Trends in Ownership and Usage of Food Thermometers in the United States, 1998 through 2010

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ABSTRACT

Food safety research has shown that the use of a food thermometer is the best way to ensure that meat, poultry, and other foods reach an internal temperature sufficient to destroy foodborne pathogens. The 1998, 2001, 2006, and 2010 Food Safety Surveys were used to analyze changes in food thermometer ownership and usage for roasts, chicken parts, and hamburgers in the United States. A probit regression model was used to evaluate differing trends in ownership across demographic subgroups, and probit models with sample selection were used to evaluate differing trends in food thermometer usage for roasts, chicken parts, and hamburgers. The Food Safety Surveys are nationally representative telephone surveys tracking consumers’ food safety attitudes and behaviors. Findings from these surveys indicate that the percentage of consumers who own food thermometers has increased from 49% in 1998 to 70% in 2010 (P < 0.05). The use of food thermometers has also increased over this time period but varies by food type. Of those who own food thermometers, a higher percentage reported using thermometers for roasts (76% in 1998 and 82% in 2010, P < 0.05) than for chicken parts (33% in 1998 and 53% in 2010, P < 0.05) and hamburgers (14% in 1998 and 23% in 2010, P < 0.05). The results also show that men, non-Hispanic whites, those with some college education or higher, those with higher incomes, and those 65 years and older were more likely to own food thermometers. After controlling for food thermometer ownership, those aged 18 to 29 years were more likely to use a food thermometer for roasts and chicken parts than those aged 65 to 101 years. The results suggest that educational programs encouraging food thermometer usage should focus first on food thermometer ownership.

The Centers for Disease Control and Prevention estimates that, each year, approximately 1 in 6 Americans (or 48 million people) becomes ill from harmful pathogens in food and that, of these, 128,000 are hospitalized and 3,000 die (19, 24, 25). Pathogens, such as Campylobacter jejuni, Shiga toxin–producing Escherichia coli, and some Salmonella serotypes, can be transmitted from animals to humans via uncooked or undercooked meat and poultry products (2, 3, 18). Therefore, to prevent foodborne illness, meat and poultry must be cooked to a safe minimum internal temperature in order to destroy any harmful pathogens that may be present in the food. Using a food thermometer is the only reliable way to ensure that this internal temperature has been reached, and it is also helpful in preventing the overcooking of foods (31). Furthermore, Hillers et al. (9) suggested that food thermometer usage is one of the most important food handling behaviors that consumers can perform at home.

Recommendations to consumers for food thermometer usage to ensure safe cooking of meat and poultry products are relatively new. When E. coli O157:H7 was first associated with ground beef in the 1980s, the U.S. Department of Agriculture (USDA) recommended that consumers cook hamburgers until the meat was “brown or pinkish brown in the center” (14). However, as a result of research that showed that one out of four hamburgers may be brown in the center before reaching a safe internal temperature, the USDA changed its advice to consumers—instead of using color as an indicator of doneness in hamburgers, consumers should use a food thermometer to ensure that a safe temperature has been reached (14). In May 2000, the USDA launched the “Therm-y” educational campaign to encourage consumers to use a food thermometer when cooking small cuts of meat, such as hamburgers and chicken parts. The USDA also provided guidance to consumers about the safe temperature for various cuts of meat and poultry (31, 32).

In addition to “Therm-y,” other national and local campaigns aimed at consumer adoption of food thermometer usage for small cuts of meat have been conducted. The USDA developed the “Is it Done Yet?” campaign using social marketing principles to encourage parents of children younger than 10 years old to use food thermometers (30). The Partnership for Food Safety Education, a not-for-profit organization composed of industry associations, consumer groups, and the U.S. government, promoted food thermometer

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usage as part of its “FightBac” and “Be Food Safe” campaigns (20). University researchers have also developed educational materials encouraging thermometer usage at home (28).

