

Research Paper

Food Worker Experiences with and Beliefs about Working While Ill†

L. RAND CARPENTER,^{1‡} ALICE L. GREEN,^{1§} DAWN M. NORTON,² ROBERTA FRICK,^{3||} MELISSA TOBIN-D'ANGELO,⁴ DAVID W. REIMANN,⁵ HENRY BLADE,⁶ DAVID C. NICHOLAS,⁷ JESSICA S. EGAN,⁷ KAREN EVERSTINE,^{8,#} LAURA G. BROWN,^{9*} AND BRENDA LE⁹

¹Tennessee Department of Health, Nashville, Tennessee 37243; ²California Emerging Infections Program, Oakland, California 94612; ³California Environmental Health Specialists Network, Public Health Foundation Enterprises, Richmond, California 91746; ⁴Georgia Department of Public Health, Atlanta, Georgia 30303; ⁵Minnesota Department of Health, Mankato, Minnesota 56001; ⁶Rhode Island Department of Health, Providence, Rhode Island 02908; ⁷New York State Department of Health, Albany, New York 12180; ⁸Minnesota Department of Health, St. Paul, Minnesota 55164; and ⁹Centers for Disease Control and Prevention, National Center for Environmental Health, Atlanta, Georgia 30341, USA

MS 13-128: Received 1 April 2013/Accepted 4 August 2013

ABSTRACT

Transmission of foodborne pathogens from ill food workers to diners in restaurants is an important cause of foodborne illness outbreaks. The U.S. Food and Drug Administration recommends that food workers with vomiting or diarrhea (symptoms of foodborne illness) be excluded from work. To understand the experiences and characteristics of workers who work while ill, workplace interviews were conducted with 491 food workers from 391 randomly selected restaurants in nine states that participated in the Environmental Health Specialists Network of the Centers for Disease Control and Prevention. Almost 60% of workers recalled working while ill at some time. Twenty percent of workers said that they had worked while ill with vomiting or diarrhea for at least one shift in the previous year. Factors significantly related to workers having said that they had worked while ill with vomiting or diarrhea were worker sex, job responsibilities, years of work experience, concerns about leaving coworkers short staffed, and concerns about job loss. These findings suggest that the decision to work while ill with vomiting or diarrhea is complex and multifactorial.

Handling of food by an infected person or a carrier of pathogens is a contributing factor in up to two-thirds of restaurant-related foodborne outbreaks (3). In food worker-associated foodborne outbreaks, the most frequently reported route of transmission involves poor hand hygiene or bare hand contact with food (8). Ill food workers have been implicated in restaurant-related viral and bacterial foodborne disease outbreaks with at least 14 etiologies, including norovirus, *Salmonella*, hepatitis A virus, and *Escherichia coli* (1, 2, 4–6). The inconsistent effectiveness of such

barriers as clothing, bandages, toilet paper, and gloves, usually thought to prevent soiling or contamination, combined with some of these organisms' low infectious doses can facilitate transmission of pathogens in food service settings (9).

The U.S. Food and Drug Administration (FDA) periodically promulgates the Food Code as a model code and reference document for adoption by state, city, county, and tribal agencies. To prevent ill food workers from transmitting foodborne illness pathogens to the food they prepare, the FDA Food Code specifies that the following food workers be excluded from work: (i) those with vomiting or diarrhea (common symptoms of many foodborne illnesses), (ii) those with jaundice (symptoms of hepatitis A), and (iii) those diagnosed with a hepatitis A or *Salmonella* Typhi infection.

The Food Code also specifies that food workers who work in a food establishment that serves a highly susceptible population (e.g., a child or adult day care center) should be excluded from work when these workers are symptomatic with sore throat and fever or have been diagnosed with norovirus, hepatitis A virus, *Shigella* spp., enterohemorrhagic or Shiga toxin-producing *E. coli*, or *Salmonella* Typhi infections.

Food workers are also required to report any of these symptoms and diagnoses to the person in charge (i.e., the

* Author for correspondence. Tel: 770-488-4332; Fax: 770-488-7310; E-mail: lrg0@cdc.gov.

† This article is based on data collected and provided by the Centers for Disease Control and Prevention (CDC) Environmental Health Specialists Network, which is supported by a CDC grant award funded under CDC-RFA-EH05-013. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the CDC or the Agency for Toxic Substances and Disease Registry.

‡ Mennonite Central Committee, 47 Rhapta Road, P.O. Box 14894, Westlands, Nairobi, Kenya.

§ Present address: U.S. Department of Agriculture, Food Safety and Inspection Service, Office of Public Health Science, Butler Square West, Suite 420-C, 100 North 6th Street, Minneapolis, MN 55403, USA.

|| Present address: Alameda County Department of Environmental Health, 1131 Harbor Bay Parkway, 2nd Floor, Alameda, CA 94502, USA.

