ABSTRACT

JENNIFER LEIGH PLATT: Accelerating Sanitation: A Mixed Methods Assessment of the Health Ministry’s Role in Developing Countries (Under the direction of Sandra Greene)

Forty percent of the world’s population (2.5 billion) lives without adequate sanitation, such as a latrine at home (WHO, 2012). Because of poor sanitation, each year millions of people die and millions more get sick. Although sanitation is a public health fundamental, little research has been published regarding the public health role of the health ministry in developing countries in supporting sanitation. Furthermore, little research exists regarding how the health ministry influences sanitation use in developing countries.

This mixed methods dissertation includes a qualitative comparison of three developing countries and a quantitative analysis of 83 developing countries. The qualitative multi-case comparison of Malawi, Nepal, and Sri Lanka uses a health sector functions framework to compare the level of primary health care (selective, transitional, and comprehensive) to the inclusion of sanitation within the health sector functions. The research found that sanitation was often excluded from the health sector functions in the selective and transitional primary health care (PHC) countries (Nepal and Malawi, respectively). These countries also focused minimal attention on public or environmental health programs. The quantitative analysis shows that although countries with transitional and comprehensive PHC were more likely to have higher sanitation use, progress in sanitation use between 1990 and 2008 was similar across the PHC groups.
This research advances knowledge by: 1) using the health sector functions framework to evaluate health ministry engagement in sanitation, and 2) examining the relationship between health ministry engagement in sanitation (through PHC level) and increased sanitation use. The literature review and qualitative analysis provide initial evidence that incorporating sanitation into the health sector functions may institutionalize sanitation within the health ministry, which could increase a country’s resilience to natural disasters, prevent outbreaks, and provide support for needed health gains. However, the scope of the qualitative research is limited to the health ministry’s role in institutionalizing sanitation within the health ministry's policies and programs. This research does not consider the efforts of other ministries to institutionalize sanitation. The results show the need for more research regarding systematic efforts to address sanitation, within both health and other ministries in developing countries.
DEDICATION

To every parent who has lost a child due to poor sanitation.
ACKNOWLEDGEMENTS

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<td>ANOVA</td>
<td>Analysis of Variance</td>
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<td>CDD</td>
<td>Control of Diarrheal Diseases Program (Nepal)</td>
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<tr>
<td>DALY</td>
<td>Disability-Adjusted Life Year</td>
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<td>DHO</td>
<td>District (Public) Health Officer (Nepal)</td>
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<td>DWSS</td>
<td>Department of Water Supply and Sanitation (Malawi)</td>
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<tr>
<td>ESA/INGO</td>
<td>External Support Agency/International Non-governmental Organization</td>
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<td>FCHV</td>
<td>Female Community Health Volunteer (Nepal)</td>
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<td>FHW</td>
<td>Family Health Worker</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GFATM</td>
<td>Global Fund for Aids, Tuberculosis, and Malaria</td>
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<td>GNI</td>
<td>Gross National Income</td>
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<td>HESP</td>
<td>Hygiene Education and Sanitation Program</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome</td>
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<td>HM</td>
<td>Health Ministry professional (code used to identify interviewees)</td>
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<td>Health Management Information System</td>
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<td>HSA</td>
<td>Health Surveillance Assistant (Malawi)</td>
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<td>IMCI</td>
<td>Integrated Management of Childhood Illness</td>
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<td>IRB</td>
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<tr>
<td>LDO</td>
<td>Local Development Officer</td>
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<td>MCH</td>
<td>Maternal and Child Health</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MoH</td>
<td>Ministry of Health</td>
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CHAPTER 1

INTRODUCTION

Problem Statement

Every day, more than 1 billion people defecate in the open. Another 1.4 billion people live without adequate sanitation, such as a latrine at home, and suffer from the resulting disease burden (WHO, 2012). Each year, poor sanitation causes millions of people to die, and infectious diseases morbidity affects millions more. Poor sanitation contributes to 4.6 billion annual cases of diarrhea globally (WHO, 2008a), and in 2008 diarrhea caused nearly 20% of deaths of children under 5 years old in Africa (Black et al., 2010). Childhood undernutrition, another consequence of inadequate sanitation, contributes to more than one-third of all child deaths (WHO & UNICEF, 2010). According to a recent systematic review, sanitation use reduces diarrhea prevalence by 30%, and as much as 60% in extremely poor sanitation environments (Norman et al., 2010). Around the globe, significant efforts are underway to find innovative solutions to increase sanitation use and decrease diarrheal diseases.

Health and sanitation researchers often focus on the disease burden caused by poor sanitation and on the methods used by the sanitation sector to promote sanitation. However, little research exists regarding what health sectors do to address sanitation and to influence sanitation use. The health sector, and health professionals, can promote sanitation through many roles, including policy, planning, education, and advocacy (Mara et al., 2010). This study examines what health ministries in three developing countries do to incorporate sanitation within health sector functions and explores the relationship between the level of
primary health care and progress in sanitation use in a cross-country comparison of 83 developing countries. If opportunities exist for health ministries to increase involvement in sanitation, then they can provide support for health and economic gains in developing countries.

**Definitions**

*Sanitation Use.* For this study, *sanitation use* refers to the safe management of human excreta, including storage and disposal. Sanitation use is fundamentally lacking in many developing countries and serves as the focal point of this investigation.

*Sanitation-related health policies or health programs.* These are health policies or programs that include sanitation components, such as requirements, education, or cross-sectoral collaboration. For example, a sanitation-related health policy would require health facilities to have functioning sanitation equipment. An applicable health program would provide education on the importance of sanitation use for people with sanitation-related diseases such as trachoma.

*Health ministry.* The health ministry is the unit of a country's government responsible for protecting and promoting public health.

*Health professional.* Individuals trained in the delivery of health or related services pertaining to the identification, evaluation and prevention of diseases.

*Health sector.* The health sector is the sector within the economy that deals with health-related issues, including the delivery systems, suppliers, and payers.

*Health sector functions.* Activity or purpose intended for the health sector. For this study, *functions* refer to six health sector functions (detailed in Chapter 3 and Appendix B) relevant to environmental health, and specifically sanitation.
Health systems. Health systems include all the organizations, people, and actions whose primary intent is to promote, restore, or maintain health, including efforts to influence determinants of health and to direct health-improving activities (WHO, 2007). The term health system also encompasses the information, financing, and governance strategies that support the delivery of prevention and treatment services. The main objective of a health system is to respond to people’s needs and expectations by providing services in a fair and equitable manner (WHO, 2000).

Institutionalize. To establish (something, typically a practice or activity) as a convention or norm in an organization, program, process, or culture.

Primary health care (PHC). The concept of primary, or preventive, health care (PHC) was defined at the World Health Organization’s Alma Ata Conference in 1978. Participating countries endorsed PHC as the key to attain “Health for All.” The Alma Ata convention created a holistic definition of PHC, which includes: “education concerning prevailing health problems and the methods for preventing and controlling them…[including] an adequate supply of safe water and basic sanitation” (WHO, 1978). PHC ranges in scope from selective to transitional to comprehensive. Selective PHC systems focus primarily on immunizations and other targeted, prevention-oriented interventions. Comprehensive PHC systems promote and provide a full complement of PHC services, including immunizations, contraceptive services, skilled birth attendants, prenatal and antenatal care, and education/methods focused on prevention such as sanitation, including cross-sectoral action where needed. Transitional PHC systems fall in between selective and comprehensive systems, and will promote some preventive approaches, but not others, in accordance with national priorities. For example, a transitional system may target immunizations and prenatal
care, but not emphasize contraceptive services. The case study countries include one of each PHC type: selective (Nepal); transitional (Malawi); and comprehensive (Sri Lanka).

*Developing country.* A developing country is a country with low income or lower-middle income levels of gross national income per capita (World Bank, 2011).

**Benefits and Significance of this Study**

Health professionals have many reasons to promote sanitation use as an essential component of human health. For example, proper excrement disposal decreases diarrhea and mitigates diseases such as schistosomiasis and trachoma (Mara et al., 2010). The burden from these diseases in developing countries is substantial. Further, people with sanitation-related diseases impose high costs on health care systems (Hutton et al., 2007).

Prior research, as discussed in Chapter 2, provides scant analysis of health ministry activities to promote and facilitate the use of sanitation. Comparisons between countries using different levels of PHC and sanitation use can identify effective methods and opportunities. As a result, countries could institutionalize their approach to sanitation and improve sanitation use, further progress towards meeting Millennium Development Goal (MDG) Target 7c\(^1\), and increase health gains.

**Research Questions and Hypotheses**

The research focused on the question, “How Does Health Ministry Engagement in Sanitation Influence Sanitation Use in Developing Countries?”

To investigate the relationship between health ministry engagement in sanitation and sanitation use, I selected a mixed methods approach. Interviews of health and development

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\(^1\) Target 7c: To reduce by 50% the proportion of the population in 1990 without access to sanitation (UNDP, 2000)
professionals in three countries provided the basis for the qualitative research. The quantitative analysis examined the relationship between a country’s use of primary health care and sanitation use in a large sample of developing countries. Chapter 3 provides further rationale for using the mixed methods approach and an explanation of the methods used.

The qualitative research explored the following sub-question:

_Q1. What are health ministries in developing countries doing to include sanitation within health sector functions?_

The quantitative research tested two hypotheses:

_H1. Developing countries with higher level primary health care delivery systems in 1990 and 2000 have increased sanitation use in 2008._

_H2. Higher levels of primary health care is associated with increased progress in sanitation use in developing countries from 1990 to 2008._

**Organization of the Dissertation**

Chapter 1 provides the context for the research, including the problem statement, definitions, research questions, and significance of the research. The literature review in Chapter 2 reviews the background literature review methods and findings for the research. Chapter 3 provides a detailed description of the research methods. The research results are described in Chapter 4 and discussed in Chapter 5. Based on the research findings and conclusions, Chapter 6 presents an implementation plan, recommendations for action, and future research to advance the effort to find innovative approaches to increasing sanitation use.
CHAPTER 2
LITERATURE REVIEW

Recent literature asserts that health professionals and, indeed, the entire health sector, play important roles in influencing the use of sanitation (Bartram, 2008; Cronin & Pond, 2008; Bartram & Platt, 2010; Bartram & Cairncross, 2010). Yet little is known about what health ministries do to promote sanitation use, including addressing sanitation use within health ministry policies and programs. Approaches used by health ministries to promote sanitation use can involve education (of both health professionals and the general population), health policies such as requirements for installation and maintenance in health facilities, and surveillance monitoring to mitigate outbreaks.

This literature review explores what health sectors, ministries, and professionals do to promote sanitation. Sanitation outside the health sector is not within the scope of the literature review. The discussion includes examples found in nearly 40 countries, primarily in developing countries. Key terms are defined in Chapter 1. To search the literature, the database search terms query (see Appendix A) identified over 300 abstracts. After applying the inclusion and exclusion criteria (see Appendix A), I reviewed 58 papers, 55 of which were considered appropriate for the literature review.

Since the advent of public health, the health sector has played an important role in sanitation. As a result of a divergence between health and environmental functions, policymakers in developing countries rarely incorporate sanitation use within their countries’ health strategies, initiatives, and programs, and health sector policy mandates may not
include promoting sanitation use. Instead, policymakers often place sanitation programs within engineering-oriented agencies (Heller, 2009). Despite the potential compatibility between the health and sanitation sectors, health professionals do not seem to recognize how each sector may benefit the other. They focus on alleviating diseases and effects caused by diseases rather than environmental sources of disease (Cornell, 1996), and most do not consider sanitation to be their responsibility (Bartram & Platt, 2010).