Previous research examining consumer food handling habits has found that use of food thermometers is relatively low (1, 11, 17, 22, 27). However, few studies have used nationally representative data to investigate trends of thermometer usage over time. In 2003, Cody and Hogue (4) found that the percentage of consumers who used a meat thermometer to check for doneness of red meat, pork, or poultry increased from 22% in 1999 to 25% in 2002. However, this survey did not examine consumer food thermometer usage with specific types of meat individually, such as roasts, chicken parts, and hamburgers. We anticipate that the type of meat being prepared affects the likelihood that consumers will use a meat thermometer. For example, for large roasts, a food thermometer may be easier to use since the meat is thick and the thermometer probe can be easily inserted for an accurate reading. Also, it is difficult to determine visually if the roast is thoroughly cooked. We expect that for smaller cuts of meat, consumers may feel that it is difficult to correctly use a food thermometer and feel that they can assess doneness by other cues.

The purpose of this study was to examine national trends of food thermometer ownership and usage from 1998 to 2010. The ownership of food thermometers and how often consumers use them for three different types of meat and poultry products (roasts, chicken parts, and hamburgers) were explored, as well as demographic differences in food thermometer ownership and usage. The use of food thermometers for each food type was modeled by utilizing a two-stage probit model with sample selection (33) to correct for the sample selection bias introduced by the necessity that consumers must own a thermometer in order to use it.

MATERIALS AND METHODS

Sample. We analyzed data from the Food Safety Surveys (FSS) conducted by the U.S. Food and Drug Administration in collaboration with the USDA in the years 1998, 2001, 2006, and 2010. Respondents were at least 18 years old, resided in the United States, and had a residential telephone. The sample sizes were 2,001 in 1998, 4,460 in 2001, 4,506 in 2006, and 4,460 in 2010. Sampling selection details and response rates have been reported elsewhere (6). This study protocol was approved under exempt review by the institutional review board of the U.S. Food and Drug Administration, Silver Spring, MD.

Questionnaire design. Each FSS contains a set of core questions that are asked in the same format and order, with new questions added after the core but before the demographic questions. The surveys cover many topics related to home food safety practices, attitudes toward food safety, and risk perceptions. All questionnaires were pilot tested with cognitive interviews and pretests. Each survey took an average of 20 minutes to complete.

Variables. In 2006 and 2010, the thermometer ownership question was asked of all respondents, and in 1998 and 2001, it was limited to only those respondents who cook the main meal at least some of the time. The thermometer usage questions were asked of respondents who said they owned a food thermometer and who cooked meat (1998 survey) and cooked meat from raw (2001, 2006, and 2010 surveys). In order to make the surveys comparable across the years, the analysis was limited to those who prepare the main meal at least some of the time and who prepare raw meat or poultry products.

The food thermometer ownership question was, “Do you have a food thermometer, such as a meat thermometer?” The questions about using a food thermometer for roasts, chicken parts, and hamburgers were all worded in a similar fashion, “Thinking of your usual habits over the past year, when you prepare the following foods, how often do you use a thermometer? Would you say, always, often, sometimes, or never?” For this analysis, answers of “always,” “often,” and “sometimes” were coded as using a thermometer for the particular food.

The following demographic variables were examined: gender, education, race/ethnicity, income, age, and U.S. Census geographical region.

Statistical analysis. The data were weighted to adjust for probability of selection (based on number of telephone numbers and number of adults in the household) and to adjust the sample distributions to Current Population Survey distributions in race/ethnicity, education, and gender for the current or previous year of data collection (29). Because of large changes in the age distribution in the 2010 survey, this year was also adjusted by age. Without weighting, certain demographic groups would be over- or underrepresented in the sample. For example, in the unweighted sample in 2010, only 7% of respondents were non-Hispanic blacks. After weighting the sample to match the U.S. Census in 2010, our effective sample had 12% non-Hispanic blacks. The sample disposition has been fully described in Fein et al. (6).

To test significance and develop statistical models, the survey data for all waves of the FSS were concatenated, adding survey year as a variable. Changes in the percentage of respondents who own a food thermometer and who use it for roasts, chicken parts, and hamburgers were separately tested using a chi-square test controlling for multiple comparisons to see if there were any differences between the survey years. For all significant chi-square tests, follow-up differences in proportion tests were conducted between each survey year and the preceding year.