Present address: National Center for Food Protection and Defense, University of Minnesota, St. Paul, MN 55108, USA.

manager) of the restaurant. Food workers experiencing persistent sneezing, coughing, or a runny nose are not required to be excluded from work. However, these employees should not work with exposed food and may be assigned to duties that minimize the potential for contaminating food and surrounding surfaces and objects (11).

Despite evidence that ill food workers pose a substantial foodborne illness risk, little is known about the experiences and characteristics of workers who work while ill or the factors that may influence their decisions to do so. To fill this knowledge gap, the Environmental Health Specialists Network (EHS-Net) of the Centers for Disease Control and Prevention (CDC) conducted a study designed to describe ill workers' experiences, characteristics, and beliefs and to identify factors related to workers' decisions to work while ill.

The current article presents three sets of data collected for this study. The first set describes food workers' experiences the last time they worked while ill. These data concern all illnesses and illness symptoms, not just those that are potentially foodborne (e.g., vomiting and diarrhea). We chose this broad scope because it is important to understand what happens in restaurants when food workers are ill, regardless of their symptoms. For example, we wanted to understand whether and how managers learn about ill food workers' symptoms; thus, we had to ask about what happens when food workers are ill in general, not what happens when food workers are ill with specific foodborne illness symptoms.

The second set of data describes workers' beliefs about the factors that influence their decisions to work while ill. Again, we chose to focus on all illnesses and illness symptoms rather than only those that are potentially foodborne because it is important to have a general understanding of how food workers think about working while ill. For example, it would be difficult to determine whether and how food workers' decisions to work while ill are influenced by their illness symptoms if we only asked about specific symptoms.

The third set of data describes the frequency with which food workers work while ill with the specific symptoms of vomiting or diarrhea and identifies worker characteristics and beliefs associated with working while experiencing these symptoms. We collected these data to develop a better understanding of how often food workers work while ill with potential foodborne illness and the characteristics and beliefs of these workers. Although the Food Code lists several situations other than vomiting or diarrhea that require exclusion from work, we focused on vomiting and diarrhea because these are the most likely symptoms food workers would have experienced.

MATERIALS AND METHODS

EHS-Net is a network of environmental health specialists and epidemiologists focused on the investigation of environmental factors contributing to foodborne illness and is a collaborative project of the CDC, the FDA, the U.S. Department of Agriculture, and state and local health departments. At the time this study was

TABLE 1. *Description of interview data collected concerning food workers' last experience working while ill, specific factors influencing workers' decisions to work while ill, and workers' likelihood of working with specific symptoms*

| |
|---|
| Workers' last experience working while ill |
| Who made the decision for them to work while ill |
| Why they worked while ill |
| What their symptoms were when they worked while ill |
| Whether their managers had been aware of their symptoms |
| How their managers became aware of their symptoms |
| Whether they behaved differently at work because of the illness |
| How they behaved differently |
| Specific factors influencing workers' decisions to work while ill |
| Not getting paid if they do not work |
| Fear of losing job |
| Fear of other consequences such as losing shifts |
| Not wanting to leave coworkers short staffed |
| Dedication to the job |
| Possibility of making others ill |
| Severity of illness symptoms |
| Type of illness symptoms |
| Workers' likelihood of working with specific symptoms |
| Repeated episodes of vomiting |
| Repeated episodes of diarrhea |
| Sore throat and fever |
| Frequent cough |
| Jaundice with yellow eyes and skin |

conducted, the EHS-Net state and local health departments were located in California, Connecticut, New York, Georgia, Iowa, Minnesota, Oregon, Rhode Island, and Tennessee.

Sample. The study sample consisted of randomly selected restaurants located in predefined geographical areas in each of the nine EHS-Net states. Within each state, data were collected at approximately 50 restaurants. Restaurants were defined as establishments that prepare and serve food or beverages to customers, excluding institutions, food carts, mobile food units, temporary food stands, supermarkets, restaurants in supermarkets, and caterers. Only restaurants with English-speaking managers and English-speaking workers were included in the study, and only one restaurant from any given regional or national chain was included per EHS-Net site.

Data collection. The study protocol was approved by the CDC Institutional Review Board and by the institutional review boards in the participating states. Data were collected in 2008. No data were collected that could identify individual restaurants or staff. Data collectors participated in training designed to increase data collection consistency.