To address the environmental health-related gaps in health sector roles, Rehfuess et al. (2009) developed a framework (Table 1) that encompasses six functional areas needed to facilitate progress towards environmental health gains: (1) norms and regulations (2) intersectoral policy, (3) health facilities, (4) disease-specific and integrated programs, (5) disease outbreaks, and (6) impacts, threats and opportunities. Using this framework, Bartram

<table>
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<th>Function</th>
<th>Corresponding Health Sector Roles</th>
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<tr>
<td>1. Norms and Regulations</td>
<td>● Develop health-protecting standards and regulations appropriate to the country’s social, economic, and environmental circumstances&lt;br&gt;● Monitor implementation and contribution to population health</td>
</tr>
<tr>
<td>2. Intersectoral Policy and Coordination</td>
<td>● Build the capacity to track and influence major policies that impact health&lt;br&gt;● Employ formal mechanisms for health impact assessments&lt;br&gt;● Establish effective multi-disciplinary collaboration</td>
</tr>
<tr>
<td>3. Health Facilities</td>
<td>● Set standards for health care facilities&lt;br&gt;● Budget for structural improvements and capacity-building to encourage staff behavioral changes&lt;br&gt;● Enforce compliance through an independent oversight function</td>
</tr>
<tr>
<td>4. Disease-Specific and Integrated Programs</td>
<td>● Integrate environmental determinants (e.g., sanitation use) into health professional curricula&lt;br&gt;● Incorporate environmental health actions into health programs&lt;br&gt;● Work with partners to raise awareness</td>
</tr>
<tr>
<td>5. Outbreaks</td>
<td>● Maintain expertise to advise on and conduct outbreak investigations&lt;br&gt;● Test, implement, and revise procedures, in cooperation with other actors</td>
</tr>
<tr>
<td>6. Impacts, Threats, and Opportunities</td>
<td>● Update regulations and policies accordingly&lt;br&gt;● Seek evidence for causal associations between environmental factors (e.g., absence of sanitation) and health&lt;br&gt;● Assess potential values and harms of technology innovations and policy development</td>
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*Source: Rehfuess et al., 2009*
and Platt (2010) reviewed health ministry roles in providing safe water, sanitation, and hygiene. For example, health care facilities can provide access to reliable sanitation, health curricula can include materials that address the cumulative adverse impacts of poor sanitation, and patient protocols for diseases associated with poor sanitation could include preventive measures. No known research has used the health sector functions framework to analyze what specific countries do to include sanitation within the health sector functions.

This dissertation furthers recent research by using the health sector functions framework to analyze three country case studies. The framework provides a set of useful benchmarks for measuring and quantifying health sector involvement in sanitation, as well as other public health functions. This research could help countries identify gaps within their own health ministries and governments to support sanitation use. This chapter reviews the literature in two relevant areas of inquiry:

Part I: Historical precedents for health sector engagement in sanitation: public health as the guiding framework

Part II: The role of sanitation within primary health care, environmental health, and public health strategies

**Part I: Historical Precedents for Health Sector Engagement in Sanitation: Public Health as the Guiding Framework**

Health professionals were actively involved in the 19th-century sanitation revolution in Europe and North America. England’s Public Health Act of 1848 mandated a prevention-based approach to public health in which medical officers of health reported on sanitary conditions and inspectors looked for violations (Cornell, 1996). During the mid to late 20th century, health ministries promoted sanitation by giving away latrines (Roemer, 1991; Saywell, 1998). Overall, the longstanding tradition of health sector involvement in sanitation
is reflected in the experience of a number of developing nations. Several countries integrated sanitation early on into their public health approaches, as shown in Sri Lanka, Japan, Cuba, Costa Rica, Mexico, and Yakima, Washington in the United States.

Sri Lanka’s historical epic of Sinhala kings, the *Mahavamsa*, describes sanitary measures taken as early as the 4th century BC to safeguard health when King Pandukabhaya appointed workers to clean the streets and to clear the sewers. In recent history, public health responsibilities in Sri Lanka were granted to local councils upon adoption of the *Municipal Councils Ordinance No. 17 of 1865* in Colombo, Kandy, and Galle. Smaller areas were entrusted to the care of Sanitary Boards via the *Small Towns Sanitary Ordinance of 1892* (CCPSL, 2001). In 1925, as awareness of the importance of public health increased, curative and preventive services were brought under the control of a Director of Medical and Sanitary Services. Sri Lanka’s approach to preventive health care was established in 1926 upon inauguration of the Health Unit system, first established in Kalutara (DeSilva, 2007; CCPSL 2001). Dr. SF Chellappah (Director of Medical Services from 1942-1948), recognizing the Health Unit system’s significance, noted that this “will become a red-letter day in the history of the island” (CCPSL, 2001). Health Unit responsibilities, which integrated sanitation, included the following:

- Carry out general and health surveys in the various problems in the area
- Collection and study vital statistics in the area
- Health education
- Investigate and control infectious diseases
- Maternal and child health
- School health work
• Rural and urban sanitation

Sri Lanka’s Health Unit system eventually covered the entire island; as discussed in Chapter 4, this system remains today with few modifications (CCPSL, 2001).

Japan adopted its first Public Health Center Act (PHCA) in 1937, with an update in 1947 to include administrative roles in environmental health. The Community Health Act of 1994 authorizes local government authorities to oversee public health via primary health centers. Japan’s primary health center network targets several sanitation-related tenets: environmental sanitation including sewage and waste disposal, community health education, collecting community health-related statistics, prevention of infectious diseases, laboratory tests on sanitation/environment, and health facilities standards. (Health and Welfare Statistics Association, 2010, as cited in Katsuda et al., 2011). Japan appears to have “institutionalized” its approach to sanitation by including it within most of the health sector functions.

The Cuban Ministry of Public Health launched a comprehensive approach to primary health care in 1960, and relies extensively on volunteer brigades to educate peers on preventive activities to promote health. Public health, including sanitation use, was considered the responsibility of the Federation of Cuban Women (FMC). By 1977 over 47,000 FMC members, who had taken health and sanitation courses, provided a grassroots-level link between the Ministry of Public Health and communities. Monthly meetings were held to discuss educational materials provided by the Ministry. The FMC’s role was critical: “It is this constant link between divulgation, information and education which has made possible the achievement of almost every goal in the field of public health.” (Domínguez, 1977). Rosero-Bixby (1991) concluded that Costa Rica’s adoption of multiple public health policies in the early 1970s helped achieve infant mortality rates comparable to those in
developed countries. PHC efforts included interventions for diseases related to sanitation (e.g., diarrhea and helminthiases) and health worker household visits to disadvantaged rural and urban areas. In addition, the Ministry of Health established a Central Sanitary Office (Rosero-Bixby, 1991).

In addition to the long-term sustained sanitation initiatives described, other public health efforts to include sanitation were implemented in response to outbreak-driven crises. The case of Yakima, Washington, US provides an early 20th century example and Mexico a late 20th century example.

A typhoid outbreak in the US in the early 1900s in Yakima, Washington presents a “prime example of the nation’s problems with poor sanitation and public failure to link these conditions with disease” (Casner, 2001). With a mortality rate five times the national average due to poor sanitation, health professionals spearheaded a multi-faceted “Do It Now” campaign against rural typhoid (Casner, 2001). Local officials adopted watershed protection ordinances (Lumsden, 1911 as cited in Casner, 2001), created a health officer position, and implemented a high visibility program to educate and engage the public through a “Sanitary League.” To be a member one had to secure access to sanitation via a latrine or sewage connection and to implement other sanitary practices. Members wore “DO IT NOW” buttons, creating a feeling of shame if one did not have one. The local health office installed demonstration toilets and civic groups rallied behind the Sanitary League (Casner, 2001). Casner (2001) asserts that several aggressive efforts within the first year of the campaign played a fundamental role in the country’s approach to a “new public health”: proactive local health boards, adoption of laboratory procedures, hiring of sanitarians and public health nurses, funding for education programs, and waste removal guidelines. Yakima modeled “the
worth of local actions and proved the importance of changing individual habits” (Casner, 2001). Typhoid rates decreased by 90% within the first year (U.S. Congress, 1914 as cited in Casner, 2001).

More recently, a national effort in Mexico in the late 20th century illustrates a recent widespread effort to mitigate cholera that commenced upon its re-appearance in the western hemisphere. In January 1991, the Mexican government deemed cholera’s appearance in Latin America a national security problem. To prevent a health crisis, the health ministry mounted a massive intersectoral collaboration initiative, including health (e.g. epidemiological surveillance, laboratory network and patient care) and other sectors (public education and basic sanitation). This experience can be “considered as the operationalization of a new public health system spanning multisectorial activities, involving community participation, political will and with impact on public health and economic issues” (Sepúlveda et al., 2006).

Due to the multi-pronged efforts, Mexico’s cholera incidence between 1991 and 2001 remained less than 17.9 per 100,000 inhabitants and impacted primarily rural areas. Control strategies decreased diarrheal mortality for children under 5 and prevented tourism or economic consequences. The population benefited not only from acquisition of knowledge about preventive measures, but also from modification of risky practices and from reinforcement of city and municipal drinking water supplies (Sepúlveda, et al., 2006).

Despite the historical precedents described for the public health approaches used to combine the sanitation and health sector functions, in the mid-20th century a general divergence between health and sanitation occurred. Roles and responsibilities related to environmental health concerns such as sanitation shifted into the environment or infrastructure departments (Bartram, 2008) in the 1960 and 1970s. As a result, two primary
facets of public health, medicine and environmental pollution, diverged. Over time, medical officers’ roles shifted from prevention to treating diseases (Cornell, 1996). Health inspectors became public health officers in the mid-1950s and then environmental health officers in the mid-1970s, often with a primary focus on food inspections (Cornell, 1996). The evolution of these positions mirrored changes in the public focus on health issues and mirrored the medicalization of health in some countries (Starr, 1982).

Today, global health initiatives rarely target sanitation. The Millennium Development Goals (MDGs) target both health and sanitation but connections between the two are rare. Mostly in response to the MDGs, over 100 global health initiatives have launched at the beginning of this century. Most of these initiatives focus on controlling specific diseases: only a small number target sanitation-related programs, such as diarrhea control (World Health Organization Maximizing Positive Synergies Collaborative Group, 2009).

**Part II: The Role of Sanitation within Primary Health Care, Environmental Health, and Public Health Strategies**

At the same time responsibility for sanitation was generally moving away from the health sector in the mid-seventies, the Alma Ata Declaration, which included preventive measures such as sanitation, was adopted in 1978 (WHO, 1978). The Alma Ata Declaration on Primary Health Care called for “all governments, all health and development workers, and the world community to protect and promote the health of all people of the world.” Preventive interventions such as sanitation were an essential part of Alma Ata’s vision. Specific excerpts from the declaration included:

- Tenet #7.2: [PHC] addresses the main health problems in the community, providing promotive, **preventive**, curative and rehabilitative services accordingly;
• Tenet #7.3: [PHC] includes at least: **education** concerning prevailing health problems and the methods of preventing and controlling them;...[and] an adequate supply of basic **sanitation**;

• Tenet #7.4: [PHC] involves, in addition to the health sector, **all related sectors** and aspects of national and community development, in particular [sectors such as]**public works**;

• Tenet #8: All governments should formulate **national policies, strategies and plans** of action to launch and sustain primary health care as part of a comprehensive national system and in coordination with other sectors. To this end, it will be necessary to exercise political will, to mobilize the country’s resources and to use available external resources rationally;

Spurred by the Alma Ata Declaration, many countries began to implement PHC (Rohde et al., 2008). Some countries, such as Sri Lanka, responded by revising their existing approaches to PHC (CCPSL, 2001). However, within a year, a seminal article by Walsh and Warren (1979) proposed the use of selective interventions to enable rapid achievement of high use for practices such as immunizations and family planning, prioritized by cost-effectiveness (Walsh & Warren, 1979). Debate in the global health community ensued about whether countries should focus on selective or comprehensive interventions. Donors particularly liked the selective approach because results were measurable and specific (Lawn, et al., 2008). Health systems in countries that chose selective approaches shifted away from opportunities to address prevention-oriented mechanisms such as sanitation, whether within the health ministry itself or via intersectoral collaborations. Despite Walsh and Warren’s recommendation (1979) that selective interventions be used as a short-term strategy towards
implementing PHC, many countries continued the selective approach into the 21st century (Lawn et al., 2008). Furthermore, Walsh and Warren’s cost-effectiveness calculations (1979) were later shown to be misleading because they used gross costs rather than net costs. For example, the calculations underestimated health impacts because they looked at single diseases. Consequently, the results were biased against interventions such as sanitation that produced health gains from multiple diseases (Briscoe, 1984). Later research showed sanitation interventions to be among the most cost-effective available. For example, sanitation promotion was shown to avert 90 DALYs per $1,000USD spent as compared to one to three DALYs averted per $1,000USD for HIV/AIDS antiretroviral therapy (Laxminarayan, Chow, and Shahid-Salles, 2006). Although the study did not consider sanitation construction costs, the health sector does not usually hold responsibility for construction expenditures (Bartram and Cairncross, 2010).