We used probit modeling techniques to examine the effects of demographic characteristics on the probability of owning a food thermometer. Since individuals in our sample either owned or did not own a food thermometer, our dependent variable was binary, taking on the values of 1 or 0, respectively. In such a case, conventional regression techniques, such as ordinary least squares, would produce biased regression coefficient estimates. Also, the predicted probabilities generated by equations estimated using ordinary least squares are not bounded by 0 percent and 100 percent, as the probability of owning a food thermometer must be. See, for example, Greene (7) for more information on probit techniques.

To examine food thermometer usage, we used an application of two-stage techniques first developed by Heckman and extended by Van de Ven and Van Praag (8, 53). The probability of using a food thermometer can only be observed for those individuals that own a food thermometer. Ownership of a food thermometer was not randomly assigned to individuals in our sample. Rather, individuals self-selected into ownership or nonownership by choosing to purchase a food thermometer. Heckman has shown that ordinary least-squares models estimated using sample data in
TABLE 1. Percentage of respondents who cook raw meat and poultry in each survey year who own food thermometers, and percentage of those who own food thermometers who use them for each type of food

<table>
<thead>
<tr>
<th>Sample characteristic</th>
<th>1998</th>
<th>2001</th>
<th>2006</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size (n)b</td>
<td>1,699</td>
<td>3,882</td>
<td>3,745</td>
<td>3,769</td>
</tr>
<tr>
<td>% who own a meat thermometer</td>
<td>49 63 72 70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use for roasts</td>
<td>76 79 79 82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use for chicken parts</td>
<td>33 40 47 53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use for hamburgers</td>
<td>14 21 19 23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a All estimates are based on data weighted by sex, race, and education and also weighted by number of adults and number of telephone lines in the house.
b Sample sizes vary slightly among variables in each survey because of missing data.
c A chi-square test controlling for multiple comparisons and a follow-up difference between proportions test showed a significant difference (P < 0.05) between this year and the previous year for the variable.

which self-selection is present produce biased coefficient estimates. Van de Ven and Van Praag (33) showed that the same principal applies to probit models. We followed the techniques in Van de Ven and Van Praag to estimate two-stage probit models with sample selection.

The two-stage probit model predicts the probability of using a food thermometer for each of the three foods by considering simultaneously the probability of thermometer ownership. In the first stage, the probit model discussed above is used to predict the probability of food thermometer ownership. In the second stage, another probit model is used to predict the probability of food thermometer usage. To adjust for the probability of ownership (and hence correct the coefficient estimates for self-selection), this stage incorporates, as an additional regressor, an estimate of the probability of food thermometer ownership constructed using the coefficients from the first stage. Compared with a probit model of usage probability, the two-stage model can provide more reliable estimates of the effects of demographic characteristics and survey year on the usage probability. The chi-square tests were conducted using SAS 9.1 (1999, SAS System for Windows, Cary, NC), and the probit and two-stage probit models were estimated using STATA 9.2 (2006, College Station, TX).

RESULTS

Descriptive statistics of thermometer ownership and usage over time. Across the 1998 to 2010 time period, ownership of food thermometers has increased from 49% in 1998 to 70% in 2010 (Table 1). A chi-square test controlling for multiple comparisons and follow-up difference between proportion tests showed that there were significant increases in ownership between two of the three survey intervals, i.e., between 1998 and 2001 and between 2001 and 2006. Between 2006 and 2010, the percentage of ownership was the same. During the same time period, the use of thermometers among thermometer owners who prepare each type of food increased for each type of meat. Overall, increases were observed for thermometer use for each type of meat, with significant increases across all three survey intervals for chicken parts. For roasts and hamburgers, only two of three intervals showed significant increases. The use of thermometers for roasts increased from 76% in 1998 to 82% in 2010, for chicken parts from 33% in 1998 to 53% in 2010, and for hamburgers from 14% in 1998 to 23% in 2010.

Thermometer ownership. Unlike ordinary least-squares regression coefficients, probit model coefficients are not easily interpretable because the predicted probability of a particular outcome (in this case food thermometer ownership) is a nonlinear function of the independent variables. Hence, any change in probability in response to a change in an independent variable is not constant over the range of underlying values of that variable. However, the direction and statistical significance of a variable can be directly determined and the probit equation can be used to compute predicted probabilities for specified values of the independent variables. Our independent variables are all categorical, and hence, the coefficients can be used to tell the direction and significance of the effect of being in one category compared to the effect of being in the reference category, holding all other variables in the model constant.