EHS-Net staff telephoned randomly selected restaurants at each EHS-Net site to request study participation and arrange for on-site face-to-face interviews with a kitchen manager (defined as a person with authority over the kitchen) and at least one food worker. To increase participation and cooperation during the study visit, EHS-Net staff asked kitchen managers to choose the food worker(s) to be interviewed. Each manager interview lasted approximately 25 min and assessed the manager's and the restaurant's characteristics; the manager interview data were reported previously (7). Each worker interview lasted approximately 10 min and assessed worker characteristics, including sex,

TABLE 2. Interview data on food workers' characteristics

| Worker characteristic | No. (%) of workers (N = 491) ^a |
|--|---|
| Sex | |
| Male | 239 (48.7) |
| Female | 252 (51.3) |
| Age (yr) | |
| 15–20 | 76 (15.5) |
| 21–30 | 199 (40.5) |
| 31–40 | 84 (17.1) |
| 41+ | 132 (26.9) |
| Education (N = 487) | |
| Less than high school | 74 (15.2) |
| High school diploma and no further education | 203 (41.7) |
| Some college or college degree | 210 (43.1) |
| Primary language spoken | |
| English | 384 (78.2) |
| Spanish | 70 (14.3) |
| Asian language | 20 (4.1) |
| Other language | 17 (3.5) |
| Work experience (yr) | |
| 0 to <2 | 117 (23.8) |
| 2 to <6 | 126 (25.7) |
| 6 to <10 | 93 (18.9) |
| ≥10 | 155 (31.6) |
| No. of primary job responsibilities | |
| 1 | 93 (18.9) |
| 2 | 132 (26.9) |
| ≥3 | 266 (54.2) |
| Job responsibilities^b | |
| Food preparation | 398 (81.1) |
| Cooking | 332 (67.6) |
| Cleaning | 218 (44.4) |
| Dishwashing | 174 (35.4) |
| Food storage | 170 (34.6) |

^a N = 491 unless otherwise noted.

^b Workers were able to provide multiple responses to the question; thus, the numbers of workers responding in this category add to more than 491 and percentages add to more than 100.

age, education, primary language spoken, primary job responsibilities, and years of experience working in food service kitchens.

To contribute to our understanding of what happens in restaurants when food workers are ill, the worker interviews also assessed workers' experiences working while ill. Specifically, workers were asked to recall the last time they had worked while ill (they were told we were interested in instances of occasional illness, not instances of injuries or chronic illnesses for which they may repeatedly miss work). Workers who could recall a time that they had worked while ill were then asked a series of questions about that experience (Table 1). The worker interviews also assessed workers' beliefs about the effect of specific factors on their decisions to work while ill and about their likelihood of working with specific symptoms (Table 1). On a scale of 1 to 5 (1, not at all; 5, a great deal), workers rated the degree to which eight factors influenced their decision to work while ill. On a scale of 1 to 5 (1, not likely; 5, very likely), they also rated how likely they would be to come to work with specific illness symptoms.

TABLE 3. Interview data on food workers' last experience working while ill

| Worker experience | No. (%) of workers ^a |
|--|---------------------------------|
| Ever worked a shift while ill (N = 491) | |
| No | 199 (40.5) |
| Yes | 292 (59.5) |
| Whose decision to work while ill (N = 292) | |
| Worker only | 261 (89.4) |
| Management or owner only | 21 (7.2) |
| Worker and management or owner | 10 (3.4) |
| Reasons for working while ill (N = 292)^b | |
| No paid sick leave or sick leave policy | 127 (43.5) |
| Understaffed or no staff to cover shift | 94 (32.2) |
| Symptoms did not feel bad or not contagious | 90 (30.8) |
| Felt obligated or have strong work ethic | 89 (30.5) |
| Symptoms (N = 288) | |
| Vomiting and/or diarrhea | 19 (6.6) |
| Nausea, upset stomach, stomach "flu" | 47 (16.3) |
| Sore throat and fever | 7 (2.4) |
| Jaundice | 0 |
| Other symptoms | 215 (74.7) |
| No. of symptoms (N = 288) | |
| 1 | 108 (37.5) |
| ≥2 | 180 (62.5) |
| Manager aware of worker's symptoms (N = 288) | |
| No | 106 (36.8) |
| Yes | 182 (63.2) |
| Source of manager's awareness of symptoms (N = 182) | |
| Worker informed manager | 149 (81.9) |
| Manager observed | 24 (12.6) |
| Manager asked | 1 (0.5) |
| Worker informed manager and manager asked | 10 (5.49) |
| Worker behaved differently at work (N = 292) | |
| No | 148 (50.7) |
| Yes | 144 (49.3) |
| No. of behavioral changes (N = 142) | |
| 1 | 114 (80.3) |
| ≥2 | 28 (19.7) |
| Type of behavioral changes (N = 142)^b | |
| Worked shorter hours | 45 (31.3) |
| Washed hands more frequently | 40 (27.8) |
| Worked at slower pace or took frequent breaks | 36 (25.0) |
| Abstained from food handling | 27 (18.8) |

^a Total number of workers interviewed differs among categories because of skip patterns in the interview.

^b Workers were able to provide multiple responses to the question; thus, the numbers of workers responding in this category add to more than 491 and percentages add to more than 100.