In spite of a general increased focus on selective interventions, some countries continued to implement or to contemplate a comprehensive approach to PHC. After gaining independence, Namibia “inherited a system of medical services rather than health services. It was curative oriented and waited for the sick to attend” (Iyambo, 1992). Upon the government’s recognition that population health relates to both economic development and determinants such as sanitation, the Namibian health system shifted from a curative approach to primary health care orientation focused on prevention and promotion, combined with strong emphasis on community involvement (Iyambo, 1992). Vietnam’s PHC strategy, begun in 1986, closely followed Alma Ata’s tenets and included sanitation as one of ten goals to reach by 1990. In conjunction with 3,000 community health centers, Vietnam’s community health workers provided basic treatment and health education from their homes (Birt, 1990).
After deciding to implement PHC in the early nineties, Nepal asked Japan to develop and evaluate a pilot maternal and child health (MCH) center in Kavre District, modeled after Japan’s primary health centers, that integrated health education, maternal and child health (MCH) services, family planning, immunization, control of endemic diseases (e.g., diarrhea and malaria), and basic sanitation (Kuratsuji, 1993). Karungula (1992) asserts that the needs of Tanzania’s citizens (such as sanitation) can be met “only by maintaining primary health care as a major part of the country’s development strategy.” Botswana’s health ministry conducted a pilot integration of specialized interventions into PHC network – with health education and sanitation recognized as core components. The pilot project also included latrine installations and monitoring by a health inspector; however, quantitative results were not provided (Ali et al., 1989).

Along with transitioning their health systems to a PHC approach, many countries recognized that health professionals needed training to use preventive approaches, which would include encouraging sanitation use. In addition to understanding preventive medicine, health workers should also understand how to educate their patients (Grant, 1989).

**Health education for and by health professionals**

Both the education of health professionals and their ability to educate others are important components of managing diseases caused by poor sanitation. Indeed, Jim Grant, executive director of UNICEF from 1980-1995, argued that one of the primary causes of preventable deaths is the lack of knowledge transfer from health professionals to society. He asserted that the problem was two-fold: first, the poor training of health personnel to apply methods, and, second, the inadequate study of methods to apply knowledge (i.e. health education). Grant also pointed out the importance of using medical education to teach
professionals not only how to treat disease but also how to promote health, stating that less than 1% of the medical education is related to community health, and health education. He advocated that medical schools needed to teach students to promote health in tandem with treating disease, that students should experience different settings (e.g. rural health and urban centers), and that primary health oriented curricula must include community training (Grant, 1989).

The literature search revealed several country systems that provide primary health education for health professionals. In the eighties Tanzania’s Ministry of Health developed a continuing education program that included PHC training, available via distance learning and institutional settings. Distance learning PHC units included environmental sanitation and diarrheal diseases. However Tanzania’s continuing education program suffered from lack of funds, lack of qualified staff, and inadequate support (Pemba & Ndeki, 1994).

Development of health professional training, and integrating service and teaching, were top priorities of Nicaragua’s PHC-driven Unified National Health System, established in 1979. Medical residents could obtain formal training in primary care specialties. Brigadistas, volunteer health personnel, played a vital role in educating communities and implementing sanitation campaigns. Principal elements of Nicaragua’s new system, such as personnel training and community-oriented primary care, were modeled after the Cuban health system (Braveman & Roemer, 1985).

Not only is health professional education important, but their ability to educate is also necessary. The next section discusses community health education and changes in sanitation use.
Health education to increase sanitation use (Health Sector Function #4)

Integrated health and education have long served as key components of successful programs to increase sanitation use. Health workers play a vital role in disease management by educating their communities. In Pakistan, over 100,000 Lady Health Workers (LHWs) provide the backbone of the country’s primary health-care (PHC) system. When visiting households, health workers cover a range of concerns related to infectious disease control, including sanitation use. Although specific increased sanitation use was not documented, the LHW programme showed improved health outcomes through reductions in childhood diarrhea. In follow-up evaluations, populations receiving LHW visits had fewer incidents of diarrhea than populations not receiving visits (Barzgar et al., 1997). Similarly, researchers of diarrheal disease interventions in Mexico compared the effects of oral rehydration therapy, increased immunizations, clean water programs, and increased sanitation use between 1978 and 1993. They concluded that improved sanitation produced the greatest reduction in under-5 mortality (Gutierrez et al., 1996). As the authors asserted,

...the only way to change general morbidity and mortality is to invest in holistic public health programs to include both education and sanitation. Furthermore, emphasizing only the potential of oral rehydration therapy (ORT) to reduce diarrheal disease mortality will distract attention from investing in health, more specifically, in sanitation. (Gutierrez et al., 1996, p. 195)

As both of these examples did not describe rigorous methods, more research would be needed to confirm the conclusions reached by Barzghar and Guiterrez et al.

In 1976 Mozambique's Ministry of Health began a self-help latrine construction program, which facilitated the installation of several thousand latrines. However, the program failed due to the lack of appropriate supplies and technical education. A renewed effort
commenced in 1985; community members provided assessment, monitoring and education. From 1979-1996 170,496 latrines were installed. Success factors included the use of an integrated health and hygiene education package (Saywell, 1998).

The community health development paradigm, also known as a horizontal approach, emphasizes local community involvement to determinants of health such as sanitation use. Community health clubs (CHC) are reported to provide a cost-effective mechanism to create both a strong demand for sanitation and a culture of health. Fifteen years of pilot projects in Zimbabwe produced substantive results (Waterkeyn & Cairncross, 2005; Waterkeyn, 2010): after health workers provided six months of weekly hygiene promotion sessions, use of sanitation increased substantially (up to 100%). Due to successes in nearby countries, Rwanda’s Ministry of Health in 2010 initiated plans to use CHCs in every village with more than 15,000 residents to address sanitation and other community health concerns. The CHC approach has recently spread to Asia, where the government of Vietnam is establishing CHCs in 5 districts (Waterkeyn, pers. comm. 2011).

Ethiopia’s health extension worker program, launched in 2005, increased PHC delivery from 77% to 90%, with over 30,000 health extension workers trained in disease prevention and rural health promotion. Environmental hygiene and sanitation are one of the four subprograms (Banteyerga, 2011). Use of improved sanitation increased from 14% in 2005 to 21% in 2010. Open defecation decreased from 61% in 2005 to 46% in 2010 (WHO/UNICEF JMP, 2012).

To complement ongoing community education, health workers can model the use of sanitation in health facilities. However, evidence of strong sanitation practices in developing country health facilities is scarce.
Health facilities (Health Sector Function #3)

Evidence of poor sanitation in developing country health facilities exists from the mid 19th century when Florence Nightingale (1863) stated, “What would be thought in [an England hospital] without a water-closet, or bath, or means of personal cleanliness? Such a hospital would be considered as a mere makeshift.” Although sanitation use in health facilities is paramount to health, no studies found in this review presented discussion and evidence of current policies related to sanitation in health facilities. Conditions in many developing country health facilities are dire. As Cronin and Pond (2008) assert, “the health sector can play a pivotal intermediate role between [health and sanitation] but too often it is not in a position to take the higher ground due to inaction or inability to prioritize water and sanitation in even its own most basic facilities.” A cross-case comparison found that conditions in US Civil War hospitals 1860 are better than present day Sierra Leone (2008), including adequate sanitation (Crompton et al., 2010).

To mitigate a typhoid outbreak in a Singaporean hospital, stringent measures included proper flushing and disinfection of toilets (Goh et al., 1992). Papua New Guinea’s National Health Plan 1991-1995, which recognized that clear performance guidelines would support quality care and proper planning, primary health service standards require community health workers’ homes to have an external tank and a latrine (National Health Plan 1991-1995 as cited in Garner & Thomason, 1993).

Sanitation use is an important practice in health facilities, where health professionals can exert substantial influence. Another important area of influence for health professionals is outbreaks – mitigation and prevention.
Outbreaks (Health Sector Function #5)

Some evidence exists that sanitation-related outbreaks can be lessened in the presence of a strong preventive health network. After Myanmar’s cyclone Nargis in 2008 – the country’s largest natural disaster on record – health services combined with prevention and control measures to mitigate outbreaks. Although incidence of diarrhea, dysentery and ARIs increased, other disease incidence rates and mortality rates remained stable, and disease spikes returned to normal by 2009 (Myint et al., 2011). To avoid outbreaks after the 1995 volcanic eruption in Montserrat, health workers monitored shelter health practices daily and used mass media education (Cooper & Tuitt, 1998). After natural disasters Japan’s primary health center network provides the means to administer crisis response (Fujimoto, 2009 as cited in Katsuda, et al., 2011).

Earlier discussion shows how health professionals can respond en masse to strengthen sanitation use in response to outbreaks. Substantive disease reductions were achieved in the Yakima outbreak, and the incidence of cholera was mitigated in Mexico with a large scale, multi-sectoral sanitation campaign. Recent literature shows increased attention to integrating sanitation into disease-specific interventions.

Sanitation and disease-specific and integrated interventions (Health Sector Function #4)

Emerging evidence demonstrates that population health improves when health professionals use disease-specific initiatives to promote sanitation. Within the past decade, increased numbers of disease-specific programs as discussed in this section have begun to incorporate sanitation use, thus evolving into integrated program approaches. Efforts to address schistosomiasis (also called Bilharzia), a disease caused by parasitic worms or snails and transmitted through fecal matter, have increasingly used integrated approaches. After
confirming that chemotherapy alone would not break the cycle of schistosomiasis transmission in high-risk communities in Egypt, researchers explored the use of integrated approach via PHC to increase sanitation use. Although large-scale chemotherapy is an affordable and feasible strategy, integrated control strategies provide permanent improvement in sanitation to address endemic locales (Curtale, 2010). In a case-control study to evaluate schistosomiasis mitigation in China, routine chemotherapy was supplemented by new interventions including sanitation. Infection rates decreased from 11.3% to 0.7% in one village and from 4.0% to 0.9% in the other (each p < .001). As a result, China’s national schistosomiasis control strategy now embraces comprehensive control measures (Wang et al., 2009).

Trachoma is another disease for which opportunities to integrate sanitation remain largely neglected by the health sector (Montgomery and Bartram, 2010). To combat trachoma, the Amhara (Ethiopia) Regional Health Bureau developed low-cost materials to promote household latrine construction and use, and to train local leaders and health extension workers. Ngondi et al. (2010) describe the use of political support, local policy, and community education to increase household access to latrines rose from 6% to over 50% within one year. Within three years, over one million household latrines were constructed in the region. Follow-up research to explore the exceptional increase in sanitation yielded several findings. First, a substantive predictor of latrine ownership was participation in the health education sessions. Second, as in the Yakima and Mexico examples, a multi-pronged effort that included intense community mobilization and local latrine requirements led to a substantial increase in latrines (Ngondi et al., 2010). By making latrine ownership a requirement, local governments can penalize noncompliant households if needed. Sanctions
also added an element of urgency and legitimacy. Follow-up research showed high prevalence of latrine use more than three years later (Emerson, 2005; Golovaty, 2009).

In a typhoid outbreak in Myanmar, researchers determined that risk factors included pervasive poor latrine conditions. Mitigation measures used by the Disease Control Implementing Committee included latrine repair, improved surveillance, and education (Aye & Siriarayapon, 2004). A pilot school helminth control program in Egypt recommended using a gradual, step-by-step approach to integrating disease control efforts. The authors also emphasized that health staff and participant communities should assist in the development of educational materials (Curtale et al., 2003).

In numerous articles health ministry staff recommended sanitation improvements to alleviate disease impacts, including shistosomiasis control in Uganda (Kazibwe et al., 2010); to mitigate shigellosis in Thailand, MOH staff recommended improved sanitation and health education (Chompook et al., 2006); to reduce and manage trachoma risk in Sierra Leone, NTD staff recommended 36,000 latrines (Koroma et al., 2011); to control NTDs in Morocco the authors advocated an integrated approach including sanitation to control transmission to prevent re-emergence (Smits, 2009); to manage diarrhea and upper respiratory infections in Sembabule district Uganda (Mbonye, 2004), the researchers recommended sanitation and health education. An integrated approach and minimal operational costs are believed to contribute to the continued viability of parasite control in the Seychelles (Albonico et al., 1996). In addition to growing evidence for long-term effectiveness, integration can reduce costs and relieve human resource constraints (Smits, 2009).

