, most managers described cooling processes that did not incorporate all FDA-recommended components—testing and verification, time and temperature monitoring, thermometer calibration, and time and temperature measurement recording. These data indicate that most restaurants have cooling deficiencies that should be addressed.

Over a third of interviewed managers did not know their jurisdiction's cooling regulation. If managers do not know the cooling regulations, it seems unlikely that these regulations will be followed. Clearly, more education is needed concerning cooling regulations and practices.

Refrigeration was the most common cooling method used by restaurants. However, 16% of the units used for cooling were observed operating above the FDA-recommended maximum temperature for cold holding of foods. These data are concerning, because food cooling rates decline exponentially as ambient cooling temperatures approach 41°F (5°C) and higher. Additionally, FDA recommendations for facilitating rapid cooling during refrigeration were not always followed. Most frequently, restaurants did not refrigerate food at shallow depths. They also did not always ventilate cooling food, provide open-air space around the tops and sides of food cooling containers,

TABLE 5. *Ambient temperatures taken from the cooling units used in 466 refrigeration steps observed in 410 restaurants*

Cooling unit	Median	25th percentile	75th percentile	*n*	% > 41°F (5°C)	*n* > 41°F (°C)
Walk-in coolers	39.0	36.0	40.0	344	11.6	40
Reach-in coolers	40.0	37.0	44.0	93	34.4	32
Freezers	3.0	−0.5	21.0	29	0.5	1
All	39.0	36.0	40.0	466	15.7	73

and refrain from stacking cooling food containers on top of each other. These practices facilitate rapid cooling; however, depending on the amount of food being cooled, they could also require considerable refrigerator space. A need for more refrigerator space could, at least in part, account for the prevalence of these poor cooling practices. Indeed, qualitative data suggest that food workers view the lack of adequate space as a barrier to proper cooling *(3)*.

The ice bath was the next most frequent cooling method. Again, practices that would best facilitate rapid cooling by use of this method, such as ensuring that the ice and water were filled to the outside top of the food containers and that the food was stirred regularly during the cooling process, were not always followed. These activities are relatively easy to do; it could be that food workers are unaware of their importance to proper cooling.

Although ice wands were used infrequently, they were used correctly for the most part—they were filled with ice and inserted into the cooling food. However, as with the use of ice baths, the cooling foods were not always stirred during the cooling process. The cooling methods of ice as an ingredient and blast chillers were also rarely used. Ice as an ingredient is likely used infrequently because it could affect the quality, taste of the food. Blast chillers, although effective, are expensive, and their cost likely explains the infrequency of their use.

In about a fifth of cooling steps observed, cooling food was kept at room temperature. Because room temperature storage is not a method that facilitates rapid cooling, this practice is not recommended for cooling foods that are in the temperature danger zone. However, this practice might be acceptable for foods that are not in the temperature danger zone. For example, it would be acceptable to cool a hot food at room temperature until the food cooled to 135°F

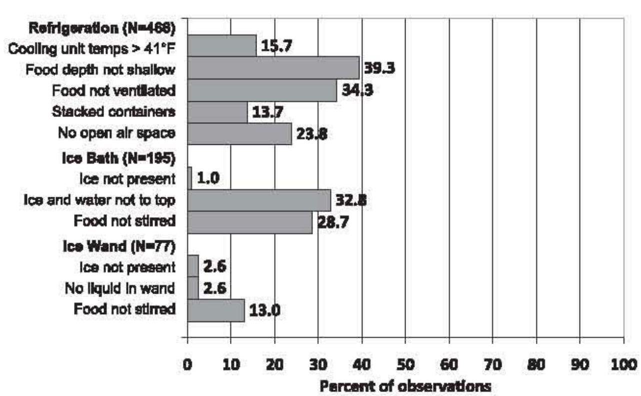

FIGURE 1. *Frequencies of improper food cooling practices observed in refrigeration, ice bath, and ice wand steps in 410 restaurants.*

(57.2°C; the high point of the temperature danger zone). At that point, however, a rapid cooling method would need to be used. Food temperature monitoring is a particularly important part of any cooling process in which room temperature is used, because it is critical to identify when the food reaches the danger zone so that a rapid cooling method can be implemented.

This study had several limitations. First, this study included only English-speaking managers and workers. Second, the study collected self-report data (managers reported on their workers' and their own practices and policies); these data are susceptible to a bias to over-report socially desirable behaviors, such as cooling food properly. Lastly, the study also collected observation data; these data are susceptible to reactivity bias, in that food workers might have reacted to being observed by changing their cooling practices. These last two biases could have led to an underestimation of the prevalence of improper cooling practices.

Our data suggest that many restaurant managers do not understand how to cool food properly. Data from this study can be used by food safety programs and the restaurant industry to target training and intervention efforts to improve cooling knowledge, policies, and practices. An important focus of these efforts would be to emphasize the need for testing, verification, and monitoring to ensure that the cooling process works properly. These fundamental components of a food safety management system control foodborne illness risk factors *(5)*.

Training and intervention efforts should also focus on the most frequent poor cooling practices identified in this study—inadequate cooling unit temperatures, inadequate facilitation of rapid cooling during refrigeration, and inadequate ice baths. Efforts should focus not only on how to cool foods properly but also on *why* it is important to cool foods properly. Research has indicated that this ''why'' aspect is an important component of effective training *(2, 3)*. Thus, a focus on the temperature danger zone and how cooling time and temperature requirements are designed to reduce the amount of time that food remains in this zone would be appropriate. Efforts to improve cooling practices should also focus on identifying barriers and facilitators to proper cooling practices and addressing them. For example, if restaurants are implementing refrigeration cooling methods improperly because they do not have the space to do otherwise, food safety programs could work with them to identify alternative methods of cooling.

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