TABLE 4. Workers' ratings of specific factors that influence their decisions to work while ill^a

| Factor | No. (%) of workers reporting: | |
|--|-------------------------------|-------------------------|
| | No or little influence | Some or great influence |
| Severity of illness symptoms (<i>N</i> = 480) | 129 (26.9) | 351 (73.1) |
| Type of illness symptoms (<i>N</i> = 474) | 136 (28.7) | 338 (71.3) |
| Possibility of making others ill (<i>N</i> = 484) | 139 (28.7) | 345 (71.3) |
| Dedication to job or work ethic (<i>N</i> = 482) | 167 (34.7) | 315 (65.4) |
| Does not want to leave coworkers short staffed (<i>N</i> = 485) | 195 (40.2) | 290 (59.8) |
| Not getting paid if not working (<i>N</i> = 488) | 251 (51.4) | 237 (48.6) |
| Fear of losing job (<i>N</i> = 487) | 363 (74.5) | 124 (25.5) |
| Fear of other consequences (e.g., losing shifts) (<i>N</i> = 483) | 388 (80.3) | 95 (19.7) |

^a The 5-point rating scale responses were dichotomized into two groups. Responses of 1, 2, and 3 were grouped as "no or little influence" and responses of 4 and 5 were grouped as "some or great influence."

To assess workers' frequency of working while ill with potential foodborne illness symptoms, workers were asked how many shifts they had worked in the previous year while ill with the specific symptoms of vomiting or diarrhea.

The interview questions were open ended, except for the rating scale questions. For these questions, workers were shown the scales in writing.

Data analysis. We used SAS version 9.3 (SAS Institute, Cary, NC) to analyze the data. We conducted univariate analyses to obtain descriptive statistics on workers' characteristics, workers' experiences concerning the last time they worked while ill, workers' ratings of factors influencing their decisions to work while ill, workers' likelihood of working with specific illness symptoms, and the number of shifts workers worked while ill with vomiting or diarrhea during the previous year. For the variables concerning the influences on workers' decisions to work while ill, responses of 1, 2, or 3 were grouped into a category of "no or little influence" and responses of 4 and 5 were grouped into a category of "some or a great deal of influence." For the variables concerning the likelihood of working with specific illness symptoms, responses of 1, 2, or 3 were grouped into a category of "not likely" and responses of 4 and 5 were grouped into a category of "very likely."

We also constructed bivariate and multivariate logistic regression models to examine associations between potential explanatory variables (workers' characteristics, workers' ratings of factors influencing their decisions to work while ill, and the likelihood of workers working with specific illness symptoms) and the outcome variable of whether workers worked one or more shifts in the previous year while ill with vomiting or diarrhea, as reported in their interviews. We considered explanatory variables

that were significant at *P* < 0.30 in the bivariate analysis as potential predictors in the multivariate logistic regression modeling for the odds of working one or more shifts with vomiting or diarrhea in the previous year. We used a stepwise selection method for variable selection and determination of model fit. Variables that were significant at *P* < 0.05 were included in the final model. We tested two-way interaction terms among the significant predictors in the model. No significant interaction terms were found; therefore, they were removed from the final model.

RESULTS

Workers' characteristics. Sixty-seven percent (426 of 637) of managers of eligible contacted restaurants agreed to allow us to conduct the study in their restaurant. We interviewed a manager in 100% of these restaurants and at least one food worker in 92% (391) of these restaurants. In some restaurants, we interviewed more than one worker. In total, we interviewed 491 workers (Table 2). Because of missing data from nonresponse, the percentages reported for worker data were based on responses from 483 to 491 workers. Fifty-one percent of workers were female, 40% were 21 to 30 years of age, 42% had a high school diploma (and no further education), 78% spoke English as their primary language, and 26% had less than 2 years of experience working in food service kitchens. Fifty-four percent had three or more primary job responsibilities; the most frequently reported job responsibilities were food preparation (e.g., washing and cutting food, 81%) and cooking (68%).

TABLE 5. Workers' ratings of their likelihood of working with specific symptoms^a

| Symptom | No. (%) of workers reporting: | |
|---|-------------------------------|-------------|
| | Not likely | Very likely |
| Repeated episodes of vomiting (<i>N</i> = 486) | 475 (97.7) | 11 (2.3) |
| Jaundice with yellow eyes or skin (<i>N</i> = 440) | 427 (97.0) | 13 (2.9) |
| Repeated episodes of diarrhea (<i>N</i> = 486) | 458 (94.2) | 28 (5.8) |
| Sore throat and fever (<i>N</i> = 486) | 403 (82.9) | 83 (17.1) |
| Frequent cough (<i>N</i> = 483) | 302 (62.5) | 181 (37.5) |

^a The 5-point rating scale responses were dichotomized into two groups. Responses of 1, 2, and 3 were grouped as "not likely" and responses of 4 and 5 were grouped as "very likely."