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2 Neglected tropical diseases such as soil-transmitted helminthiasis, shistosomiasis, lymphatic filariasis, onchocerciasis and trachoma
As discussed earlier, many current global health initiatives center around disease-specific programs, providing the opportunity to integrate sanitation within existing efforts. In addition to vertical interventions, horizontal interventions used in the late 1900s also offer an opportunity to address sanitation. Consideration of these historical program approaches merits consideration.

**Other integrated programs**

Other integration efforts used family planning as vehicle to promote sanitation. Umati, which pioneered nonprofit voluntary family planning activities in Tanzania in the late fifties, led efforts to support gaps in Ministry of Health MCH programs through an integrated project designed to address parasite control and nutrition. By responding to community needs, the organization found a means to implement activities such as sanitation promotion. This was accomplished by soliciting community participation, which also facilitated community ownership. A local steering committee oversaw program efforts (Mamuya, 1985; Rukonge, 1987). Similar integration efforts were carried out by International Planned Parenthood Federation in Zambia (IPPF, 1989),

**Sanitation within public health and environmental health frameworks**

In addition to a primary health care-oriented approach to sanitation, a number of countries use a public health or environmental health focus to incorporate sanitation within health sector functions. The U.S. Institute of Medicine’s seminal report, *The Future of the Public’s Health in the 21st Century* (1988) recognizes three core functions of public health: assessment, policy development, and assurance.

- **ASSESSMENT** – the regular collection, analysis and sharing of information about health conditions, risks and resources in a community.
• **POLICY DEVELOPMENT** – information gathered from assessment used to develop local policies. It includes consideration of:
  - Political, organizational and community values
  - Information sharing, citizen participation, compromise and consensus building.

• **ASSURANCE** – making sure that needed health services and functions are available.

Sanitation crosses all three functions. Countries such as India have recently initiated a public health approach to advance sanitation-related efforts. Recent initiatives to address poor sanitation in India are based on public health precepts. Chauhan (2011) asserts an urgent need to address India’s “triple burden of disease” from communicable, non-communicable, and emerging infectious diseases must be addressed through an effective public health service to deal with determinants of health such as sanitation. Chauhan blames part of the existing disease burden on inadequate national standards for public health education; however, there has been a recent increase in public health courses in medical colleges. He also recognizes the importance of prevention:

  Focusing on clinical services while neglecting services that reduce exposure to disease is like mopping up the floor continuously while leaving the tap running” (Chauhan, 2011).

In an attempt to address poor health services, India is currently revitalizing its primary health care infrastructure through the National Rural Health Mission (NRHM). The NRHM focuses on providing community-level health care through active engagement of local participants. District health planning now includes integration with broad determinants of health such as sanitation (Dingra and Dutta, 2011).

In some countries sanitation is a component of a national commitment to environmental health. To address the links between environment, health, and economic
development, Egypt’s Ministry of Health and Population crafted a national environmental health strategy at the beginning of the 21st century. In further recognition of its importance, environmental health was one of four main objectives for the Ministry’s Healthy Egyptians Initiative (Anwar, 2003).

In Peru explosive growth and urbanization depleted the government’s capacity to provide public and environmental resources. As a result, the Ministry of Health established the Directorate of Environmental Health (DIGESA), and created the Urban Environmental Health Project to empower communities to mitigate local hazards (Baffigo et al., 2001). In addition to community ownership, sufficiently-trained human capital comprises another critical piece within environmental health programs.

Palau’s health ministry understood the value of an environmental health approach: “Environmental health can no longer be on the back burner…begging for survival from year to year…as a hindsight activity.” To address the lack of human resources capacity in environmental health, the ministry created an environmental health certificate program and an incentive-based career ladder (Sengebau-Kingzio, et al., 2005).

**Conclusion**

Historical evidence exists that health ministries promoted sanitation use through a public health orientation that often included a combination of education, incentives such as distribution programs, and regulations. Over time, health and sanitation functions diverged as governmental institutions have become more complex, and as health and sanitation have also increased in complexity. With a few exceptions, public or environmental health has mostly been subsumed and responsibilities for sanitation within health sector functions are vague. However, some models such as Japan’s primary health center network provide examples of
multi-pronged efforts that offer a means to institutionalize sanitation within health ministry functions.

The review reveals many gaps in understanding about what health ministries do to include sanitation within health sector functions. Much of the research presented is descriptive. While many of the articles described characteristics of individual functions, such as health facilities (function #3) or disease-specific or integrated programs (function #4), none reviewed or even mentioned activities that pertained to all six functions. Other than the reviews by Rehfuess et al., (2009) and Bartram and Platt (2010), no articles included a theoretical framework to analyze health sector engagement in sanitation, thus constraining the ability to examine sanitation promotion by the health sector in a holistic manner. Additionally, only a few articles provided concrete data on increased sanitation use due to health ministry interventions, and none used a rigorous approach. Thus, the need exists for greater attention to health sector opportunities to impact sanitation. This research seeks to explore what health ministries in developing countries do to include sanitation within health sector functions and how health ministry engagement influences sanitation use in developing countries.
CHAPTER 3
CONCEPTUAL FRAMEWORK AND METHODS

Study Design

This study uses a triangulation mixed methods design to investigate the relationship between health ministry engagement in sanitation and sanitation use (Figure 1). The purpose of combining the qualitative and quantitative research was to compare health ministry engagement in sanitation with an analysis of the relationship between primary health care and sanitation use, and then to form a synthesis interpretation of the joint findings. The two methods used here are designed to complement each other. Quantitative research summarizes large amounts of data to draw statistical generalizations while qualitative research provides descriptive details to better understand complex phenomena (Trochim, 2005). The qualitative multi-case comparison provides a micro, or close-up, examination of what three health ministries in developing countries do to incorporate sanitation within health sector functions. Informant interviews provided first-hand knowledge and perspectives on programs and policies used to facilitate the use of sanitation.
Preventive health measures such as sanitation may be included in primary health care-focused programs. To analyze the relationship between PHC and sanitation, the quantitative analysis provides a macro, or large-scale, assessment of the relationship between level of primary health care and sanitation use. When combined, these two perspectives enable the researcher to compare and contrast large-scale trends to country-specific examples (Figure 2). The country-specific examples will provide the opportunity to probe in depth the use of sanitation within health sector functions, using informant interview data. These data are not accessible through quantitative data or the literature and provide unique, firsthand perspective on challenges and opportunities.

Figure 1. Triangulation mixed methods research design.
(Adapted from Creswell & Plano Clark, 2007)
The qualitative component of the study was a multi-case comparison of what health ministries do to include sanitation within the health sector functions. The multiple case study approach is the study of multiple cases within a larger phenomenon, defined as the "quintain" (Stake, 2006). The quintain for this study is health ministries in developing countries. The multi-case approach helps the researcher understand the quintain's complexities (Stake, 2006). Emphasizing the need for commonality of individual cases than can be bound together, Stake (2006) notes that multi-case comparison studies are “studies of particularization more than generalization.” To evaluate examples of each level of primary health care (selective, transition, and comprehensive), three country case studies provided the basis for the multi-case comparison: Nepal, Malawi and Sri Lanka. Data were obtained from informant interview transcripts and focus group interview transcripts from 65 participants, consisting of health professionals, sanitation professionals, development professionals from external support agencies and international nongovernmental organizations (NGOs), and local NGO leaders. Other data for comparison included in-country policy documents and grey literature.
In contrast to the descriptive detail provided by the qualitative research, the quantitative research provides a statistical snapshot of the relationship between the level of primary health care and sanitation use. Use of the primary health care variable allows comparison on one aspect of a health ministry’s commitment to sanitation, with country-aggregated data. The quantitative investigation used health program indicator data, including coverage, economic and government variables from the World Bank, UNESCO, and UNICEF, and sanitation use data from the World Health Organization/UNICEF Joint Monitoring Program.

This investigation builds on recent health sector functions research (Rehfuess et al., 2009) by conducting a multi-case comparison of what three developing country health ministries do to incorporate sanitation into health sector functions using the health sector functions framework. This framework provides a holistic approach to assess use of the six functions, and to determine gaps. This investigation also builds on research by exploring the relationship between levels of PHC and sanitation use. Products of this research will be a series of papers for publication and policy briefs for health ministers and policymakers in developing countries.

**Mixed Methods Research**

The nascent field of mixed methods research was introduced in the late 20th century. As a result, researchers continue to develop and refine procedures to ensure methodological rigor. Current criteria used by mixed methods proponents to establish rigor include intentional collection of quantitative and qualitative data, reporting detailed procedures, using a consistent approach to all research phases, and defending interpretations by addressing
design challenges and using consistent methods (Creswell & Plano-Clark, 2007). I applied these criteria to establish rigor throughout the investigation.

**Conceptual Framework: Health Sector Functions Framework**

Rehfuess et al. (2009) proposed six health sector functions needed to address environmental health issues: (1) setting and overseeing the implementation of health-protecting **norms and regulations**; (2) ensuring that environmental health issues are adequately reflected in **intersectoral policy** development and implementation; (3) incorporating environmental health in **disease-specific and integrated health programs**; (4) practicing environmental health in **health care facilities**; (5) preparing for and responding to **outbreaks** of environment-mediated diseases; and (6) identifying and responding to **emerging threats and opportunities** for health (Rehfuess et al., 2009). Table 1 (p. 7) lists the health sector functions and health professional roles within each function. The six health sector functions provide the basis to examine how health ministries include sanitation. For a detailed discussion of the health sector functions and how they relate to sanitation, see *How health professionals could lever health gains from improved water, sanitation and hygiene practices*, in Appendix B (Bartram & Platt, 2010).
Qualitative Methods: A Multi-Case Comparison of Three Countries

The qualitative component of this study (Figure 3) is an examination of what three developing country health ministries do to incorporate sanitation into health sector functions.

![Diagram of qualitative research stages]

**Figure 3.** Qualitative research stages.
*(Adapted from Creswell & Plano Clark, 2007)*

**Data collection**

The qualitative data collection first began with selecting three case study countries for the multi-case comparison. Next I determined the study population. Then, I reviewed literature and in-country planning documents to compare results.

Country selection. The case study countries were a subset of countries used in the research study *Institutional Arrangements for Sanitation: What Can and Should the Health Sector Do?* conducted by the UNC Water Institute in 2010. To select countries, the original study used a cluster analysis (adapted from Crocker, 2010) to group countries with common characteristics regarding various aspects of sanitation and health systems, such as governance structures, usage of primary health care and sanitation use. Other selection factors included availability of research subjects and the extent of current intersectoral collaborations between sanitation and health. The countries selected for the current analysis were Nepal, Malawi, and Sri Lanka (Table 2): the three countries exhibit different levels of health ministry engagement in primary health care (selective, transitional and comprehensive) and different
levels of sanitation use (ranging from low to high). As shown in Table 2, Nepal’s health ministry has less engagement in primary health-related activities, whereas Malawi and Sri Lanka have a higher involvement in prevention. Sanitation use is less in Nepal (31%), moderate in Malawi (56%), and highest in Sri Lanka (91%).