The probit model estimating the probability of owning a food thermometer shows a number of significant variables (Table 2). For the variable ‘‘year,’’ all of the coefficients are significant and positive. This means that compared with the reference year of 1998, consumers were more likely to own a food thermometer in 2001, 2006, and 2010.1 Men were more likely to own one than women. Non-Hispanic blacks, Hispanics, and those of other races were less likely to own a food thermometer than non-Hispanic whites. Consumers with some college or a college degree or higher were more likely to report owning a food thermometer than those with less than a high school education. All consumers younger than 65 years old were significantly less likely to own food thermometers than those older than age 65. Consumers who lived in the Northeast were less likely to own a food thermometer than those living in the Midwest region of the United States. Consumers in four income categories $>30,000 were more likely to own a food thermometer than consumers in the $30,000 income category.

Uses of thermometer. There were a number of significant effects in the Heckman sample selection models for predicting use of a food thermometer for cooking roasts, chicken parts, and hamburgers. For cooking roasts, there are significant effects for race/ethnicity, age, and region, but survey year is not significant. Non-Hispanic blacks, Hispanics, and those of other races are all more likely to use a food thermometer for roasts than non-Hispanic whites.

1 In general the predicted probability of owning a food thermometer (\( \hat{y} \)) can be computed as \( \hat{y} = \Phi(bX) \), where \( b \) represents the coefficient estimates, \( X \) represents the independent variables, and \( \Phi() \) is the cumulative normal distribution function. For example, the probability of owning a food thermometer is 0.42 in 1998 (our reference year) and 0.66 in 2010 for individuals in all the other reference categories (non-Hispanic white women, with less than a high school education, aged 65 and older, in the Midwest, with incomes of $30,000 or less).
Those aged 18 to 29 years are more likely to use a food thermometer, and those aged 40 to 49 and 50 to 65 years are less likely to use a food thermometer for roasts than those aged 65 and older. Finally, those living in the Northeast region are more likely to use a food thermometer for roasts than those living in the Midwest.

Survey year, race/ethnicity, age, and region were significant in predicting usage of a food thermometer for chicken parts. In every survey year since 1998, consumers were more likely to use a food thermometer for chicken parts than in 1998. Non-Hispanic blacks were less likely and those of other races more likely to use a food thermometer for chicken parts than non-Hispanic whites. Those aged 18 to 29 and 30 to 39 years were more likely to use a food thermometer for chicken parts than those aged 65 and older. Finally, those living in the Western region were less likely than those living in the Midwest to use a food thermometer for chicken parts.