TABLE 6. Workers' characteristics and beliefs associated with working ≥ 1 shift while ill with diarrhea or vomiting in the previous year, bivariate analyses

| Variable | Worked ≥ 1 shift while experiencing diarrhea or vomiting in previous year | | |
|----------------------------------|--|--------------------------|---------|
| | No. (%) of workers | OR (95% CI) ^a | P value |
| Sex | | | |
| Male | 58 (59.8) | 1.77 (1.13–2.79) | 0.01 |
| Female | 39 (40.2) | | |
| Age (yr) | | | |
| 15–20 | 15 (15.5) | 1.54 (0.72–3.30) | 0.10 |
| 21–30 | 49 (50.5) | 2.09 (1.15–3.80) | |
| 31–40 | 15 (15.5) | 1.37 (0.64–2.89) | |
| 41+ | 18 (18.6) | | |
| Education | | | |
| Some college or college degree | 46 (47.4) | 0.92 (0.49–1.73) | 0.29 |
| High school diploma | 34 (35.1) | 0.65 (0.33–1.26) | |
| Less than high school | 17 (17.5) | – | |
| Primary language spoken | | | |
| English | 77 (79.4) | 1.01 (0.53–1.92) | 0.90 |
| Spanish | 14 (14.4) | | |
| Asian language | 4 (4.1) | 1.00 (0.29–3.49) | |
| Other language | 2 (2.1) | 0.57 (0.12–2.79) | |
| Work experience (yr) | | | |
| 0 to <2 | 18 (18.6) | 1.80 (0.94–3.44) | 0.24 |
| 2 to <6 | 31 (32.0) | 1.57 (0.78–3.15) | |
| 6 to <10 | 21 (21.6) | 1.14 (0.60–2.17) | |
| ≥ 10 | 27 (27.8) | | |
| Food preparation | | | |
| Yes | 74 (76.3) | 0.69 (0.41–1.18) | 0.18 |
| No | 23 (23.7) | | |
| Cooking | | | |
| Yes | 60 (61.9) | 0.74 (0.46–1.17) | 0.20 |
| No | 37 (38.1) | | |
| Cleaning | | | |
| Yes | 40 (41.2) | 0.85 (0.54–1.34) | 0.49 |
| No | 57 (58.8) | | |
| Dishwashing | | | |
| Yes | 28 (28.9) | 0.69 (0.42–1.11) | 0.13 |
| No | 69 (71.13) | | |
| Food storage | | | |
| Yes | 39 (40.2) | 1.34 (0.85–2.12) | 0.20 |
| No | 58 (59.8) | | |
| Severity of illness symptoms | | | |
| Some or great influence | 62 (64.6) | 0.61 (0.38–0.98) | 0.04 |
| No or little influence | 34 (35.4) | | |
| Type of illness symptoms | | | |
| Some or great influence | 58 (60.4) | 0.54 (0.34–0.87) | 0.01 |
| No or little influence | 38 (39.6) | | |
| Possibility of making others ill | | | |
| Some or great influence | 59 (62.1) | 0.59 (0.37–0.94) | 0.02 |
| No or little influence | 36 (37.9) | | |
| Dedication to job or work ethic | | | |
| Some or great influence | 71 (73.2) | 1.57 (0.96–2.56) | 0.07 |
| No or little influence | 26 (26.8) | | |

TABLE 6. *Continued*

| Variable | Worked ≥ 1 shift while experiencing diarrhea or vomiting in previous year | | |
|--|--|--------------------------|---------|
| | No. (%) of workers | OR (95% CI) ^a | P value |
| Does not want to leave coworkers short staffed | | | |
| Some or great influence | 71 (74.1) | 2.20 (1.34–3.61) | <0.01 |
| No or little influence | 25 (26.0) | | |
| Not getting paid if not working | | | |
| Some or great influence | 49 (50.5) | 1.10 (0.71–1.72) | 0.66 |
| No or little influence | 48 (49.5) | | |
| Fear of losing job | | | |
| Some or great influence | 40 (41.2) | 2.52 (1.57–4.05) | <0.01 |
| No or little influence | 57 (58.8) | | |
| Fear of other consequences (losing shifts) | | | |
| Some or great influence | 30 (31.9) | 2.31 (1.39–3.84) | <0.01 |
| No or little influence | 64 (68.1) | | |
| Repeated episodes of vomiting | | | |
| Very likely | 5 (5.2) | 3.43 (1.02–11.60) | 0.05 |
| Not likely | 92 (94.8) | | |
| Jaundice with yellow eyes or skin | | | |
| Very likely | 4 (4.6) | 1.82 (0.55–6.06) | 0.33 |
| Not likely | 83 (95.4) | | |
| Repeated episodes of diarrhea | | | |
| Very likely | 15 (15.5) | 5.23 (2.39–11.45) | <0.01 |
| Not likely | 82 (84.5) | | |
| Sore throat and fever | | | |
| Very likely | 31 (32.0) | 3.08 (1.84–5.15) | <0.01 |
| Not likely | 66 (68.0) | | |
| Frequent cough | | | |
| Very likely | 55 (56.7) | 2.73 (1.75–4.24) | <0.01 |
| Not likely | 42 (43.3) | | |

^a OR, odds ratio; CI, confidence interval.