**Table 2.** Comparison of PHC Level and Sanitation Use in Case Study Countries

<table>
<thead>
<tr>
<th>Level of PHC</th>
<th>Comprehensive</th>
<th>Transitional</th>
<th>Selective</th>
<th>Sri Lanka</th>
<th>Malawi</th>
<th>Nepal</th>
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<tbody>
<tr>
<td>Low</td>
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<td>Medium</td>
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**Percent Sanitation Use**

**Study population.** Informant interviews and focus group interviews conducted during the 2010 Water Institute study provided the qualitative data for this study (see Appendix C). Interview participants were health professionals, sanitation professionals, development professionals from external support agencies (ESAs), international nongovernmental organizations (NGOs), and local NGOs from Nepal, Malawi, and Sri Lanka, as shown in Figure 4. Of the 65 interviewees, 19 (29%) were staff members of national health ministries, 13 (18%) were from national sanitation ministries, 12 (18%) were from in-country NGOs, and 21 (32%) were from external support agencies and international NGOs. Fifteen interview and focus group sessions (42%) were conducted in Malawi, fourteen (39%) in Nepal, and seven (19%) in Sri Lanka.
To analyze the qualitative data, I first conducted a manual review of transcripts from the key informant and focus group interviews. The first reading allowed me to become familiar with the data and to start identifying emerging themes. I then loaded the data into Dedoose, a mixed methods analytic software program. I coded excerpts based on the six health sector functions, with additional codes created as needed to describe the data. Dedoose also provided the mechanism to compare responses among different categories of participants. Further analysis allowed me to evaluate the emergence of repeating themes (Berkowitz, 1997). After coding was completed, I grouped codes by categories (health sector functions, facilitators and barriers, and policy/planning). I reviewed excerpts for their applicability to these categories. I also evaluated the responses according to their organizational and country representations (Table 3) to determine similarities and differences in responses and perceptions (Yin, 2009).
I coded all of the qualitative data myself. Ideally, more than one person would have coded the data, so that coding results could be compared between raters to test the data quality (inter-rater reliability). To test the reliability of self-coding, I reviewed and coded a random sample of 43 excerpts (10%) a month after the initial coding analysis. The recoding results were in 95% conformity with the initial coding analysis.

**Data results**

After completing the data analysis, I determined the thematic findings by using word repetition, pawing, and cutting and sorting (Ryan & Bernard, 2003). I also looked for unexpected conclusions or inconsistencies in results. Next, I triangulated the thematic findings by comparing the informant interview and focus group data with other sources (Yin, 2009), such as country-specific policy and planning documents and published literature. The use of other sources provided the means to further validate the data collected. Other validation techniques are discussed below.

**Validity and reliability**

The qualitative research incorporated several strategies to address validity. To address construct validity, I used data from semi-structured interview questions and coded the responses (Berkowitz, 1997; Neuman, 1997). Next, I reviewed excerpts by code to search for varying opinions and compared the results from health ministry responses and other
participant group responses. When possible, I evaluated how the interview findings converged with other data sources, such as published literature and country policy or planning documents.

To increase the reliability of the qualitative findings, I employed three principles of data collection (Yin, 2009). First, I collected multiple sources of evidence and analyzed their similarities and differences. For example, interview data were compared to literature results. In addition, I analyzed the interview data by comparing health ministry participant responses to responses from “observer” audiences, such as sanitation ministry participants and representatives of external support agencies. Although this research used previously collected interview data, I managed the project that produced the original data and was able to draw from the initial insights gained from those data. In the previous study, a field consultant conducted all interviews, and a second team member reviewed the notes to increase reliability. Next, I created a database to evaluate, track, and cite all evidence. Third, this paper reviews the entire chain of evidence used, from developing the research questions to determining the research findings.

**Figure 5.** Quantitative research stages. (Adapted from Creswell & Plano Clark, 2007)
Quantitative Methods: Analysis of Primary Health Care and Sanitation Use

In contrast to the descriptive detail provided by the qualitative research, the quantitative research provides a statistical analysis of the relationship between primary health care and sanitation use (Figure 5). Use of the primary health care variable allows perspective on one aspect of the health sector functions framework.

Data collection

Data used in the quantitative analyses were obtained from OECD, World Bank, UNESCO, UNICEF, and WHO/UNICEF Joint Monitoring Program data listed in Table 4. A full explanation of data sources and definitions is provided in Appendix D. In addition to the health and sanitation use variables needed for this analysis, I chose other determinants that might influence sanitation use to test the strength of various relationships. For example, countries with fewer people in poverty should have higher sanitation use. Increased rates of educated females can be associated with increased sanitation use (Behrman & Wolfe, 1987). Seven input measures are determinants of health services; seven determinants measure economic, aid, and government inputs; three measure education; and the final determinant addresses sanitation use. Appendix D provides a detailed description of the data definitions and sources.
### Table 4. Variables Used in the Study Database

**Health Determinants**
- Government health spending as percent of total health spending–2000
- Government health spending as percent of total government spending–2000
- Total health spending as percent of GDP–2000
- Percent of 1-year-olds with DTP3 immunization–2009
- Percent of births attended by skilled health staff–1990, 2000, 2010
- Percent of mothers receiving 1+ visits for antenatal care–2009
- Percent of mothers receiving 4+ visits for antenatal care–2009

**Economic and Government Determinants**
- Gross domestic product per capita ($/capita)
- Government effectiveness (World Bank index)
- Income share held by lowest 10%–2010
- Income share held by highest 10%–2010
- Percent of total population living on less than $1 per day in international dollars–2008
- Water and sanitation aid per capita–2008
- Overseas develop aid as percent of gross national income–2009

**Education Determinants**
- Percent of total population completing tertiary education
- Percent of female population completing secondary education
- Girls-to-boys ratio in primary and secondary education–2010

**Sanitation Status**
- Percent of population using improved sanitation

*Data sources: OECD, World Bank, UNESCO, UNICEF, and WHO/UNICEF JMP, 2010. A full explanation of data sources and definitions is provided in Appendix D.*

**Country selection**

Three parameters were used to select the countries for the quantitative investigation: per-capita gross national income, level of primary health care, and use of improved sanitation (see Figure 6). First, I obtained the list of 210 countries listed in the World Bank’s World Development Indicators database. Because the focus of this research is developing countries, I selected low-income countries, those classified by the World Bank as below $1,005 gross national income (GNI) per capita in 1990, and lower-middle income countries, those with below $3,975 GNI per capita in 1990.

Next, I determined the country-level use of primary health care. A complex array of indicators are used to determine whether a country uses a selective, transitional, or comprehensive approach to primary health care (Rohde et al., 2008). These indicators include immunization coverage of one-year-olds with diphtheria, pertussis, and tetanus (DPT3); the percentage of mothers receiving antenatal care; prevalence of contraceptive use;
and the percentage of births attended by skilled health staff members (Rohde et al., 2008). Review of the data revealed that immunization coverage was fairly uniform, and the antenatal care data were sparse. For the purpose of this analysis, I used the “percent of births attended by skilled health workers” as the indicator for level of primary health care, which is recognized as a marker in other research (Kharkee & Jha, 2010; Rohde et al., 2008).

The percent of births attended by skilled health workers also provides information on the availability of health care, or coverage, throughout a country. Although regional or local gaps in coverage may exist, this indicator provides the best available data. The level of primary health care was evaluated as follows: selective PHC countries had fewer than 50% of births attended by skilled health workers, transitional health care countries had between 50 and 80% of births attended, and comprehensive PHC countries had more than 80% coverage of births by skilled health personnel. These ranges and PHC levels match those used by Rohde, et al. (2008).

The final set of data used to select countries for the quantitative analysis was sanitation use. The earliest WHO/UNICEF JMP comprehensive dataset for sanitation use are from 1990. I selected countries that had sanitation use data ranging from 4% to 90% in 1990. Because the analysis examined the growth in sanitation use between 1990 and 2008, the upper limit was set at 90% to allow some room for increased use in the analysis. After applying the exclusion criteria for GNI per capita, skilled birth attendance, and sanitation use, 83 countries remained for the quantitative analysis. Sixty of these countries had all determinants available for analysis of 1990 data; the full set of 83 countries was used for analysis of 2000 data (Table 5).
Figure 6. Flow diagram of countries selected and analyses conducted on PHC and sanitation use.
Table 5. Countries Analyzed by Level of PHC in 1990 and 2000

<table>
<thead>
<tr>
<th>1990</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selective PHC (n=26)</strong></td>
<td><strong>Transitional PHC (n=25)</strong></td>
</tr>
<tr>
<td>Bangladesh, Bolivia, Burkina Faso, Burundi, Côte d'Ivoire, Egypt, Ghana, Guatemala, Guinea, Haiti, Honduras, India, Indonesia, Kenya, Lesotho, Mauritania, Morocco, Nepal, Niger, Nigeria, Pakistan, Rwanda, Senegal, Togo, Uganda, Yemen</td>
<td>Benin, Bolivia, Cameroon, Comoros, Congo, Côte d'Ivoire, Djibouti, Egypt, Guinea, Honduras, Indonesia, Lesotho, Liberia, Malawi, Maldives, Mauritania, Morocco, Namibia, Nicaragua, Paraguay, Philippines, Senegal, Syria, Vietnam, Zimbabwe</td>
</tr>
<tr>
<td>Algeria, Belize, Botswana, Brazil, Cameroon, China, Ecuador, El Salvador, Jamaica, Madagascar, Malawi, Namibia, Paraguay, Philippines, Sudan, Syria, Tanzania, Thailand, Tunisia, Turkey, Zambia, Zimbabwe</td>
<td>Angola, Bangladesh, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Eritrea, Ethiopia, Ghana, Guatemala, Haiti, India, Kenya, Madagascar, Mali, Mozambique, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Rwanda, Tanzania, Togo, Uganda, Yemen, Zambia</td>
</tr>
</tbody>
</table>

Note: Multi-case study countries are presented in boldface

Data source: Data derived from UNICEF, State of the World's Children, Childinfo, and Demographic and Health Surveys by Macro International

Data analysis

Microsoft Excel 2008 for Mac and SPSS 18.0 were used for the quantitative analyses, with the assistance of a statistician. Descriptive statistics were employed to examine sanitation use trends for the case study countries. To explore relationships and compare differences among variables, the statistical tests used were Pearson's product moment correlation coefficient and analysis of variance. These tests allowed the determination of the strength of the relationship between progress in primary health care (in 1990 and 2000) and progress in sanitation use (between 1990 and 2008).
Institutional Review Board

An Institutional Review Board (IRB) application was submitted and approved by the Public Health Nursing Institutional Review Board at UNC in August 2011. The qualitative and quantitative research both were deemed “not human subjects” and the proposed research endorsed. Data analysis began in September 2011.
CHAPTER 4

RESULTS

Qualitative Research: A Multi-case Comparison of Three Countries

Case studies from three countries provided the context for the multi-case research: Nepal, Malawi, and Sri Lanka. Each case study country presents a different combination of health ministry roles in sanitation and sanitation use. The focus of the qualitative research was to use the health sector functions framework to understand what health ministries in the three case study countries do to incorporate sanitation within the health sector functions.

The first section provides background on each country’s political and socioeconomic trends, disease burden from sanitation-related diseases, and trends in sanitation use from 1990–2008. The second section then presents the results according to the major themes that emerged during the research, and discusses the findings.

Background

Nepal political status and socioeconomic situation. Nepal’s political structure changed in 2008 when the constitutional monarchy was replaced by a republic with a multi-party system. The country transition continues toward a federal democratic republic (World Health Organization, 2009a), with its development and its 29 million people highly dependent on foreign funding. The gross national product has tripled within the past 20 years and was estimated at US$13.4 billion in 2008 (United Nations Statistics Division, 2010). However, over 20% of the government budget and half of the capital budget is provided by
foreign aid (World Bank, 2011). After 50 years of humanitarian aid and foreign development efforts within the country, economic development remains comparatively slow.

Although sources provide different assessments of poverty rates, over 55% of the Nepalese people in 2004 were estimated to live in extreme poverty, defined as having daily incomes below US$1 (PovcalNet, n.d.). Despite this extreme poverty, Nepal has made notable progress in education. In 1991, the literacy rate was approximately 33%, but by 2009, approximately 59% of Nepalese people were able to read and write (UNESCO Institute for Statistics, n.d.). The geography of Nepal poses serious challenges to delivering health services to all citizens. Trekking one to four hours to reach the nearest health post or subhealth post is quite common in the mountains.