### TABLE 2. Probit and Heckman probit regression coefficients of owning and using a food thermometer for preparing roasts, chicken parts, and hamburgers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ownership probit results</th>
<th>Roasts</th>
<th>Chicken parts</th>
<th>Hamburgers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Significance level</td>
<td>Coefficient</td>
<td>Significance level</td>
</tr>
<tr>
<td>Sample size (n)</td>
<td>Ownership</td>
<td>10,711</td>
<td>10,516</td>
<td>10,644</td>
</tr>
<tr>
<td>Usage</td>
<td>6,974</td>
<td>7,102</td>
<td>6,037</td>
<td></td>
</tr>
<tr>
<td>Survey year (1998)</td>
<td>2001</td>
<td>0.35</td>
<td>***</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>0.66</td>
<td>***</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>0.61</td>
<td>***</td>
<td>0.15</td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>Male</td>
<td>0.11</td>
<td>**</td>
<td>0.04</td>
</tr>
<tr>
<td>Race/ethnicity (non-Hispanic white)</td>
<td>Non-Hispanic black</td>
<td>−0.42</td>
<td>***</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>−0.35</td>
<td>***</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Other race</td>
<td>−0.17</td>
<td>*</td>
<td>0.39</td>
</tr>
<tr>
<td>Education (&lt;high school)</td>
<td>High school graduate</td>
<td>0.10</td>
<td></td>
<td>−0.07</td>
</tr>
<tr>
<td></td>
<td>Some college</td>
<td>0.25</td>
<td>***</td>
<td>−0.03</td>
</tr>
<tr>
<td></td>
<td>College degree or higher</td>
<td>0.18</td>
<td>*</td>
<td>0.09</td>
</tr>
<tr>
<td>Age (65–101)</td>
<td>18–29</td>
<td>−0.51</td>
<td>***</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>30–39</td>
<td>−0.36</td>
<td>***</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>40–49</td>
<td>−0.21</td>
<td>***</td>
<td>−0.18</td>
</tr>
<tr>
<td></td>
<td>50–64</td>
<td>−0.12</td>
<td>*</td>
<td>−0.15</td>
</tr>
<tr>
<td>Region (Midwest)</td>
<td>Northeast</td>
<td>−0.18</td>
<td>**</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>South</td>
<td>−0.08</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>−0.10</td>
<td></td>
<td>−0.06</td>
</tr>
<tr>
<td>Income (≤$30,000)</td>
<td>$30,001–$50,000</td>
<td>0.33</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$50,001–$70,000</td>
<td>0.51</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$70,001–$100,000</td>
<td>0.62</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$100,001–$160,000</td>
<td>0.84</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−0.21</td>
<td>*</td>
<td>0.80</td>
<td>***</td>
</tr>
<tr>
<td>rho</td>
<td>−0.28</td>
<td></td>
<td>0.36</td>
<td></td>
</tr>
</tbody>
</table>

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a All estimates are based on data weighted by sex, race, and education and also weighted by number of adults and number of telephone lines in the house. The sample was combined across years for this analysis.

b Reference categories are in boldface and shown in parentheses.

c *, P < 0.05; **, P < 0.01; ***, P < 0.001.
Survey year was also highly significant in the model predicting food thermometer use for hamburgers. Food thermometer usage with hamburgers in 2001, 2006, and 2010 was significantly higher than in 1998. Gender was also significant, with men more likely to report using a food thermometer for hamburgers than women. Education was also significant; those with a college degree or higher were less likely to use a food thermometer for hamburgers than those with less than a high school education. Race/ethnicity, age, and region were not significant predictors of using a food thermometer for hamburgers.

**DISCUSSION**

In order to use a food thermometer, consumers must first own a food thermometer, want to use it, and finally, feel that they have the skills needed to use it properly. Since ownership is a precursor to using a food thermometer, we analyzed the trends in owning a food thermometer separately from the trends of using it. For consumers who own food thermometers, we expected to find differences in usage by meat type. Therefore, we analyzed use of a food thermometer for roasts, chicken parts, and hamburgers separately.

The trends in food thermometer ownership and usage for the three types of meat are similar. During the 1998 to 2010 time frame, food thermometer ownership has increased. Controlling for demographic differences and self-selection into food thermometer ownership, thermometer usage for chicken parts and hamburgers but not roasts has also increased over these survey years. In each survey year, thermometer usage was highest for roasts. The most dramatic change of all the reported trends is in the percentage of consumers who own a food thermometer (49% in 1998 to 70% in 2010).

We anticipate that there were a number of factors that contributed to this large increase. First, in 2000, the USDA changed its advice to consumers, recommending that they use food thermometers when cooking hamburgers and other small cuts of meat (14). The USDA and others promoted this message with a number of research-based educational campaigns, including “ThermY,” “Is it Done Yet?,” and “FightBac” (20, 30). While the FSS did not specifically ask consumers why they use a food thermometer or ask directly about exposure to food safety educational campaigns, the results suggest that the messages promoted by these educational campaigns are reaching consumers either directly or indirectly via the news media. These results are also somewhat consistent with other food safety trends. Fein et al. (6) found that over the 1993 to 2010 time frame, overall food handling improved at the same time the number of media stories related to food safety also increased, suggesting that consumers have become more attentive to food safety in the home. It is also probable that relatively inexpensive food thermometers were readily available during this time. A survey of the availability of food thermometers in Washington State and Idaho found that, on average, 70% of stores (73% of grocery stores) surveyed had thermometers for sale (16).