Workers' experiences of working while ill. Almost 60% of workers were able to recall a situation in which they worked while ill (Table 3). Most (89%) of these workers said that the decision to work while ill was solely their decision, 7% said it was solely the management's decision, and 3% said it was a decision made by both the worker and management. Workers most commonly cited the following four reasons for their decision to work while ill: the restaurant did not have paid sick leave or a sick leave policy (43%), the restaurant was understaffed or they or management could not find someone to cover their shift (32%), they did not feel bad or they thought their illness symptoms did not seem contagious (31%), and they felt obligated to other coworkers or had a strong work ethic and did not want to miss work (30%).

When asked to describe their symptoms on the occasion that they had worked while ill, more than 60% of workers described two or more symptoms. Almost 7% said that they had vomiting or diarrhea. Sixteen percent said that they had nausea, upset stomach, or the "stomach flu," i.e., symptoms that could be associated with foodborne illness. About 2% said that they had a sore throat and fever. Other symptoms reported included cough, aches and pains, runny

nose, and headaches. Sixty-three percent of workers also said that a manager knew the nature of their illness symptoms. For most of these workers (82%), their managers knew about their symptoms because the workers told them about it rather than because the manager had asked about or observed the symptoms.

Forty-nine percent of workers said that on the occasion that they had worked while ill they altered their behavior at work because of the illness. Of those who said they behaved differently, 80% made only one behavioral change. The most common changes were working fewer hours (31%), washing hands more frequently (28%), working at a slower and more cautious pace or taking frequent breaks (25%), and abstaining from handling food (19%).

Workers' beliefs about factors that influenced their decisions to work while ill. More than 70% of workers said that the severity of illness symptoms (73%), the type of illness symptoms (71%), and the possibility of making others ill (71%) had some or a great deal of influence on their decisions to work while ill (Table 4). Other factors rated by workers as having some or a great deal of influence

on their decisions to work while ill were dedication to the job or a strong work ethic (65%), not wanting to leave coworkers short staffed (60%), not getting paid (49%), fear of losing job (25%), and fear of other consequences such as losing work shifts (20%).

Workers' likelihood of working with specific illness symptoms. More than 90% of workers said that they would be unlikely to work if they experienced the symptoms of repeated episodes of vomiting (98%), jaundice with yellow eyes and skin (97%), and repeated episodes of diarrhea (94%) (Table 5). Eighty-three percent of workers reported that they would be unlikely to work with a sore throat, and 62% reported that they would be unlikely to work with a cough.

Workers' frequency of working while ill with diarrhea or vomiting. Almost 20% (19.9%, 97 of 487) of workers said that they had worked one or more shifts in the previous year while ill with diarrhea or vomiting. Of those workers, 39.2% (38 of 97) reported doing so on only one shift, and 60.8% (59 of 97) reported doing so on two or more shifts.

Characteristics and beliefs associated with working while ill with diarrhea or vomiting. In the bivariate analysis (Table 6), 19 worker-related variables were significantly associated ($P < 0.30$) with workers having said that they had worked one or more shifts while ill with vomiting or diarrhea in the previous year: sex; age; education; years of work experience; having primary job responsibilities of food preparation, cooking, dishwashing, or food storage; self-reported influences of severity of illness symptoms, type of illness symptoms, the possibility of making others ill, dedication to the job or work ethic, not wanting to leave coworkers short staffed, fear of job loss, fear of other consequences; and self-reported likelihood of coming to work with symptoms of repeated episodes of vomiting, repeated episodes of diarrhea, sore throat and fever, or a frequent cough. These 19 variables were then included in the multivariate analysis.

In multivariate analyses (Table 7), 9 of the 19 worker-related variables were significantly associated ($P < 0.05$) with workers reporting having worked one or more shifts while ill with vomiting or diarrhea in the previous year. Male workers had higher odds of reporting that they worked while ill. Workers responsible for cooking and dishwashing, compared with workers with other primary roles, had lower odds of reporting having worked while ill, and workers responsible for food storage, compared with those with other primary roles, had higher odds of reporting having worked while ill. Compared with workers with <2 years of experience, workers in the other experience categories (2 to <6 years, 6 to <10 years, and >10 years) had higher odds of reporting having worked while ill.

Workers who rated fear of job loss and concern about leaving coworkers short staffed as having influenced their decisions to work while ill, when compared with workers who did not report these influences, had higher odds of reporting having worked while ill. Workers who said that they would be

