Citation:

Kosa KM, Cates SC, Karns S, Godwin SL, Chambers D. Consumer home refrigeration practices: Results of a web-based survey. *J Food Prot.* 2007 Jul; 70 (7): 1,640-1,649.

PubMed ID: 17685337

Study Design:

Cross-sectional study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

NEUTRAL: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- To collect data on refrigerator thermometer ownership, home refrigerator temperatures and the frequency of cleaning for home refrigerators
- The demographic characteristics of consumers who do and do not follow government-recommended refrigerator practices were also assessed.

Inclusion Criteria:

- Adults over age 18 living in the United States
- Having a telephone number.

Exclusion Criteria:

Households without telephones (2.4% of US households) were not included in the sample.

Description of Study Protocol:

Recruitment

- Nationally representative sample of US adults
- The sample was selected from a Web-enabled panel developed and maintained by Knowledge Networks, a survey research firm. The Web-enabled panel is designed to be representative of the US population and is based on a list-assisted, random-digit-dial sample drawn from all 10-digit telephone numbers in the US
- Sample was stratified to provide results for pregnant women (aged 18 to 40 years), older adults (60 years and older) and the remaining population.

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Design

Cross-sectional study.

Statistical Analysis

- Respondents from the three subpopulations were combined, and the data were weighted to reflect the selection probabilities of sampled units and to compensate for differential non-response and under-coverage
- The final weights were trimmed and scaled to sum to the total US population 18 years or older so that the weighted survey results were representative of the US adult population
- Weighted frequencies were calculated for each survey question
- For each comparison, sociodemographic and other variables were included in the analysis
- Chi-square tests were performed for relationships between the variables of interest and various sociodemographic and other variables.

Data Collection Summary:

Timing of Measurements

- All respondents were mailed a refrigerator thermometer and completed a questionnaire
- Prior to survey administration, the survey instrument was pre-tested with 12 adults from the target population using cognitive interviewing techniques and refined
- Data were collected over a 21-day field period.

Dependent Variables

- Refrigerator thermometer ownership before the survey
- Home refrigerator temperature at the time of the survey
- The last time respondents cleaned the inside of their home refrigerators; this information was collected from half of the older adult respondents and half of the respondents from the remaining population.

Independent Variables

Sociodemographic and other information:

- Gender
- Age
- Educational background
- Marital status
- Household size
- Race or ethnicity
- Household income

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- Metropolitan status
- Whether or not a member of the household had been diagnosed with diabetes, kidney disease, or another condition that weakens the immune system.

Description of Actual Data Sample:

- *Initial N:*
  - Approximately 28,000 panel members were actively participating at the time of sample selection
  - An e-mail was sent to 5,074 female panel members (aged 18 to 40 years) to collect information on pregnancy
  - Census information was collected on the 296 women who reported that they were pregnant
  - Another 1,059 older adults and 1,073 adults from the remaining population were randomly selected for a total sample size of 2,428 adults
- *Attrition (final N):* 2,060 adults
  - 48.3% male, 51.7% female
  - 249 pregnant women
  - 946 older adults
  - 865 subjects in remaining population
- *Age:*
  - 21.7% were aged 18 to 29 years
  - 29.2% were aged 30 to 44 years
  - 27.1% were aged 45 to 59 years
  - 10.8% were aged 60 to 69 years
  - 11.2% were aged 70+ years
- *Ethnicity:*
  - 69.7% were White, non-Hispanic
  - 11.0% were Black, non-Hispanic
  - 3.0% were Other, non-Hispanic
  - 12.9% were Hispanic
  - 3.5% were Multiracial, non-Hispanic
- *Other relevant demographics:*
  - 28.8% were 60 years or older
  - 2.4% were pregnant
  - 14.0% were diagnosed with diabetes or kidney disease
  - 3.1% were diagnosed with a condition that weakens the immune system
- *Location:* United States.

Summary of Results:

Respondents' Ownership of Refrigerator Thermometers Before the Survey

Variables	Pregnant Women (N=249)	Older Adults (N=946)	Total Population (N=2,060)

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Owners	15 (8.8%)	151 (15.4%)	243 (10.7%)
Non-owners	234 (91.2%)	789 (83.8%)	1,810 (89.1%)
No response	0 (0%)	6 (0.8%)	7 (0.2%)

Respondents' Refrigerator-cleaning Practices at Least One Month Before the Survey

Variables	Pregnant Women (N=249)	Older Adults (N=466)	Total Population (N=1,144)
Cleaned at least one month prior	104 (48.3%)	231 (49.7%)	527 (47.4%)
Did not clean at least one month prior	145 (51.7%)	235 (50.3%)	617 (52.6%)

Other Findings

- About half of all respondents had cleaned their refrigerators at least one month before the survey
- Only 11% of all respondents had a thermometer in their refrigerator before the survey
- Older adults (15.4%) were significantly more likely than the remaining population (9.4%, P=0.0018), but not significantly more likely than pregnant women (8.8%, P=0.1131) to own a refrigerator thermometer
- 72% of all respondents reported that their refrigerators were at the recommended temperature
- Older adults (77.5%) were more likely than the remaining population (70.4%, P=0.0057) to have their refrigerators at the recommended temperature but not significantly more likely than pregnant women (70.9%, P=0.1174)
- Older adults who were not married and who lived alone were less likely to have refrigerator thermometers and to have their refrigerators at a recommended temperature ($P<0.05$)
- For all respondents, those who had previously owned a refrigerator thermometer were more likely to have their refrigerators at the recommended temperature than were respondents who did not previously own a thermometer ($P<0.01$)
- This same finding was observed in the sub-population of older adults (P=0.0317) and the remaining population (P=0.0008), but not for pregnant women.

Author Conclusion:

- Food safety educators can use the survey findings and results of previous research to target educational materials and help consumers, especially those at risk for listeriosis, to safely store refrigerated foods at home
- The survey findings provide evidence of the need to educate consumers on the recommended refrigerator temperature of 40°F or below and the importance of using a thermometer to

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monitor refrigerator temperature
- We found that consumers could benefit from information on how to keep refrigerated foods at a safe temperature.

Reviewer Comments:

- *Nationally representative sample*
- *Not all respondents completed all questionnaire information*
- *Authors note that the resulting sample size of pregnant women was relatively small, which may have limited the ability to detect differences in survey estimates among the subpopulations*
- *Self-reported practices may not always reflect actual practice.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes

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2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	???
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	???
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	???
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	???
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	???
4.1.	Were follow-up methods described and the same for all groups?	???
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	???
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A

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5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	???
7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	???
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes

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8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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