

Improving Household Food Hygiene in a Development Context

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Introduction

In children under 5 years of age in low-income countries, diarrheal disease is the second leading cause of death, behind pneumonia, and is responsible for approximately 10.5 percent of child deaths annually (Child Health Epidemiology Reference Group 2012). Diarrhea can cause acute wasting and is the most important infectious determinant of stunting of children's linear growth (Black et al. 2013). Food is among the most important factors in transmitting pathogens that cause diarrheal illness (Motarjemi et al. 2012) and up to an estimated 70 percent of diarrheal episodes among young children could be due to pathogens transmitted through food (Motarjemi et al. 1993; Esrey and Feachem 1989).

In developing countries, health statistics for many foodborne diseases are often recorded as "diarrheal diseases" because the specific pathogen is almost never identified. "Diarrheal diseases" is also carried over in WHO statistics. For this reason, the exact proportion of diarrhea caused by contaminated food remains unclear, however it is estimated that foodborne and waterborne diarrheal disease kills an estimated 2 million people annually, according to analysis from the World Health Organization (WHO 2015) and appropriate food hygiene could substantially contribute to reducing the incidence of diarrhea. Food hygiene interventions may result in improved knowledge regarding the relationship between food hygiene practices and diarrheal illness, improved practice of key prioritized food hygiene behaviors, decreased levels of contamination

Diarrheal disease is the second leading cause of death among children under 5 years of age in low-income countries. Appropriate food hygiene could substantially contribute to reducing the incidence of diarrhea.

of prepared food (including complementary food for children), and decreased prevalence of diarrheal disease.

This technical note presents information on foodborne disease and key areas and considerations at the household level to reduce foodborne contaminants in developing countries. Recommendations on potential programmatic and research activities related to foodborne disease are also included. The food hygiene topics that are beyond the scope of this brief include food contamination with agrochemicals, such as pesticides; industrial chemicals, such as heavy metals; and naturally occurring toxins, such as mycotoxins.

Foodborne Pathogens and Basic Modes of Transmission

While a wide range of pathogens can cause foodborne diseases, viruses, bacteria, and parasites pose the greatest share of preventable foodborne threats (Fischer Walker et al. 2010). For parasites and viruses, food serves as a vehicle for transmission to a new host, while for bacteria, food offers an opportunity to grow exponentially to infectious levels. Once a person is exposed to the pathogen, the time to onset of disease symptoms varies, ranging from a few hours to possibly weeks. Symptoms are also highly variable, ranging from mild and self-limiting to permanently disabling and fatal (WHO 1984). More than 120 important viral, bacterial, and parasitic agents transmitted by food have been identified (Motarjemi et al. 2014). Thirty-two of these are significant public health problems and more than half cause diarrhea, either alone or in combination with other adverse symptoms.

While some pathogens can survive in the environment, the main reservoirs for these agents are domestic animals, household pests such as rats and mice, and humans. Pathogens can be present on the surface of food due to direct or indirect contact from an animal, pest, or human, or in the case of many parasites and certain bacteria, such as *Salmonella* Enteritidis in eggs, the pathogen is present already within the food.

