Food Safety and Technology (2010 Dietary Guidelines Advisory Committee)

Overview, Needs for Future Research

Overview:

The Food Safety and Technology Subcommittee (SC) conducted Nutrition Evidence Library (NEL) systematic reviews on three primary families of questions:

- In-home favorable techniques and behaviors for food safety
- New technologies related to food safety in the home
- Risks and benefits associated with seafood consumption.

As in 2005, the 2010 Dietary Guidelines Advisory Committee (DGAC) reviewed the evidence on food safety techniques for application in the home including those on food storage, food preparation and handling, personal hygiene, and management of cooking utensils. Additionally, the SC conducted NEL systematic reviews to examine consumer behaviors related to favorable techniques for preventing foodborne illness. The literature search generally covered 2004 through 2009, with slight variations in date ranges by topic.

While the basic pillars of food safety in the home remain unchanged, the SC considered recent technological developments that may assist consumers in their food management practices. Thus, the second area of formal review encompassed common and emerging technologies associated with items such as thermometers, food contact surfaces and sanitizers. Although this topic was not previously addressed by the 2005 DGAC, the literature search date range for NEL systematic review was limited to 2004 through 2009 because information has emerged only recently.

In addition to the questions stated previously, the 2010 DGAC conducted literature searches for two other questions on aspects of in-home technologies: 1) technological materials that may be effective in increasing the shelf life of foods, and 2) the accessibility and economical practicality of effective technological materials that are designed to improve food safety or increase shelf life. These questions did not result in enough evidence to draw any conclusions.

Originally presented in the 2005 DGAC Report, SC also conducted a review to update the evidence on methyl mercury exposure from seafood. This review focused on the new evidence related to the benefit-risk ratios associated with seafood consumption and health outcomes published since

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2007. The impact of exposure to persistent organic pollutants (POPs) also is addressed in the review of the literature for this question. A formal search of the evidence-based literature began in 2007 because a report published that year from the Institute of Medicine, Seafood Choices-Balancing Benefits and Risks (IOM, 2007), provided an evidence-based assessment of the methyl mercury and POPs issues from the 2005 Report through 2007.

Needs for Future Research:

Food Safety in the Home

1. Improve the validity of self-reported food safety behaviors.

- **Rationale:** The great majority of the published descriptive epidemiology on US food safety consumer behaviors is based on self-report. Food safety self-reported behaviors are subject to "social desirability" biases. This is particularly evident among hygiene/cleaning behaviors.

2. Understand how to improve consumers' food safety knowledge, attitudes, self-efficacy, internal locus of control and ultimately behaviors.

- **Rationale:** Studies have consistently documented the need to develop cost-effective consumer food safety behavior change interventions. This research needs to take into account the socio-ecological framework that acknowledges the constant interaction between environmental forces and individuals' choices on health behaviors (Levy, 2008; Mary Story, 2008). Whenever possible, these studies should include objective microbiological food safety indicators to assess the effectiveness of the interventions.

3. Understand whether and how home kitchen microbial cross-contamination during food preparation translates into actual risk for foodborne illness.

- **Rationale:** There is indisputable laboratory evidence demonstrating that potentially harmful bacteria (mostly Campylobacter) present in raw poultry can be transferred to ready-to-eat foods through cross-contamination in the home kitchen. Cross-contamination risk studies have heavily concentrated on the transmission of Campylobacter through poultry, and the great majority have been conducted in Europe, leaving a knowledge gap for the US. Studies are also needed in the US that concentrate on pathogens and food vehicles other than Campylobacter and poultry.

4. Improve monitoring and surveillance to better understand the epidemiology of home-based foodborne illness outbreaks.

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- **Rationale:** The proportion of foodborne outbreaks that can be attributed to improper food safety practices in the home kitchen remains largely undetermined. Translating unsafe food safety behaviors into actual food safety risk will require prospective studies that collect microbial as well as associated morbidity data, in addition to observed food safety behaviors.

Technologies Related to Food Safety

5. Validate and apply food safety sensors for home appliances and cooking utensils.

- **Rationale:** The development of sensors that monitor commercial food processing standards has improved the quality assurance and safety of those food products. Applications of this technology should be incorporated into and validated in home refrigerators, stoves, ovens and cooking utensils.

6. Develop, test and apply environmentally friendly food safety packaging technologies to improve nutritional quality and safety of foods.

- **Rationale:** Future packaging materials and in-home containers, in addition to being biodegradable and environmentally friendly, will function beyond protecting the product from contamination and maintaining physical properties to nutritional qualities of foods. Some common food ingredients, such as several kinds of dietary fiber and food flavors, when incorporated into food packing materials, can inhibit the growth of potential pathogens. In addition, some foods, like meats, poultry and seafood, may be packaged in an environment with different kinds of gases, such as nitrogen and carbon dioxide (CO_2). Applications of these gases at the levels necessary to inhibit microbial growth in the food supply are considered safe by the Food and Drug Administration (FDA). (Title 21, US Code of Federal Regulations, Part 184). These kinds of environments, in conjunction with good sanitation practices, can effectively reduce the risk of microbial growth and subsequent contamination, and extend the quality and shelf life of frozen and refrigerated food products.

7. Further develop and promote contemporary educational resources for encouraging food safety behaviors in the home.

- **Rationale:** The United States Department of Agriculture (USDA) has numerous food safety education sources in contemporary electronic game formats. It is expected that the further development and acceptance of these kinds of educational sources linked to in-home food safety practices and monitoring of in-home environments will reduce the risk of food-related illnesses in the home.

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Seafood Safety

8. Conduct consumer risk communication research to determine how best to translate seafood benefit/risk findings to the public.

- **Rationale:** An unfortunate outcome for the 2004 Environmental Protection Agency (EPA)/FDA Federal seafood consumption advisory was an unintended decrease in fish consumption among pregnant women (Oken, 2008). This may have been the result of a lack of proper coordination and formative evaluation in benefit/risk communications targeting diverse audiences. Since then, researchers have developed user-friendly computer-based educational systems (Domingo, 2007a; Santerre, 2009). However, much more research is needed in this area to effectively reach out to the socioeconomically and culturally diverse US population with the tools needed to maximize the health benefit of their individual seafood choices (Ginsberg, 2009; Verger, 2008).

9. Further refine seafood intake recommendations for US consumers (IOM 2007).

- **Rationale:** Improving seafood intake recommendations will require a better understanding of benefit(s) and risk(s) response functions that take into account the simultaneous presence of multiple beneficial and detrimental bioactive substances in a variety of seafood (Domingo, 2007b; Ginsberg, 2009; Gochfeld, 2005; Mozaffarian, 2006; Sioen, 2008; Verger, 2008). Similar information also will be needed for other key protein sources (e.g., dairy, meat, plant-based), as consumption changes in one protein source lead to concomitant changes in consumption of other protein sources.

10. Improve and optimize current seafood consumption surveillance and monitoring.

- **Rationale:** Monitoring of POPs and other contaminants should be a priority, especially because of the increasing reliance in aquaculture and the multiple origins of seafood being consumed in the US. In particular, systems should become more proactive and less reactive in nature (IOM, 2006).

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