TABLE 7. Workers' characteristics and beliefs associated with working ≥ 1 shift while ill with diarrhea or vomiting in the previous year, multivariate analyses

| Variable | OR (95% CI) ^a | P value |
|--|--------------------------|---------|
| Sex | | |
| Male | 2.18 (1.25–3.79) | 0.01 |
| Female | | |
| Cooking | | |
| Yes | 0.42 (0.24–0.74) | <0.01 |
| No | | |
| Dishwashing | | |
| Yes | 0.45 (0.24–0.84) | 0.01 |
| No | | |
| Food storage | | |
| Yes | 2.38 (1.28–4.44) | 0.01 |
| No | | |
| Work experience (yr) | | |
| 0 to <2 | | |
| 2 to <6 | 3.08 (1.46–6.50) | 0.03 |
| 6 to <10 | 2.41 (1.04–5.59) | 0.38 |
| ≥ 10 | 1.91 (0.87–4.20) | 0.94 |
| Does not want to leave coworkers short staffed | | |
| Some or great influence | 2.31 (1.31–4.08) | <0.01 |
| No or little influence | | |
| Fear of losing job | | |
| Some or great influence | 2.37 (1.37–4.09) | <0.01 |
| No or little influence | | |
| Repeated episodes of diarrhea | | |
| Very likely | 4.29 (1.68–10.98) | <0.01 |
| Not likely | | |
| Frequent cough | | |
| Very likely | 2.53 (1.51–4.25) | <0.01 |
| Not likely | | |

^a $N = 472$. OR, odds ratio; CI, confidence interval.

likely to come to work while experiencing repeated episodes of diarrhea or a frequent cough had higher odds of reporting having worked while ill than did those workers who said they would not be likely to come to work with these symptoms.

DISCUSSION

This article presents findings on three important facets of working while ill: what happens in restaurants when food workers are ill, workers' beliefs about the factors that influence their decisions to work while ill, and characteristics and beliefs associated with working while ill with specific potential foodborne illness symptoms of vomiting and diarrhea. Findings from this study indicate that workers themselves, without managers' input, predominantly made the decision to work while ill. Almost half the workers who reported having worked while ill noted that the restaurant manager was not aware of their illness symptoms. National guidelines (10, 11) assign to management the responsibility for determining whether ill employees should be excluded

from work. The current Food Code states that managers or persons in charge are responsible for employee health oversight, including decisions regarding exclusion and restriction of ill employees, with a particular focus on food service employees with gastrointestinal illness. Versions of the FDA Food Code have been adopted inconsistently by food regulatory agencies at the EHS-Net study sites, and not all study site jurisdictions required an employee health plan such as those laid out in the 2005 and 2009 versions of the Food Code (10, 11). Nevertheless, best practices guide managers to be involved in decision making about ill workers and to train food workers on their responsibility to report to management information about their health and activities as they relate to foodborne illnesses. The results of this study clearly suggest that these FDA guidelines are not being followed in most restaurants.

About half of food workers who reported having worked while ill said that they altered their behavior while at work. However, most food workers described making only one behavioral change. Some of the behavioral changes, such as working shorter hours and taking more breaks, were likely aimed at worker comfort. Fewer than one-third of food workers described behavioral changes related to food safety, such as washing hands more frequently and avoiding food preparation. These data suggest that food workers are working while ill and are not taking the necessary precautions to prevent their customers from getting ill. From a food safety and worker productivity perspective, these data may call into question the practicality of allowing ill workers to work, either in a full or restricted capacity, rather than simply excluding them from the workplace.

Most workers said that the possibility of spreading illness was a factor that influenced their decisions to work while ill. This finding suggests that food workers are aware of their potential role in the spread of infection. However, many workers said that additional factors had a greater influence on their decisions to work while ill, indicating that the possibility of spreading infection was not always a primary factor in the decision-making process.

A majority of workers also reported that dedication to their job and a desire not to leave the restaurant understaffed influenced their decisions to work while ill. These factors were rated as influential by a higher percentage of workers than were such factors as lack of pay and fear of job or shift loss. Multivariate analyses revealed that workers who cited fear of leaving the restaurant short staffed as a factor in the decision to report to work while ill were also more likely to report that they worked a shift in the past year while ill with vomiting or diarrhea. These findings suggest that many food workers have a sense of responsibility toward their work and coworkers. Training that emphasizes refraining from working while ill and policies and practices that help mitigate pressures to work while ill may help address these factors. This hypothesis is supported by the findings of Sumner et al. (7), who reported that workers in restaurants with on-call staff were less likely to report having worked while ill.

Almost half of food workers rated loss of pay resulting from illness-related absence as an influential factor in their

decisions to work while ill. However, in the multivariate analysis this variable was not significantly related to reports of having worked a shift while experiencing vomiting or diarrhea in the past year. These findings suggest that although workers have concerns about absence-related loss of pay, these concerns do not seem to be primary in decisions about whether to work while ill. Social and personal concerns appear more likely to guide workers' decisions. Efforts to limit the role of ill workers in food preparation should take these factors into consideration.

Workers who reported that they were likely to work while ill with diarrhea were also more likely to report having worked in the past year while ill with vomiting or diarrhea. This finding, although not surprising, suggests a correlation between past and predicted behavior. Workers who reported a high likelihood of working with a frequent cough were also more likely to report having worked a shift in the past year while ill with vomiting or diarrhea, further suggesting that workers who are willing to work with one illness symptom may be more willing to work while ill in general.