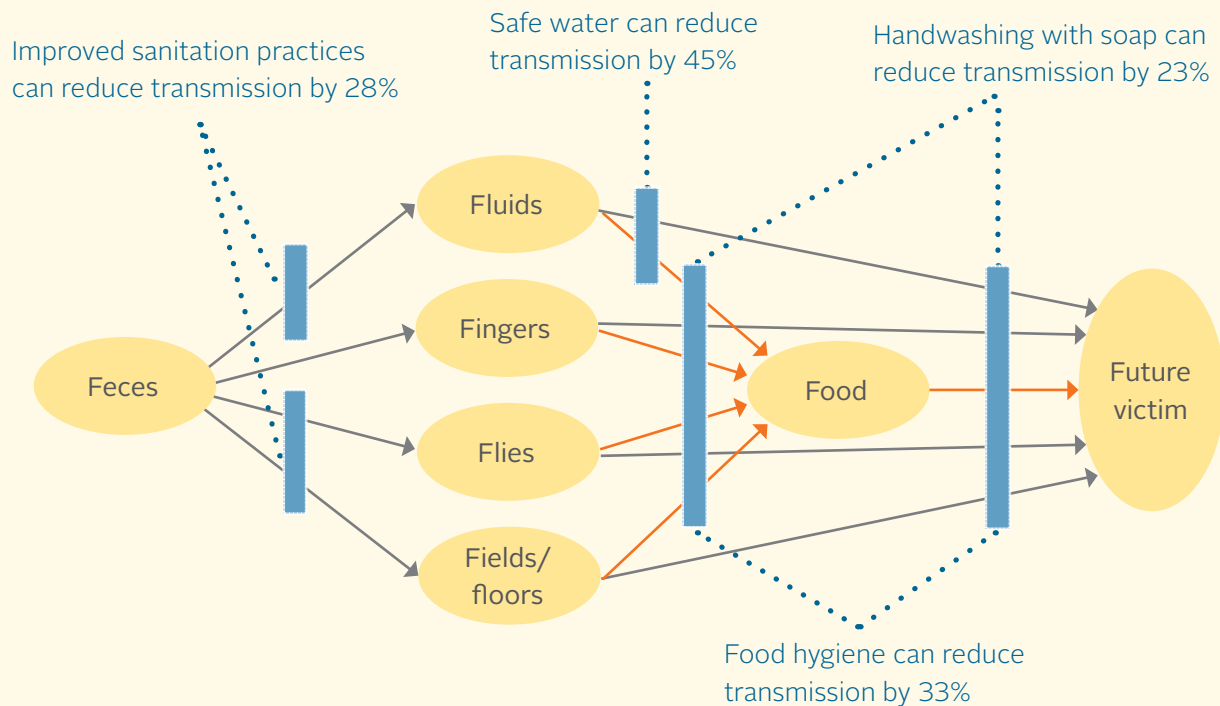
Many pathogens known to cause diarrhea are spread by the fecal-oral route. The primary routes of transmission of these pathogens include through contaminated (1) fluids, such as water contaminated with feces; (2) fingers, such as hands contaminated from one's own feces or those of another household member, such as an infant (3) flies, which may carry feces and contaminate food or other surfaces; and (4) fields/floors, from rainwater or irrigation water that is contaminated with feces, or household floors that are contaminated with fecal material that then spreads the feces via the routes mentioned above (fluids, fingers, and/or flies). All of these routes of transmission can cause illness and diarrhea directly in an individual, but can also do so via food contaminated by feces in fluids, on fingers, and/or

from flies. Keeping food free of fecal contamination is one of the key ways to prevent the transmission of disease (Curtis et al. 2011).

Figure 1 illustrates the routes of transmission of feces, in which food plays a major role. The figure also shows the estimated percentage of reduction in risk of diarrheal disease that occurs from consistent and correct practices to reduce diarrheal disease transmission. According to WHO (2014) risk of diarrheal disease may be reduced by 28 percent through improved sanitation, including sewer connections; reduced by 45 percent through effective water treatment at the household level (such as boiling water or treating water with chlorine or other appropriate agents) and safe water storage; and reduced by about 23 percent through handwashing with soap. Appropriate food hygiene practices have been shown to reduce the risk of diarrhea by 33 percent (Sheth et al. 2006). This figure may be even higher given that up to 70 percent of diarrheal episodes among young children could be due to pathogens transmitted through food. Food hygiene behaviors, such as thorough cooking, storage at appropriate temperature, and handwashing with soap before preparing food, play an important role in interrupting transmission of diarrheal diseases regardless of whether the source of the pathogen is human or animal feces.

Water is also a critical component of food hygiene. Once food enters the household, water plays a significant role at multiple points in food preparation, such as for cleaning food, washing utensils, cooking, and handwashing. At the point of consumption, it can be challenging to tease out the extent to which food alone contributes to disease transmission, exclusive of water/fluids. Therefore, many research studies that evaluate household food hygiene include water as a component of food. Past efforts in developing countries to reduce diarrheal disease through treating drinking water and providing sanitation services have been met with mixed results in part due to the lack of appropriate hygiene education, including food hygiene (Zwane and Kremer 2007).