Another major finding of our study is that thermometer usage varies by food type. We found that consumers are much more likely to use a food thermometer for roasts than for smaller cuts of meat like chicken parts and hamburgers. This result is consistent with other research that has found that consumers are resistant to using food thermometers, especially for small cuts of meat (1, 11, 17, 22, 27). Some of the main barriers include that it is difficult to use most food thermometers on small cuts of meat since the tip of the thermometer must be inserted deep enough into the meat to get an accurate temperature and that, in general, food thermometers are hard to calibrate (13). Additionally, people think they know when food is done by taste and texture (12, 17, 22, 27). Popular TV cooking shows further promote the idea that experienced cooks do not need a food thermometer to know when food is done (15).

We found significant demographic differences in food thermometer ownership and usage. Not surprisingly, consumers with higher incomes and higher levels of education were more likely to own food thermometers than those with lower levels of income and education. This suggests that the price of food thermometers may prevent those with lower incomes from purchasing food thermometers (26). We also found that older adults were more likely to own food thermometers than younger adults. This is consistent with the focus group findings that seniors have more experience and familiarity with food thermometers than younger adults (12). Also, men were slightly more likely to own food thermometers than women. Since food thermometers are generally owned by a household, not individuals, it is not clear if men are more likely to purchase a food thermometer or merely live in households where someone else has purchased a food thermometer.

In general, the demographic effects of food thermometer usage are not consistent across food types and are only somewhat consistent with other food handling skills (6, 21, 23). Fein et al. (6) found that men, those with higher levels of education, the youngest and oldest, and Hispanics had the least safe food handling behaviors. We also found that those with higher levels of education are less likely to use food thermometers. Scheule found that cost may be a barrier preventing lower-income women from owning and hence using food thermometers (26). One study found that older adults were more likely to own food thermometers than younger adults. This is consistent with the focus group findings that seniors have more experience and familiarity with food thermometers than younger adults. Also, men were slightly more likely to own food thermometers than women. Since food thermometers are generally owned by a household, not individuals, it is not clear if men are more likely to purchase a food thermometer or merely live in households where someone else has purchased a food thermometer.

The demographic differences between using a food thermometer and other food handling skills are not completely surprising since using a food thermometer is different from other good food handling behaviors, such as washing cutting boards or promptly refrigerating foods, which do not require the purchase of a special instrument and specialized skills for performing it correctly. Observed demographic and other differences support the idea that educational programs promoting food thermometer usage should be designed differently than those for other food handling behaviors.
For example, compared with older consumers, younger cooks may feel that they have less experience and feel less confident about their own cooking skills. This lack of confidence in their own ability to know when meat or poultry is cooked by taste or texture may encourage them to use food thermometers, if they own one. Since they are less likely to own a food thermometer but more likely to use it when they own it (for roasts and chicken parts), programs to promote food thermometer usage by younger adults should first focus on encouraging them to own a thermometer. 

This study had a number of strengths and limitations. The main strengths are that the data are nationally representative and, by asking the same questions across time, we were able to track changes in food thermometer ownership and usage from 1998 to 2010. Also, unlike other studies, by applying a two-stage probit model with sample selection, we were able to control for the self-selection bias inherent in the thermometer usage questions. Unfortunately, questions about perceived benefits of food thermometer usage and reasons for not using food thermometers were not included in the survey. Other studies (27) have shown that behavioral intentions, subjective norms, and perceived control affect food thermometer usage. Ideally, these constructs would be included in our models for predicting thermometer ownership and usage. Since the survey is of individuals who are randomly selected in households with more than one adult and, generally, households, not individuals within the household, own food thermometers, it is possible that the demographic results of the food thermometer ownership model may be biased. Also, like other random digital dialing telephone surveys, the response rates for the FSS have been declining over time (5, 10). Finally, there is the potential for bias due to the nature of the self-reported data. For example, individuals may tend to overreport thermometer ownership and usage because they understand the benefits of such usage and believe they “should” be using one or even believe they are using thermometers more than they actually do.

In conclusion, we found that food thermometer ownership and usage for chicken parts and hamburgers but not roasts has increased over the 1998 to 2010 time frame. However, food thermometer usage for small cuts of meat, such as chicken parts and hamburgers, remains relatively low.

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