Food Control 62 (2016) 381–389

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

Importance of cohorts in analyzing trends in safe at-home food-handling practices

Mario F. Teisl[a,*], Amy M. Lando[b], Alan S. Levy[b], Caroline L. Noblet[a]

[a] School of Economics, 5782 Winslow Hall, University of Maine, Orono, ME 04469, USA
[b] Center for Food Safety and Applied Nutrition, Food and Drug Administration, 5100 Paint Branch Parkway, College Park, MD 20740, USA

ARTICLE INFO

Article history:
Received 21 June 2015
Received in revised form 20 October 2015
Accepted 27 October 2015
Available online 2 November 2015

Keywords:
Birth cohort
Safe food handling
Trends

ABSTRACT

Safe in-home food preparation is the last line of defense for preventing foodborne illness. The Food Safety Survey assessing consumers' food handling behavior has been conducted every 3–5 years (1993, 1998, 2001, 2006, 2010) using a random digit telephone sample of United States adult consumers. Sample sizes ranged from 1620 to 4547. A previous analysis of this data has examined trends in safe food handling (as measured by washing hands and/or cutting boards after touching/cutting raw meat or chicken and by washing hands after cracking eggs). We continue and expand this analysis by modeling the unique effects of age, survey period (year) and birth cohort on safe food handling. We find that age, period, and cohort effects are relevant in measuring changes in food handling behavior; however, the effects are not similar in size or apparent mediating process. The strongest effect is period, followed by age and cohort. Thus it appears contemporaneous changes in information activity can make relatively large short-run improvements, whereas changes in one's maturation and accumulated experience have quadratic effects, and the unique shared experience of cohort leaves its own definite long-lasting imprint. We propose that the birth cohort effects can be explained by the food safety environment during young adulthood. Those who were young adults in two critical time periods – before 1940 when there were widespread foodborne infections and immediately after the 1993 outbreak of *Escherichia coli* O157:H7 – have better food handling behaviors.

1. Introduction

A large number of foodborne illnesses are due to in-home food safety failures (Ryan, Wall, Gilbert, Griffin, & Rowe, 1996). Thus, proper in-home food handling, storage and preparation (hereafter, safe handling) are the last line of defense for preventing these illnesses (Brennan, McCarthy, & Ritson, 2007; Redmond & Griffith, 2003a; Unusan, 2007). Foodborne pathogens[1] cause 48 million illnesses,[2] 128,000 hospitalizations and 3000 deaths per year in the United States (Painter et al., 2013; Scallan et al., 2011); the annual cost for these illnesses is estimated to be about $78 billion (Scharff, 2012).[3] Given the complex nature of the food safety system it is unclear what percent of these illnesses occur due to food safety failures in the home; e.g., studies provide ranges from 12 to 17 percent (Redmond, Griffith, Slader, & Humphrey, 2004) to 50–80 percent (Eves et al., 2006).

A number of studies use cross-sectional data to examine how food safety awareness, perceptions and behaviors vary across populations (e.g., Byrd-Bredbenner, Maurer, Wheatley, & Schaffner et al., 2007; Cates et al., 2006; Jevšnik, Hoyer, & Raspor, 2008; Osaili, Obeidat, Abu Jamous, & Bawadi, 2011; Redmond & Griffith, 2003a). Longitudinal analyses aimed at understanding how food safety messages work, typically examine short-run reactions to information about specific food safety issues or perceived failures (Kalaitzandonakes, Marks and Vickner, 2004; Mayer & Harrison, 2012; Piggott & Marsh, 2004; Verbeke & Ward, 2001). Less common are studies that examine longer-run trends in food safety perceptions and behaviors (some examples: Fein, Lando, Levy, & Teisl, 2011; Lando & Chen, 2012; Verrill, Lando, & O'Connell, 2012; De Jonge, Van Trijp, Renes, & Frewer, 2010), possibly due to the lack of longer-run data series with consistent measures and procedures (Fein et al., 2011).