Figure 1. Pathways of Transmission of Pathogens through the Fecal-Oral Route and Percentage Reductions in Risk of Diarrheal Disease from Improved Water, Sanitation, and Hygiene Practices



Adapted from Wagner and Lanoix 1958

Vulnerable Populations

While everyone is potentially susceptible to foodborne disease, certain vulnerable groups are often at greater risk of contracting a foodborne disease and/or suffering more severe consequences from the disease, including death. The main vulnerable groups include:

- **Infants and young children.** Their immune systems are still developing and the protection afforded by the gut flora is not as effective as in adults.
- **Pregnant women.** Hormonal changes during pregnancy affect a mother's immune system, resulting in decreased immune function and greater susceptibility to foodborne disease. Also, the developing fetus is susceptible to foodborne pathogens that may not cause illness in the pregnant women.
- **The immune-compromised.** People with weakened immune systems are prone to acquire foodborne disease. Particularly susceptible are those with chronic illness (such as HIV and tuberculosis).
- **The elderly.** Older people are more susceptible to foodborne disease because natural defenses and ability to fight disease decreases as people age.

Key Issues and Critical Actions in Household Food Hygiene

Once food enters the home, there are a series of steps that individuals take in preparing it prior to consumption, including cleaning, cooking, serving, and in some cases, storing. Based on the findings from a literature review by FANTA (Woldt and Moy 2015), the most critical household food hygiene actions to avoid introducing the potential for foodborne illness in developing country settings include:

- Cooking at adequate temperature and time
- Decreasing the time food is stored at ambient temperature
- Reheating at adequate temperature and time
- Adequate handwashing to avoid contamination
- Use of clean utensils to avoid contamination
- Storage of food at sufficiently low or high temperatures to prevent bacterial multiplication

Key actions must be tailored to the local context based on formative research given that foods, eating practices, and the enabling environment to adopt improved practices can vary greatly from one country to another and even within the same country (Chan 2014).

Food Hygiene Interventions

Peer-reviewed research has demonstrated that food hygiene interventions can effectively improve knowledge regarding the relationship between food hygiene practices and diarrheal illness, increase the practice of key prioritized food hygiene behaviors, decrease levels of contamination of prepared food (including complementary food for children), and reduce the prevalence of diarrheal disease. While few rigorous studies exist, several interventions targeting one or more of the critical actions have effectively improved household food hygiene practices, and subsequently lowered fecal contamination and reduced child diarrhea incidence. In addition, several social and behavior change studies have shown that improved knowledge, attitude, and practices around food hygiene was associated with fewer child diarrheal episodes (Sheth et al.

2006; Takanashi et al. 2013; Ejemot et al. 2009). Improvements in handwashing practices have demonstrated decreases in diarrheal infections in children by approximately one-third and evidence shows that adding soap to handwashing can further reduce diarrheal disease (Luby et al. 2011; Ejemot et al. 2009; Burton et al. 2011).

Successful food hygiene interventions have employed common approaches in their design, implementation, and evaluation. Formative research has been highly effective in assessing why certain behaviors are or are not practiced and identifying cultural barriers to adoption. Also, the use of systematic methods, such as the Hazard Analysis and Critical Control Point (HACCP) approach to identify food hygiene risks, have been essential in tailoring the critical actions to the target population. Pre-testing and monitoring implementation of the critical actions allowed researchers to observe if adoption occurred and if further modification of the interventions were necessary.

Gaps in the Evidence Base on Preventing Foodborne Illness

Critical gaps remain in the literature regarding proven methods to prevent foodborne illness through improved food hygiene practices. Little rigorous research using appropriate study methodology and demonstrating statistical significance exists from which to draw conclusions. Even for those studies that looked at effectively modified food hygiene behaviors, the evidence is still lacking around the sustainability of the adopted practices due to short study duration and follow-up. Research is needed to identify which food hygiene practices may be the most effective in preventing diarrheal illness in developing contexts. More formative research is needed to identify why individuals do or do not practice specific food hygiene behaviors in various settings, including consideration of cultural norms and beliefs. Lack of context-specific formative research in food hygiene directly impacts the ability to design and implement effective programs using consistent methods, particularly appropriate social and behavior change messaging and mediums. Rapid assessment tools to identify key problems and critical actions for intervention are also lacking.