In addition to workers' beliefs and reported likelihood of working with specific symptoms, several additional characteristics were associated with reports of having worked in the past year while experiencing vomiting or diarrhea. These characteristics included sex, job responsibilities, and work experience, suggesting that decisions to work while ill are influenced by multiple personal factors. Sumner et al. (7) found that several restaurant characteristics (manager experience, number of meals served by the restaurant, and practices that relieve pressures to work while ill [e.g., on-call workers]) were associated with working while ill. These findings suggest that the decision to work while ill is complex and multifactorial.

This study had certain limitations. The cross-sectional study design limited causal inferences, and findings may not be applicable beyond the scope of the sample population. The managers' choice of workers for participation in the study was a potential source of selection bias. Reported diarrhea or vomiting unrelated to foodborne illness may have resulted in misclassification of some workers' motivations and influences. The study's findings are limited to English-speaking managers and food workers. Cultural differences accounting for alternative beliefs and behaviors among workers and restaurant policies on working while ill may not be adequately communicated to food workers who speak languages other than English.

Food safety practitioners should be encouraged by the finding of some understanding of foodborne illness among food workers, whose decisions appear to be influenced by modifiable factors. Restaurant policies and practices that alleviate workers' concerns regarding understaffing may assist in encouraging ill employees to stay home. Educating managers and workers on their respective responsibilities for making decisions concerning working while ill is important to the food service industry and regulatory agencies. Continued training of managers in their responsibilities regarding ill workers is vitally important, and managers must create a climate of

collaborative communication with food workers about illness and risks to food safety. Training workers on food safety and the connections between contamination and foodborne illness could also contribute to a safety-conscious restaurant environment.

ACKNOWLEDGMENTS

This study was conducted in states receiving CDC grant awards funded under CDC-RFA-EH05-013. The authors thank the restaurant managers and workers who participated in this study and the EHS-Net environmental health specialists who assisted with study design and data collection.

REFERENCES

1. Boxman, I., R. Dijkman, L. Verhoef, A. Maat, G. van Dijk, H. Vennema, and M. Koopmans. 2009. Norovirus on swabs taken from hands illustrate route of transmission: a case study. *J. Food Prot.* 72:1753–1755.
2. Greig, J. D., E. C. D. Todd, C. A. Bartleson, and B. S. Michaels. 2007. Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 1. Description of the problem, methods, and agents involved. *J. Food Prot.* 70:1752–1761.
3. Hedberg, C. W., S. J. Smith, E. Kirkland, V. Radke, T. F. Jones, C. A. Selman, and the EHS-Net Working Group. 2006. Systematic environmental evaluations to identify food safety differences between outbreak and nonoutbreak restaurants. *J. Food Prot.* 69:2697–2702.
4. Hedican, E., C. Hooker, T. Jenkins, C. Medus, S. Jawahir, F. Leano, and K. Smith. 2009. Restaurant *Salmonella* Enteritidis outbreak associated with an asymptomatic food worker. *J. Food Prot.* 72:2332–2336.
5. Jain, S., L. Chen, A. Dechet, A. T. Hertz, D. L. Brus, K. Hanley, B. Wilson, J. Frank, K. D. Greene, M. Parsons, C. A. Bopp, R. Todd, M. Hoekstra, E. D. Mintz, and P. K. Ram. 2008. An outbreak of enterotoxigenic *Escherichia coli* associated with sushi restaurants in Nevada, 2004. *Clin. Infect. Dis.* 47:1–7.
6. Roberts, C. M., J. Archer, T. Renner, P. A. Heidel, D. L. VandeBunte, B. M. Brennan, C. Croker, R. Reporter, S. Nakagawa-Ota, and A. J. Hall. 2009. Norovirus outbreaks on three college campuses—California, Michigan, and Wisconsin, 2008. *Morb. Mortal. Wkly. Rep.* 58:1095–1100.
7. Sumner, S., L. G. Brown, R. Frick, C. Stone, L. R. Carpenter, L. Bushnell, D. Nicholas, J. Mack, H. Blade, M. Tobin-D'Angelo, K. Everstine, and the Environmental Health Specialists Network Working Group. 2011. Factors associated with food workers working while experiencing vomiting or diarrhea. *J. Food Prot.* 74:215–220.
8. Todd, E. C. D., J. D. Greig, C. A. Bartleson, and B. S. Michaels. 2007. Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 3. Factors contributing to outbreaks and description of outbreak categories. *J. Food Prot.* 70:2199–2217.
9. Todd, E. C. D., J. D. Greig, C. A. Bartleson, and B. S. Michaels. 2009. Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 6. Transmission and survival of pathogens in the food processing and preparation environment. *J. Food Prot.* 72:202–219.
10. U.S. Food and Drug Administration. 2005. Food Code 2005. Available at: <http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/Foodcode/FoodCode2005/default.htm>. Accessed 3 December 2012.
11. U.S. Food and Drug Administration. 2009. Food Code 2009. Available at: <http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodCode/FoodCode2009/default.htm>. Accessed 3 December 2012.