**Malawi political status and socioeconomic situation.** Malawi is a democratic republic with a presidential representative, who is head of state and government and presides over a multi-party system. After the recent death of President Mutharika, Joyce Banda was sworn in as President in April 2012. In 2004, nearly 74% of Malawi’s population lived in extreme poverty (PovcalNet, n.d.), though the GDP more than doubled from 1990 to 2010, when it was estimated at US$5.1 billion, or $343 per capita (World Bank, 2011). However, Malawi is heavily dependent on foreign aid, and international input into development projects causes the GDP to fluctuate (IMF, 2010). Furthermore, Malawi’s economy relies on agriculture (World Health Organization, 2011), which is highly vulnerable to harsh climatic conditions, which are themselves affected by deforestation, desertification, and overpopulation. Almost 70% of Malawi’s export goods are agricultural (World Health Organization, 2011).
The Malawian education system consists of eight years of primary school, four years of secondary school, and access to universities. The literacy rate in Malawi increased from approximately 49% in 1987 to 74% in 2009 (UNESCO Institute for Statistics). However, due to extreme poverty conditions, many children have little time to attend school; recent data indicate that over 10% of school-aged children do not attend primary school, and only 26% of children complete the entire primary school cycle (UNICEF, 2010a).

*Sri Lanka political and socioeconomic situation.* Sri Lanka, a democratic socialist republic, gained independence from the British in 1948. Sri Lanka’s moderately high economic growth largely relies on a market-oriented environment and strong export performance. The GDP increased five-fold within the past two decades, reaching US$49.6 billion in 2010 (World Bank, 2011), which resulted in a steady decline in poverty. Although 15% of the population in 1991 lived in extreme poverty, that rate decreased to 14% in 2002 and to 7% by 2005 (PovcalNet, n.d.). In the 1940s, Sri Lanka introduced a free education program that allowed everyone to attend school from grade one to university (UNICEF, 2010b). This program resulted in substantive improvements in the country’s literacy rate, which was 91% in 2008 (UNESCO Institute for Statistics, n.d.).

*Trends in sanitation-related health indicators.* A review of sanitation-related health outcomes shows wide differences among the three case study countries. In general, Malawi has the least healthy population and Sri Lanka has the healthiest. Indicators reviewed include under-5 (U5) child mortality, diarrheal rates, nematode infections, malnutrition, and the presence of such tropical diseases as trachoma and schistosomiasis.

Among the three case study countries, wide variation exists in the child mortality trends (Figure 7). Sri Lanka has the lowest U5 mortality at 10 deaths per 1,000 live births,
similar to developed country regions such as Western Europe. Nepal’s U5 rate of 47 deaths per 1,000 live births is nearly five times greater than Sri Lanka’s, but it is less than half the rate in Malawi, which has 97 U5 deaths per 1,000 live births. Between 1970 and 2010, childhood mortality in Malawi, Nepal, and Sri Lanka declined substantially (72%, 80%, and 85%, respectively).

![Graph showing mortality rate in children under 5 (per 1,000 live births): Three-country and worldwide trends.](image)

**Figure 7.** Mortality rate in children under 5 (per 1,000 live births): Three-country and worldwide trends.  
*Data source: Rajaratnam et al., 2010.*

Table 6 provides an overview of the estimated prevalence of sanitation-related disease indicators in the case study countries. In 2004 (the most recent year for which comparative data are available), diarrheal disease caused an estimated 6%–9% of the deaths and 6%–8% of the disease burden, measured in DALYs\(^3\), within Malawi and Nepal. In

\(^3\) Disability-adjusted life years, a measure of disease burden that sums total life years lost and total life years disabled due to the relevant disease.
contrast, diarrhea caused less than 1% of the deaths and disease burden in Sri Lanka. Other diseases related to sanitation, such as intestinal nematode infections, malnutrition, trachoma, and schistosomiasis, were estimated to have caused several thousand deaths and a substantive disease burden each year in each country. The total estimated WaSH-related disease burden differs significantly among the case study countries, with 12% in Malawi, 11% in Nepal, and 2% in Sri Lanka. The total death rate from sanitation-related diseases also varies, with 11% in Malawi, 7% in Nepal, and less than 1% in Sri Lanka.

Table 6. Total Deaths and Disability-Adjusted Life Years (DALYs) for Sanitation-Related Diseases in Case Study Countries

<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
<th>Deaths</th>
<th>% of Deaths</th>
<th>DALYs</th>
<th>% of DALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nepal</td>
<td>26,554,000</td>
<td>17,900</td>
<td>7%</td>
<td>835,000</td>
<td>11%</td>
</tr>
<tr>
<td>Malawi</td>
<td>12,895,000</td>
<td>25,700</td>
<td>11%</td>
<td>903,000</td>
<td>12%</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>19,040,000</td>
<td>1,000</td>
<td>&lt;1%</td>
<td>98,000</td>
<td>2%</td>
</tr>
<tr>
<td>World</td>
<td>6,436,826,000</td>
<td>2,461,811</td>
<td>4%</td>
<td>103,232,988</td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: Prüss-Ustün et al., 2008

**Trends in sanitation use.** Figure 8 compares changes in sanitation use from 1990 to 2008 in the case study countries. The sanitation ladder format shows use for each sanitation type: “open defecation” (i.e., no use of sanitation), “unimproved” (does not ensure hygienic separation of human excreta from human contact), “shared” (an improved facility that is shared among two or more households), and “improved” (ensures hygienic separation of human excreta from immediate human contact). For 2008, Nepal has the highest rate of open defecation at 52%; Sri Lanka has the lowest rate at 1%. The 2008 rate for improved sanitation use also varies widely, ranging from 31% in Nepal to 91% in Sri Lanka.
Results: Multi-case Comparison of Nepal, Malawi, and Sri Lanka Case Studies

The following sections review what health ministries do to incorporate sanitation into health sector functions within the three case study countries, based on the health sector functions framework. Data sources were informant and focus group interviews, in-country policy documents, and published and gray literature. Four categories of participants provided input for this study: health ministry professionals (coded HM in text citations), sanitation ministry professionals (SM), local and national non-governmental organizations representatives (NGO), and members of external support agencies, such as international health, development, and aid organizations (ESA/INGO). First, the discussion reviews each country’s inclusion of sanitation within health-related policies, followed by a description of
each country’s health planning processes and the degrees to which sanitation is integrated in those processes. Then, the chapter presents an analysis of how sanitation is addressed within each country using the health sector functions framework.

**Sanitation within health policies**

A country’s legislative infrastructure sets the stage to implement effective policies from the national to the local levels. The importance of having national legislation to support health ministry action on sanitation was discussed among health ministry participants in all three countries. As one participant explained, “The right to health [through sanitation] is only meaningful if supported by clear supporting legislation, including accountability at the highest political level, i.e. ministers should report annually to the president’s office” (HM2900). In addition, participants pointed out that legislation must meet current needs, with updates enacted when necessary. As one official noted, “Our acts are outdated” (HM1647). Respondents from Nepal and Malawi indicated that the lack of effective legal and regulatory frameworks causes difficulties with enforcement of sanitation-related regulations, as evidenced by these two statements:

- Existing policies are not enforced due to the lack of effective legal and regulatory frameworks/back-up. (HM2358)

- We do have bylaws in the urban area, but we cannot show the actual text of the bylaw and [as a result] the bylaws are not being enforced. (HM1647)

Another official described the consequences of policy gaps, describing his division’s last-ditch actions to mitigate an outbreak:

Even though we were able to enlist the police [during the outbreak], there was no law they could refer to. So their inputs were to scare people in applying good sanitation and hygiene. The vacuum of laws and absence of guidance to [district health officers] in this respect remains a problem. (HM1355)
In some countries, draft policies may exist, but delays in approval leaves them languishing, as one participant noted, “We have a rural sanitation policy [drafted in 2004], still to be approved [in 2010]” (SN863). Thus, enabling legislation at the national level is an important prerequisite needed to incorporate sanitation within health ministry functions.

Sri Lanka’s policy framework provides an example of the importance of legislative support. It provides for effective support at the national level via the Public Health Act of 1848 and for field enforcement by the public health inspector (PHI). At the federal level, officials from Sri Lanka’s Ministry of Health coordinate with local authorities to apply the Public Health Act of 1848 and to ensure that all households have a latrine. Maintaining effective links between national legal mechanisms and local implementation is critical. For example, although participants recognized the importance of the national policy framework, one respondent touched on the importance of community action, noting that “Policy is not the same as practice” (HM3967).

**Sanitation within health planning**

In addition to an underlying policy framework, the planning process sets the framework for program development and implementation. Effective program implementation requires careful attention to track strategic goals and objectives established in the planning process. Although sanitation was not addressed in Nepal’s former Health Sector Implementation Plan I 2005-2010, the recently adopted Nepal Health Sector Plan-Implementation Plan II (NHSP-IPII) 2010–2015 acknowledges the relevance of sanitation to preventive health care and includes a specific objective to mainstream sanitation promotion. The plan also recognizes the importance of surveying and monitoring water quality and of promoting sanitation to improve water quality.
Sri Lanka’s Health Master Plan 2007–2016 (HMP) was designed to support improved health and to meet the country’s overall economic and social goals (Sri Lanka MOHN, 2007). The plan’s focus to improve health status and reduce inequalities relies on five strategies:

1. Ensure the delivery of comprehensive health services, which reduce the disease burden and promote health;

2. Empower communities (including households) towards more active participation in maintaining their health;

3. Improve the management of human resources for health;

4. Improve health financing, resource allocation, and utilization; and

5. Strengthen stewardship and management functions of the health system.

The HMP targets sanitation use within several relevant programs, including disease-specific initiatives such as diarrhea and HIV/AIDS. In addition, the HMP acknowledges Sri Lanka’s commitment to the sanitation and health-related MDGs, which includes Target 7c, to halve the proportion of people without sustainable access to safe drinking water and sanitation by 2015.

At district level the preparation of District Strategic Investment Plans is the key. Of course the donor partners [GFATM] push for the implementation of the[ir] package. (HM868)

Participants indicated a general lack of coordination between federal and district planning processes. As one participant stated, “inter-ministerial consolidation of these plans is absent.” The lack of coordination between departments, both within and across ministries, seems pervasive. Although joint sector review (JSR) processes have been established to increase synchronicity in planning, sector reviews often do not include outside sectors. For
example, the health ministry may not be represented at the water and sanitation sector review. Another important aspect of planning involves coordination of all parties working on health. As noted by one participant, “Ultimately integration needs to take place at district level. There are hundreds of NGOs working on health in any given district. NGOs should go through DHO/DPHO to share health resources. Often this is not happening” (HM7932).

Sanitation within health sector functions

The health sector functions described in Chapter 3 was used to frame the in-country interviews. A word frequency analysis (Ryan & Bernard, 2003 and Seghal & Stewart, 2006) identified patterns in the interview responses mapped to the six health sector functions, as presented in Figure 9. The number, size, and letter thickness of words demonstrate the degree to which the discussion focused on certain topics. For example, Function 1 “Norms and Regulations” contains fewer words than Function 4 “Disease-specific and Integrated Programs” because the Function 4 responses repeatedly covered those topics shown. The number of words, and word emphasis, within a function may not imply that the participants considered those topics the most important. Rather, the increased repetition simply indicates that the interview responses focused more on those themes. As shown in Figure 9 the intersectoral policy and the disease-specific and integrated programs functions received the most responses. Conversely, very few interview responses fell into the health facilities function.
**Figure 9.** Word frequency analysis.
*Source: Figure generated using interview data*

**Function #1: Norms and regulations.** To support sanitation use, health ministries can develop and monitor health-protecting standards and regulations (Rehfuess et al., 2009). Health-related norms and regulations are used to support sanitation to varying degrees within the case study countries. In Nepal, regulations require utilities to develop water safety plans. The Ministry of Health and Population (MoHP) is responsible for monitoring and surveillance procedures to verify water quality complies with national standards. Sanitation use in Malawi was enforced during colonial times through England's Public Health Act, although current enforcement could not be confirmed. In Sri Lanka, the installation of latrines is promoted through enforcement of legislation related to housing. For example, when health authorities approve applications for building construction, they ensure that drinking water sources will not be contaminated by water from toilets and other unsanitary sources. Furthermore, all new houses have to install toilet facilities in order to obtain
approval from the local authorities. The local department of health services usually provides financial assistance to those without toilets and to those unable to construct one with their own resources.