Photo credit: Iain McLellan, FANTA/FHI 360

A literature reviewed identified critical actions to reduce the risk of foodborne illness at the household level, including cooking and reheating at adequate temperature and time, decreasing the time food is stored at ambient temperature, adequate handwashing, use of clean utensils, and storage of food at sufficiently low or high temperatures.

Programmatic Recommendations

Given the evidence that food is a common medium for transmission of diarrheal disease and that unsafe food directly contributes to high rates of morbidity and mortality in many developing countries, relevant policies and programs should consider inclusion of food hygiene components. In light of USAID's Multi-Sectoral Nutrition Strategy 2014–2025, which advocates for stronger coordination and collaboration across programs and activities, food hygiene is a cross-cutting theme that should be integrated across sectors. By strengthening the coordination and collaboration of programs, specifically water, sanitation, and hygiene programs and other nutrition, health, and agriculture programs, greater reductions in morbidity and mortality can be realized. The following are specific recommendations for donors, partners, and programs.

Recommendations for Immediate Implementation

- **Put into practice what is already known about food hygiene.** Key actions that can be put into practice within existing programs to reduce household-level foodborne illness in

developing countries include adequate initial cooking and reheating of food, decreasing the time food is stored at ambient temperature, adequate handwashing, and use of clean utensils to avoid contamination. Social and behavior change messages and materials can be developed around these key actions, which can be integrated immediately into clinic- and community-level counseling for vulnerable populations, including pregnant women, young children, people living with HIV, and those with tuberculosis.

- **Use quality improvement approaches and operations research to build upon what is known in food hygiene and fill programming gaps.** Quality improvement approaches, such as plan, do, study, act (PDSA) cycles, mentoring, and coaching, can be used to ensure that food hygiene is integrated into clinic- and community-level programs, and that food hygiene programming is of high quality. Quality improvement approaches and/or operations research can also be used within programs to identify programming gaps in food hygiene and ways to strengthen program outcomes and impact, for example, through adjusting social and behavior change strategies or testing food

hygiene assessment tools or indicators in a program setting.

- **Promote effective linkages with existing curative and preventive programs when diarrheal disease does occur.** When diarrheal disease does occur, effective linkages with existing curative services are essential. Children with diarrheal disease should be referred to clinic- or community-based workers to provide oral rehydration therapy to prevent dehydration and zinc supplements to reduce the severity and duration of the diarrheal episode. Pregnant women, people living with HIV, and individuals with tuberculosis should also seek immediate care for treatment. Follow-up counseling and support that includes food hygiene topics should be provided to mothers, caregivers, and families to prevent diarrheal disease.

Recommendations for Longer-Term Implementation

- **Conduct formative studies to inform program design.** Emphasize and support inclusion of formative research as part of program design, including collecting qualitative and quantitative data among the target population, to understand the customs, beliefs, and rituals that lead to specific food hygiene problems and understand why specific behaviors are practiced while others are not. These studies can also form part of operations research to make ongoing adjustments to programs.
- **Develop guidance on practical, feasible ways to address food hygiene in developing country contexts.** The critical actions to decrease the risk of foodborne illness in developing countries can be challenging for households to practice. Programs need practical guidance on how to address food hygiene behaviors that consider barriers that households encounter. Operations research can inform guidance development by identifying feasible actions that households can carry out in their specific situations.
- **Develop tools to assess food hygiene.** Given the lack of available tools for assessing food hygiene at the household and community levels, donors and implementing partners should consider supporting the development and validation of generic tools (for example, rapid assessment tools) and guides to assess food hygiene at the household and community levels in developing countries, including assessing food hygiene behaviors and access to infrastructure and supplies that affect the capacity to practice desired food hygiene behaviors. Tools can then be adapted by programs to specific country contexts. These can be also be developed as a part of operations research during program implementation.
- **Develop context-specific social and behavior change strategies to improve food hygiene practices.** Develop a social and behavior change strategy to improve food hygiene practices with an appropriate mix of channels and messages, and test and modify as necessary training materials, messages, and job aids. WHO's manual, Five Keys to Safer Food, already includes messages and materials that can be adapted for different country contexts.
- **Assess and evaluate social and behavior change strategies and adjust as needed to improve impact.** Evaluate the impact of food hygiene-related social and behavior change messaging using proven methodologies, such as theoretical behavior change models and/or theories of change. More rigorous studies assessing messaging and its effect on behaviors would be useful to ensure interventions consider the various factors that influence behaviors and behavior change, including not only knowledge and beliefs but also skills and access to needed materials to employ new behaviors and social norms that influence the practice of those behaviors. These studies can form part of operations research within programs, as noted above.
- **Develop and test indicators to assess the outcomes and impact of food hygiene interventions.** There is a lack of standardized, validated indicators for measuring outcomes and impact of food hygiene activities. More research is needed in the development of practical, valid, standardized program indicators for food hygiene interventions that can be contextualized, as needed, to local situations.