Using the 1988–2010 U.S. Food and Drug Administration's (FDA) Food Safety Surveys (FSS), Fein et al. (2011) examined trends in

* Corresponding author.
E-mail address: teisl@maine.edu (M.F. Teisl).

[1] See Newell et al. (2010) for a review of major pathogens.

[2] Globally, more than two billion people annually suffer from foodborne illness (Panalimentos 2008).

[3] At-home foodborne illnesses are less likely to be reported (Karabudak, Bas, & Kiziltan, 2008; Redmond & Griffith, 2003a, 2003b) as often the symptoms are self-diagnosed as the flu; hence, reported cases are an underestimate of the actual total (Forsythe, 2002).

http://dx.doi.org/10.1016/j.foodcont.2015.10.040
0956-7135/

safe handling as well as the factors that influence these trends. Here we expand this analysis by examining the unique effects of age, survey period (year) and birth cohort on safe handling. According to Yang and Land (2008), age measures physiological changes, accumulation of experience, and changes in role or status; survey period measures short-run changes over time periods that affect all groups; and birth cohort (measured here in 10 year increments) measures long-run changes across groups of individuals who share unique experiences. In essence, studying cohorts can provide a record of social changes (Keyes, Utz, Robinson, & Li, 2010) which impact long-term habits. Our focus on cohorts is to determine if changes in the food safety landscape (e.g., changes in food safety and health knowledge, technologies etc.) has a long-term impact on today's safe handling behaviors. Understanding these unique effects can help identify which groups are in most need of targeted education efforts and what efforts are likely to be successful in improving safe handling behaviors.

To clearly identify the separate effects of age, time period and birth cohort requires an age–period–cohort (APC) analysis. Although APC analysis has been used to estimate trends in food consumption (Mori & Saegusa, 2010; Mori & Stewart, 2011; Stewart, Dong, and Carlson, 2012) and food-related health outcomes (e.g. heart attacks: Jhun, Kim, & Cho, 2011; obesity: Jaacks, Gordon-Larsen, Mayer-Davis, Adair, & Popkin, 2013; BSE: Ducrot et al., 2010; stomach cancer: Da Li et al., 2012), our study represents the first APC application focused on explaining trends in safe handling.

1.1. Literature review

For this work we follow the safe handling model where food handling is a function of people's personal characteristics (e.g. age, gender etc.), their role as food preparer, and their perceptions of the food safety risk. Further risk perceptions are a function of people's personal characteristics, knowledge gained through information (e.g., from the news media) and experience. We hypothesize our period effects will identify short-run information effects while our cohort effects will identify longer-run shared experiences.

1.1.1. Major routes of food handling failures

Although there are a multitude of factors (e.g., improper refrigeration (Taché & Carpentier, 2014), non-use of meat thermometers (Lando & Chen, 2012), and eating undercooked meat (Kosa, Cates, Bradley, Chambers, & Godwin, 2015))[4] that impact the likelihood of a food safety failure in the home, poor hand[5] washing (Bloomfield, Aiello, Cookson, O'Boyle, & Larson, 2007; Taché & Carpentier, 2014; VanAsselt, De Jong, De Jonge, & Nauta, 2008) and cleaning of surfaces, like cutting boards (McCarthy et al., 2007; Sanlier, 2009; Van Asselt, de Jong, de Jonge, and Nauta 2008) are major problem areas.[6] For this study our food safety behavior (our dependent variable) focuses on washing hands and cutting boards.