At the local level in Sri Lanka, the Public Health Inspector (PHI) verifies compliance with standards. The PHI has the authority to intervene when water quality is inadequate (such as due to poor sanitation) and to monitor for minimum distances between a well and a latrine. Upon the PHI’s recommendation, Pradeshiya Sabhas, the local units of government, can take legal action. Although Sri Lanka’s policy framework is longstanding, one participant with a long history of engagement noted that inspector responsibilities have shifted over time:

The PHI is responsible for [checking on] sanitation in the community/household. However, they are taken up by other tasks and have forgotten their old tasks. (ESA508)

**Function #2: Intersectoral collaboration.** Responsibility for sanitation is usually distributed among several ministries and economic sectors in developing nations. Cross-sectoral action can provide a financially prudent option to improve health and to encourage investments by non-health sectors. Health ministry roles include tracking policy and participating in multidisciplinary collaborations. However, effective collaboration requires the commitment and active involvement of top leadership. In addition to the health ministry, sanitation almost always involves ministries that deal with water and sanitation, infrastructure, education, and local government. For example, the health ministry can partner with the education ministry to support health instruction through the schools; this would also support Alma Ata’s tenets of local education.

Stakeholders from the three countries identified large gaps in cross-sectoral coordination at the national ministry level, and most participants noted that inter-ministerial coordination
for sanitation needed to improve. Although each case study country has a cross-sectoral sanitation coordination group that meets to develop and implement strategies to increase sanitation use, health ministry participation is not routine. In addition, junior-level health staff members may attend committee meetings rather than senior leadership. In some situations, health ministry involvement is crisis-driven, such as during cholera outbreaks. In one country, as one participant noted, this crisis-oriented approach to sanitation support recently resulted in the public perception that the health ministry could not protect public health.

The lack of an effective policy infrastructure to support intersectoral collaboration adversely affects the intersectoral collaboration function. For example, Nepal does not have a culture of multi-stakeholder involvement in policy-making processes. As a result, existing policies and legislation are highly fragmented. No common vision exists that public health is an intersectoral issue, as one participant explained: “[There is] a multiplicity of vertical programs and NGOs working at the district level, little collaboration outside of their own silo” (ESA136). However, participants do recognize the need for collaboration, with one noting that “Sanitation is not an issue that can be dealt with by one department” (HM1545).

Participants from Malawi noted that poor sanitation, a recognized problem for many years, falls between the Ministry of Health (MoH) and the Ministry of Planning and Public Works (MPPW). As one participant noted,

MoH cannot solve this problem alone. We need to coordinate with MPPW but first we need to develop a common language for defining the problem and measures to address it which are acceptable to both sides. (HM169)

Malawi’s draft Sanitation Policy 2008 suggests that the government of Malawi is preparing to implement a formal policy to oversee cross-sectoral actions to support sanitation
(MOIWD, 2008). However, responsibility for sanitation recently shifted from the Ministry of Health to the Ministry of Irrigation and Water Demand (MoIWD). One participant noted that “if the MoIWD does not integrate efforts with the MoH, it [MoIWD] will have difficulties appointing staff members at the district level and will risk duplicating tasks.”

Sri Lanka has made greater progress integrating sanitation efforts across sectors. *Sri Lanka’s Health Master Plan (2007–2016)* acknowledges the importance of intersectoral collaboration. It notes that intersectoral action is a “major process in developing health-care programs” and that “the contributions made by other sectors... cannot be under-estimated.” To continue to strengthen the health network, the plan also notes that the health ministry is developing formal intersectoral coordinating mechanisms to strengthen the health network across different levels and to ensure that different sectors collaborate to improve health (Sri Lanka MOHN, 2007). Sri Lanka’s sponsorship of the SACOSAN IV conference in April 2011 also motivated more participation in sanitation issues by various sectors.

Collaboration at the district level also presents difficulties. District health officers are responsible for bringing stakeholders together for regional efforts. However, their capacity to support regional coordination varies, and they may not be able to solicit participation by colleagues in water and sanitation. With the lack of official guidance in Nepal and Malawi, collaboration is an exception rather than the standard. In Sri Lanka, cross-sectoral collaboration is ongoing, although in recent years attention to intersectoral collaboration has waned. The 2007–2016 national health plan calls for renewed focus and ongoing commitment.

*Function #3: Health facilities.* The health facilities function represents a critical component of a health infrastructure that supports the use of sanitation. Sanitation use in
health facilities provides health professionals the means to model appropriate practices for the community. As noted in Figure 9, the interview data revealed little information about health facilities.

Health facilities assessments provide valuable data on the status of sanitation and indicate that poorly functioning sanitation equipment is common in health facilities within the case study countries. In a 2010 study of Nepal’s health facilities, 10% of health posts did not have toilets. Less than 50% of the Village Development Committee offices had toilets. What toilets did exist were likely to be poorly maintained: 62% of the toilets inspected were in poor condition (Nepal Water for Health, 2010).

For the case study countries, no standard requirements exist for construction, operation, and maintenance of toilets within health facilities. Where toilets are available in health facilities, they are often rendered inoperable for their intended purpose by a lack of maintenance or water. As a result, people choose to go elsewhere for care. For example, as one participant noted,

Public hospitals have qualified doctors and equipment. Still people go to a less qualified private health provider. Why? Because the sanitary conditions in hospitals are so bad. No water for handwashing, no toilet. If there is a pit latrine/toilet, it is also used to dump syringes. (HM7528)

Health practitioners cannot model safe practices in facilities with poor equipment. As another participant observed,

On health promotion: people know what they do and not do. As far as health behavior is concerned the role of professionals is very important, not just for advocacy, but also to demonstrate their own adherence to the hygiene principles! (ESA886)
Sanitation use in health facilities also requires coordination across sectors. In one city, health facilities depend on services from the engineering department, and the lack of communication adversely affects their operation. As a participant explained,

> Between health and engineering [departments], priorities may not match. So coordination is necessary. Thus we requested 2 cesspit emptying vehicles of the 4 available. This enabled us to at least clean all the health facilities that fall under the City Assembly. Now unfortunately only one (out of 4) is operational due to lack of funds and spare parts. (HM2744)

Health facilities play an important role in modeling sanitation use. However, poorly functioning sanitation exists in health facilities throughout the case study countries with little information was available on their management and status. One participant commented, “The challenge is to get people to construct and use latrines: promotion by health [professionals] is essential” (HM1355).

**Function #4: Disease-specific and integrated programs.** To increase outreach, disease-specific and integrated programs, such as Integrated Management of Childhood Illness\(^4\) (IMCI) should include education on sanitation use. Health professionals at all levels of the health ministry have the responsibility to teach others about sanitation use and to encourage behavior change. However, sanitation is rarely addressed in program design. Health professionals training curricula should also include environmental determinants such as sanitation (Rehfuess et al., 2009). The interview participants provided substantial feedback regarding the need to incorporate sanitation within health programs.

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\(^4\) A systematic approach to children's health which focuses on the whole child.
A surprising result from the interviews related to the disease-specific and integrated programs function was that health ministries had greater engagement in sanitation in the past than they do now. During discussions of preventive health-oriented approaches, participants from each country shared examples of greater previous health ministry involvement in sanitation. They indicated that during the past 20-30 years, health ministry roles in sanitation have diminished substantially. As one participant stated, in Nepal,

The National Health Education, Information and Communication Centre (NHEICC) used to have a sanitation unit staffed with a sanitary engineer, health promoter and a technician. Somewhere around early 90s the unit was dissolved. (HM1304)

Other participants corroborated this comment, noting that

Environmental health has been completely neglected within MoHP. There was a dedicated unit many years ago (up to early 1990s, within the NHEICC) but even then limited staff of sanitary engineers and sanitarian. (HM3106)

and

Sanitation is quite good in some areas, maybe due to earlier public health approaches (during colonial times). (ESA1773)

In Malawi, informant interviews also noted that the Ministry of Health “used to have sanitary staff in the past” (HM6788) and that “The Malawi Health services are based on PHC. Originally staff spending more time on EH, but now that we have vertical programs, staff time is absorbed for these activities” (HM680). Other informant statements called for a return to previous programs:

Used to be an effective CDD program (mid 90s) that was later subsumed under IMCI and later dropped as IMCI focused more on clinical health. (HM3320)

[In the past] PHC package including water, sanitation and hygiene was practiced but now less. But, countries like Nepal need a PHC approach due to
In Jajarkot and Rukum, poverty seems to be eating all progress. Let us try to re-introduce the Control of Diarrhoeal Diseases approach, this is now getting less attention in IMCI, where it is placed now. (HM5411)

Malawi’s HESP program used a community-based approach and included water and sanitation as core components of health education.

Participants asserted that the reduced emphasis on sanitation within health services programs matches reduced sanitation use in general. Participants in both Malawi and Sri Lanka mentioned that use was greater in the past, stating variously, “Sanitation and hygiene were once 100%, but have gone down in the last few decades” (ESA1633) and “Yes, sanitation is actively pursued by all–on paper. Sri Lanka used to have better sanitation” (SN1664).

Participants also noted greater previous involvement by the MoH in Malawi:

Ministry of Health and its district units were once active [in sanitation] and more important as the EHD reported to the Permanent Secretary, but nowadays have been sidelined by vertical programs…Health at district level has in recent years not been the strongest in public health, but has done a good bit of work. Crowding out by vertical programs has been a problem. (ESA1633)

This resembled the situation in Sri Lanka, which one participant described as follows.

In the past sanitation was with the MoH, linked to Health. Functioning well, it was like this until 4/5 years ago. Now sanitation is under the control of the Government Agent (local government). The issue was raised in the National WSS Coordination Group, and there was a recommendation to reverse the arrangement and request Government to return the task to Health. (ESA3161)

In each of the case study countries, most participant groups recognized the need for health education on sanitation, an important component of both disease-specific and integrated programs. In Nepal, “BCC (behavior change communication) is very important and needs to
get more support all around” (ESA1994). In Malawi, “Health is in preventive services. It should do more in investing in health education. We should try to do campaigns, but investment is not good enough” (HM3024). Addressing the potential of health education to affect health services, one participant noted that “Health should be involved more in hygiene promotion as it would eventually reduce their caseload if people would change their behavior” (HM739).

Informants in Nepal and Malawi indicated that disease-specific interventions were the strategic emphasis of their health ministry. In Nepal, “MoHP is dominated by doctors who focus on treatment and public health professionals are marginalized” (HM3769), and in Malawi, “With the introduction of the Essential Health Package, the focus on diseases has further strengthened and sanitation remains on paper” (HM4791). Representatives of donor organizations concur, with participants noting that “[Our office] has long recognized that the institutional response is inadequate and that there is a huge imbalance between curative and preventative interventions” (ESA327) and that “MoHP has high competition for airtime, many well endowed vertical programs, crowding out sanitation” (ESA450).

While being driven by multiple priorities, health participants also acknowledged the potential role of sanitation in alleviating disease: “We need to put more effort into prevention because it is expensive to treat the consequences” (HM612). Though recognized as important, inclusion of sanitation within health education programs was inconsistent across the three case study countries. Despite the focus on vertical interventions, sanitation seems to be rarely included in health department programs addressing diseases. As one participant explained,

“The link between HIV/AIDS and WASH interventions is known. WASH interventions could make a difference for people living with HIV/AIDS as it would
protect them against diarrhea, skin disease and respiratory infections. Health does not push services in WASH for HIV/AIDS. Only some messaging happens, with messages sometimes too simplistic” (ESA7821).

Another informant described the situation,

There are too many cases coming to the health system. Unless we strengthen the preventive side thru environmental sanitation, there will be no chance to improve the situation. [It is a] vicious cycle. (NGO3375)

Although participants from Sri Lanka made no references to preventive versus disease-specific interventions during the in-country interviews, the National Health Plan indicates that sanitation is integrated into both the PHC system and disease-specific interventions such as diarrhea and HIV/AIDS (SLMHN, 2007).

As written in the Alma Ata Declaration (WHO, 1978), preventive health interventions are a cornerstone of primary health care. Nepal’s health ministry is focused on disease-specific interventions, or selective PHC, such as immunizations (Karkee & Jha, 2010). In Malawi, the Essential Health Package addresses eleven conditions but remains disease focused. While preventive measures such as sanitation are included in health policy and planning documents, little effort occurs to mitigate open defecation and educate on poor sanitation practices. In contrast to Nepal and Malawi, which have weak emphases on integrated approaches to health, the Sri Lankan government institutionalized preventive health care programs in 1925 with sanitation as a primary component. Ninety years later, health planning and programs continue to include sanitation (Herath et al., 2001). In Sri Lanka, PHI monitoring and family health workers (FHWs) support sanitation promotion and monitoring to ensure good sanitation practices.