- **Integrate an appropriate package of water, sanitation, and hygiene interventions into programs.** Since the fecal-oral route of contamination from hands is such a large contributor to diarrheal disease, programs should integrate an appropriate package of water, sanitation, and hygiene interventions, in particular, focusing on handwashing (with soap if possible), appropriate disposal of human and animal feces, and treating and safely storing drinking water. These actions will have a positive impact on food hygiene interventions. While handwashing with water can have a significant effect, handwashing with soap and water is more effective than water alone (Burton et al. 2011). Although soap can be a costly commodity for many economically constrained households, public-private partnerships offer the opportunity to increase soap distribution. Ash is also an acceptable substitute for soap.
- **Target food hygiene interventions for vulnerable populations.** To be most effective, food hygiene messaging and behavior change interventions should be targeted to vulnerable populations. Programs addressing infectious diseases, such as HIV or tuberculosis, should consider integrating food hygiene interventions. These populations are at greater risk of infection from foodborne pathogens and have greater risk of mortality if exposed. Clinic- and community-level programs that serve pregnant women and mothers/caregivers of young children should also integrate food hygiene messaging and behavior change around food hygiene.
- **Include food hygiene components in policies, strategies, and programs.** Given the evidence that food is a common medium for transmission of diarrheal disease in developing countries and that unsafe food contributes to high levels of morbidity and mortality in these countries, relevant host country government and donor policies, strategies, and programs should include food hygiene components.
- **Support research on food hygiene.** Given the lack of sound research studies and program evaluations of household food hygiene interventions, more studies and/or program evaluations are needed to strengthen the evidence base. Such studies need to have strong methods, including, for example, use of the HACCP approach to identify and test critical control points, sufficiently long follow-up of households and individuals, rigorous intervention design and results reporting, and use of health models to provide greater theoretical basis for studies. Furthermore, research assessing the causal link between specific hygiene practices and diarrheal incidence, and its subsequent impact on nutritional status, is critical to inform future interventions and identify behaviors and practices that are the most critical to prevent foodborne illness.
- **Widely disseminate results, lessons learned, and promising practices from food hygiene research and interventions.** Given the lack of information on food hygiene research and interventions in developing countries, it is important that results and lessons learned from high-quality research and program interventions be shared to foster learning and knowledge development (Curtis et al. 2011). Of particular priority are the results of trials of food hygiene interventions; cost effectiveness of various mixes of channels, intensities of messages and activity delivery, and types of change agents; and innovative technologies for practicing good food hygiene.
- **Support the WHO initiative to estimate the global burden of foodborne diseases.** National and international donors should continue to support the WHO initiative to estimate the global burden of foodborne diseases. Funding is particularly needed to support studies that determine foodborne disease burden estimates among vulnerable populations, such as children 6–23 months of age, pregnant women, people living with HIV, and those with tuberculosis. Reliable epidemiological data are urgently needed to enable policymakers and other stakeholders to appropriately allocate resources to undertake foodborne disease prevention and control efforts and to monitor and evaluate those efforts.