1.1.2. Individual characteristics

Individuals differ in their food handling practices. People with poor practices were less experienced, e.g., more likely to cook infrequently (Fein et al., 2011), and have been cooking for a shorter time (Bearth, Cousin, & Siegrist, 2014). Women are more likely to be "safer cooks" (Fein et al., 2011; Unusan, 2007). Bearth et al. (2014) found younger[7] people had less safe behaviors while Fein et al. (2011) find that both younger (less than 30) and older (more than 65) people have relatively worse behaviors. Several studies have examined the effect of race on safe handling.[8] Rimal, Fletcher, McWatters, Misra, and Deodhar (2001) found whites were less flexible in changing their food safety behaviors; Fein et al. (2011) did not find a difference in behaviors between whites and blacks but they did find Hispanics had relatively worse food safety behaviors. Kwon, Wilson, Bednar, and Kennon (2008) found behaviors by whites were better than blacks and Hispanics. People who are more educated are less likely to perform safe food behaviors (Bearth et al., 2014; Fein et al., 2011; Patil, Cates, & Morales, 2005; Rimal et al., 2001).

1.1.3. Risk perceptions

Increasing food safety knowledge is not enough as many studies suggest disconnects exist between knowledge and behavior (Clayton, Griffith, & Price, 2003; Mullan, 2010), indicating knowledge is necessary but not sufficient to induce behavior change (Taché & Carpentier, 2014; Wilcock, Pun, Khanona, & Aung, 2004). Risk perceptions seem to be more important in driving safe food handling (Bearth et al., 2014; Roseman & Kurzynske, 2006; Schwarzer, 2008).

Lower risk perceptions are correlated with unsafe handling (Bearth et al., 2014; Redmond & Griffith, 2004; Roseman & Kurzynske, 2006) and individuals differ in their perceptions and knowledge of food safety risks. Women are more concerned about the safety of food (Knight & Warland, 2004; Worsfold, 2006), distrust government to protect the safety of the food supply and perceive more risk (Frewer, 2000). Older people are less confident in the safety of food (De Jonge et al., 2010). Higher income individuals perceive less risk from foods (Frewer, 2000). Race may play a role in food safety concern where some studies find that blacks are more likely to be concerned about food safety (Knight & Warland, 2004) than whites; however other work (Rimal et al., 2001) did not find a difference in concern between whites and non-whites. People who are more educated are more aware of food safety issues, and had higher levels of confidence in the safety of food (De Jonge et al., 2010).

Research indicates social (Mayer & Harrison, 2012) and news media (Fleming, Thorson, & Zhang, 2006; Verbeke, Viaene, & Guiot, 1999) can often affect people's perceptions of food safety risks (Brady, Li, & Brown, 2009). People who can remember food safety incidences are more likely to have lowered expectations about the safety of food, and these memories are more likely to be triggered when news media activity (newspaper accounts) is frequent and relatively recent (De Jonge et al., 2010), and people's consumption of television and radio (but not newspapers) is more frequent (Brady et al., 2009). However, one-time events may have limited impact (Brady et al., 2009) and may only heighten risk perceptions toward specific foods or food groups (Fleming et al., 2006; Verbeke et al., 1999). Generating heightened risk perceptions toward foods in general, may require a number of food scares that vary across a range of pathogens, foods and systems (De Jonge et al., 2010). To increase risk perceptions some have suggested presenting information about: the severity of consequences (Bearth et al., 2014), the reality that food pathogens and their risks are ever changing, the recent increase in antimicrobial resistance (Newell et al., 2010), the

[4] See Taché and Carpentier (2014) for a more complete review of these factors.

[5] Hands effectively transfer pathogens (Beumer & Kusumaningrum, 2003).

[6] Improper washing (DeDonder et al., 2009; Redmond & Griffith, 2003b) either before or at critical times during food preparation, e.g., after handling raw products, has been observed in several studies (Anderson, Shuster, Hansen, Levy, & Volk, 2004).

[7] Kennedy et al. (2011) suggest young people's worse food safety behaviors can be explained by their lack of cooking experience.

[8] Many factors may be reflected by differences in race; e.g., differences in "food preparation habits" (Charles & Lasky, 2007; pg. 51), types of food eaten, level of food safety knowledge, lack of resources (Quinlan, 2013) or access to foods of higher food safety (Koro, Anandan, & Quinlan, 2010).