References

- Black, R.E. et al. 2013. "Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries." *The Lancet*. Volume 382, Issue 9890, pp. 427–451.
- Burton, M. et al. 2011. "The Effect of Handwashing with Water or Soap on Bacterial Contamination of Hands." *International Journal of Environmental Research and Public Health*. Vol. 8, No. 1, pp. 97–104.
- Chan, M. 2014. "Food Safety Must Accompany Food and Nutrition Security." *The Lancet*, Vol. 384, No. 9958, pp. 1910–1911.
- Child Health Epidemiology Reference Group of WHO and UNICEF. 2012. "Global, Regional, and National Causes of Child Mortality: An Updated Systematic Analysis for 2010 With Time Trends Since 2000." *The Lancet*. Vol. 379, No. 9832, pp. 2151–2161.
- Curtis, V. et al. 2011. "Hygiene: New Hopes, New Horizons." *Lancet Infectious Diseases*. Vol. 11, pp. 312–321.
- Ejemot, R.I.; Ehiri, J.E.; Meremikwu, M.M.; and Critchley, J.A. 2009. "Handwashing for Preventing Diarrhoea." *The Cochrane Library*. Issue 3.
- Esrey, S.A. and Feachem, R.G. 1989. "Interventions for the Control of Diarrhoeal Diseases among Young Children: Promotion of Food Hygiene." WHO/CDD/89.30. Geneva: WHO. Unpublished document.
- Fischer Walker, C.L. and Black, R.E. 2010. "Diarrhoea Morbidity and Mortality in Older Children, Adolescents, and Adults." *Epidemiology and Infection*. Vol. 138, pp. 1215–1226.
- Fischer Walker, C.L.; Sack, D.; and Black, R.E. 2010. "Etiology of Diarrhea in Older Children, Adolescents and Adults: A Systematic Review." *PLoS Neglected Tropical Diseases*. Vol. 4, No. 8, e768, doi:10.1371/journal.pntd.0000768.
- Luby, S.P. et al. 2011. "The Effect of Handwashing at Recommended Times with Water Alone and with Soap on Child Diarrhea in Rural Bangladesh: An Observational Study." *PLoS Med*. Vol. 8, pp. 1–12.
- Motarjemi, Y.; Käferstein, F.; Moy, G.; and Quevedo, F. 1993. "Contaminated Weaning Food: A Major Risk Factor for Diarrhoea and Associated Malnutrition." *Bulletin of the World Health Organization*. Vol. 71, pp. 79–92.
- Motarjemi, Y.; Steffen, R.; and Binder, H.J. 2012. "Preventive Strategy Against Infectious Diarrhea – A Holistic Approach." *Gastroenterology*. Vol. 143, pp. 516–519.
- Motarjemi, Y.; Todd, E.; and Moy, G. 2014. *Encyclopedia of Food Safety*. London: Elsevier.
- Sheth, M. et al. 2006. "Food Safety Education as an Effective Strategy to Reduce Diarrhoeal Morbidities in Children Less Than Two Years of Age." *Indian Journal of Nutrition and Dietetics*. Vol. 43, No. 1, pp. 22–31.
- Takanashi, K. et al. 2013. "Long-Term Impact of Community-Based Information, Education and Communication Activities on Food Hygiene and Food Safety Behaviors in Vietnam: A Longitudinal Study." *PLoS ONE*. Vol. 8, No. 8, e70654.
- Wagner, E.G. and Lanoix, L.N. 1958. *Excreta Disposal for Rural Areas and Small Communities*. Geneva: WHO.
- WHO. 1984. *The Role of Food Safety in Health and Development: Report of the FAO/WHO Expert Committee on Food Safety, 30 May–6 June 1983, Geneva, Technical Report Series No. 705*. Geneva: WHO.
- WHO. 2014. *Preventing Diarrhoea through Better Water, Sanitation and Hygiene: Exposures and Impacts in Low- and Middle-Income Countries*. Geneva: WHO.
- WHO. 2015. *World Health Day 2015 Food Safety Campaign Toolkit*. Available at <http://who.int/campaigns/world-health-day/2015/campaign-toolkit.pdf?ua=1>.
- Woldt, M. and Moy, G. 2015. *Literature Review on Effective Food Hygiene Interventions for Households in Developing Countries*. Washington, DC: FHI 360/FANTA.
- Zwane, A.P. and Kremer, M. 2007. "What Works in Fighting Diarrhoeal Diseases in Developing Countries." *World Bank Research Observer*. Vol. 22, No. 1, pp. 1–24.



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