**Function #5: Outbreaks.** The consequences of an outbreak may be far-reaching, and include health impacts, resources needed to investigate and respond, and economic impacts.
Even an occasional outbreak can contribute significantly to a country’s annual disease burden, and resulting stresses on health staff. Health ministries usually hold responsibility for oversight of outbreak investigations, and developing and implementing procedures, and updating regulations and policies when needed (Rehfuess, et al., 2009). In Nepal, severe outbreaks in 2009 resulted in negative press and decreased public confidence in the Ministry of Health's ability to protect health:

The Jajarkot outbreaks received a lot of press, and subsequent political attention. MoHP was blamed in a televised meeting of the PM with senior government officials of Health, Local Government, Physical Planning and Home Affairs. (HM3674)

When asked whether the potential for outbreaks could be mitigated through ongoing monitoring and cross-sectoral coordination, respondents from all three countries indicated a general orientation towards crisis responses. One observer stated that “[Health is] only interested to work with watsan during outbreaks” (ESA409), and in Sri Lanka, “Our MoH is more fire-fighting than being able to do regular work” (NGO588). Another was more grim: “The response of Health is post-mortem” (ESA7473).

Coordination, participants explained, is necessary to prevent outbreaks, with one participant stating that “Sanitation is not an issue that can be dealt with by one department” (HM1545). In response to the 2009 cholera outbreak in Lilongwe, this same participant said health and IWM worked well together with “Health providing the short-term response and IWM delivering the longer-term solutions” (HM1545). A different participant noted the potential gains from such emergencies, as well, explaining that “Outbreak [crises] are good opportunities to bring [the health ministry] and watsan together” (ESA1870). Such
calamities, the participants indicated, can stimulate action, but still do not employ prevention-oriented solutions:

The government has made provisions for responding to similar emergencies in future but is not addressing the underlying causes in a systematic manner. Although there have been no acute outbreaks so far this year the figures show that large numbers are still dying from water and sanitation-related diseases but just not making headlines. (HM3327)

**Function #6: Impacts, threats, and opportunities.** Assessing impacts includes examining program effectiveness and sustainability, monitoring for potential threats, and exploring opportunities for new means to secure health. Ongoing monitoring and assessment can increase success over time by adjusting procedures if needed. The interview data indicated that this health function is underutilized in the case study countries. In Nepal, large epidemics receive greater attention than routine monitoring of sanitation-related diseases. For example, participants indicated that seemingly sporadic incidents of diarrhea are not reported. To conduct surveillance for diseases that cause diarrhea, a key area is water quality monitoring. Ongoing water quality sampling is irregular across the case study countries. One respondent noted that while the Ministry in Nepal has a mandate to test for water quality, the capacity does not exist. In Malawi, HSAs support data collection for input into a national HMIS. Sri Lanka's PHIs and FHWs conduct monitoring, and data are reported in weekly newsletters. Although some monitoring exists, none of these countries have a means to independently verify water quality data.

**Facilitators and barriers**

During the interviews, five core facilitators of health sector effectiveness emerged from the interview data that stimulate and support the health sector functions. Alternatively, these characteristics could serve as constraints to policy and program implementation. These
facilitators are leadership, financing, human resources, information systems, and community participation. The first four of these facilitators are also described as health system building blocks (WHO, 2007) and included within public health frameworks (Turnock, 2009). As shown in Figure 10, the facilitators can provide underlying support to the health sector functions. For example, leadership plays an essential part in establishing norms and regulations (Function #1), supporting intersectoral collaboration (Function #2), overseeing sanitation use in health facilities (Function #3), ensuring that sanitation is included in disease-specific and integrated programs (Function #4), mitigating outbreaks (Function #5), and supporting proactive planning for impacts, threats and opportunities (Function #6). Similarly, the employment of community participation, support of human resources, availability of information systems, and adequate financial resources all play an important role in ensuring success of the six functions.
Facilitator #1: Leadership. Participants in each of the case study countries noted the impact of leadership, including, “There was also lack of leadership on the part of Government (at all levels)” (HM1693). They also noted its influence in making actions happen, with such statements as “But the message [to promote sanitation] has to come from the leadership!” (HM6313). Policy, programs, and actions to support the health ministry’s involvement in sanitation begin with national leadership. One participant explained the consequences from a lack of leadership in Nepal, stating, “No national vision [related to sanitation], so [there is] no point to charge FCHV more. She needs higher level support first” (ESA1557). Without leaders to direct and encourage action, people are not motivated. Ultimately, leaders lead and facilitate change. For example, one Sri Lankan informant shared
that “President Rajapakse has also indicated in a meeting with relevant ministries in the beginning of 2010 that he is very keen to further promote sanitation and hygiene!” (SN4610). In addition to national leadership, health ministry executives must not only support sanitation-related policy and programs, but also actively engage in ensuring resources are available to support action.

The absence of senior health ministry leadership in intersectoral planning meetings has negative consequences. As one participant explained, “[During the] Joint Sector Review process, no health official participated. Some factions within the JSR review team are lobbying with MoIWD to take money from Health for EH” (ESA1125). The absence of health leaders during decision making can result in missed opportunities for resource allocations. Similarly, leadership is required to drive an operational convergence of health and sanitation, as described by an informant, “leadership and clearer guidance [are required] as district level officials are currently getting mixed messages which provides an excuse for inaction” (ESA795).

**Facilitator #2: Community Participation.** Sri Lanka’s local water and sanitation projects have long embraced community participation, the second facilitator (Bradley & Karunadasa, 1989). A recent example is the post-tsunami recovery project in the district of Galle. Villagers learned about safe WaSH practices from local health workers, who also monitor the construction of sanitation infrastructure and facilities.

**Facilitator #3: Information systems.** The third facilitator, information systems, provides a strong foundation to support the health sector functions. Accurate information promotes sound policymaking, program development, and monitoring and evaluation. Each of the case study countries possesses information systems, as one participant explained:
“Basic WaSH data are already integrated within zonal health information systems (HMIS)” (HM490). Interview participants recognized the potential value of information systems, with one participant noting, “HMIS data sharing should be possible. Information should be in one place. The sector is not yet using shared data for planning” (NGO2183). They also recognized its economic advantages, stating, for example, “Health data are very important! If we can prevent an outbreak, then MoH can save money” (SN5198). However, participants recognized that recordkeeping can be improved, with one stating that “District level M&E is unreliable. Data does not match clinical reporting” (ESA6242).

Nepal has mechanisms to integrate data collected from the MoH and DWSS, but they are not employed on a systematic basis. Reliability depends on the motivation of the responsible individuals. Malawi’s Health Ministry has a robust HMIS, yet HMIS does not coordinate with MoIWD to target critical areas. Malawi’s participants recognized the gap in data sharing with the watsan sector, and, as one participant confessed, “We will need to work together better” (HM1452). One participant from Sri Lanka described a similar lack of data sharing, noting that open defecation still occurs in the plantations, which are often uphill from drinking water sources; the failure to protect sources creates ongoing problems. At the local level, examples of coordinated efforts to improve data sharing and to integrate efforts occasionally occur. In one city, the local health department coordinated with the engineering division to clean out drains prior to the rains.

Participants from outside the health ministries substantiated the comments by health participants. Comments in Nepal, such as “data does not match clinical reporting” (ESA6242), confirmed that district M&E may be unreliable. In Malawi, one respondent
noted that water quality testing occurs after installation but that routine testing probably does not happen.

**Facilitator #4: Human Resources.** The lack of trained health workers to implement programs can severely reduce outreach efforts and program impact. Each case study country has challenges with human resources, the fourth facilitator. For example, Malawi has extremely high health worker shortages, with up to 50% of positions vacant in some districts. Incentives to increase rural staffing cause ramifications for urban facilities, as one participant explained:

> We need some 10-15 nurses for our health facilities. Now just 3 remain as we are not able to pay top-up. So they all go to rural projects, where they will receive top-up through the Global Fund –GoM. Very limited staff to run antenatal and under five clinic. (HM4108)

**Facilitator #5: Financing.** The final facilitator, financing, affects both policy and program implementation. In some instances, participants mentioned that the lack of funding prevents health staff members from implementing programs related to sanitation. The SWAp planning process was mentioned as one way to acquire funds for sanitation, as several participants noted.

> Health SWAp: to be able to earmark funds from SWAp, we have to change the dialogue. The big vertical programs are skewing the health sector functioning. With the right advocacy approach it should be possible to access part of the 25 million now in the SWAp. (ESA617)

> Global Fund is also for development and training of HR/65 million US$ for Health System strengthening. (HM5144)

In other instances, financial resources are directed to other priorities. One health official noted that the ministry is “bio-medical” and provides insufficient resources for community
and environmental health initiatives. Furthermore, in Nepal funds are rarely allocated to sanitation-related initiatives because of concerns regarding the cost-effectiveness of interventions:

Lastly it is essential to get a better idea of what these activities cost. MoH is always asking about costs and benefits of adding additional components to PHC package. (ESA2926)

Due to scarce or unreliable financial resources, programs once initiated may not have the ability to ensure long-term implementation. One participant complained that “In the past HESP was great, as there were funds available to do work. Now I am trying to do PHAST, but no resources for follow-up” (HM3326). A further comment noted the following regarding the impact of poor or non-existent funding.

Yes, we are taking our responsibility seriously, but limited funds. We are all the time looking for supporters to undertake our work. Reprinting of hand washing material with the support of UNICEF, the H1N1 materials with support of OXFAM. (HM3599)

An unexpected result in the research was the influence that (international) donors have in regards to health ministries’ engagement in sanitation. Country programs may focus on initiatives dictated by donor priorities in order to receive funding. Programs are often created based on donor input, which means funding priorities may not reflect the country’s highest disease burden: “Donor behavior has effectively crowded out sanitation in recent years” (ESA2846). While a few donor-related comments were from health ministry participants, most responses were from external support agency participants themselves, including the comment that “Donors are historically part of the problems” (ESA834). One
participant candidly stated, “As a [country office] we decide on the workload the activity causes. Less attention is given to [the] relevance of the activity” (ESA886).

Cross-sectoral collaboration among donors is unusual as well. A participant who had previously worked for an external support agency commented on the challenges of working across sanitation and health, noting, “My colleague was not interested. In other words, there is a risk of compartmentalization in donor agencies as well” (XYZ4031). Another respondent noted the challenges associated with funding sanitation because it crosses ministry lines:

Donors are increasingly expected to align behind government systems, so [they are] more likely to align behind programs which are clearly linked to a single ministry with clear lines of accountability. There is no such thing as a Sanitation SWAp. Sanitation remains a series of projects and so it is neglected by new aid modalities. Donor behavior has effectively crowded out sanitation in recent years. (ESA2431)

Participants recognized the challenges and offered the SWAp process as a solution:

Now that NHSP II has integrated Environmental Health, it should be possible for donors to support through the SWAp. May be there would be a role for WA Nepal to recommend the development of a ‘sanitation; action plan that would use funds that could be diverted from the SWAp funds? Jajarkot could/should be a pilot project. Show the cost-effectiveness and share the information regularly with stakeholders. (HM8455)

Donors have the opportunity to influence health ministry priorities and to engage ministries in innovative opportunities to address sanitation.

Conclusion

The qualitative analysis uses the health sector functions framework to provide a multi-case perspective of what health ministries do to address sanitation within three country case studies (summarized in Table 7). The extent to which sanitation is integrated into policy, planning and functions for the three countries, Nepal, Malawi, and Sri Lanka (low, medium,
high), parallels their level of PHC (selective, transitional, comprehensive). Nepal’s health ministry rarely incorporates sanitation into policies, planning and functions; The Ministry of Health in Malawi includes sanitation in its health plan, but action rarely occurs. Sri Lanka’s health ministry incorporates sanitation within policy, planning and functions; however, sanitation receives less attention than in the past due to other priorities.

**Table 7. Summary of Health Ministry Use of the Health Sector Functions in the Case Study Countries**

<table>
<thead>
<tr>
<th>Function</th>
<th>Nepal</th>
<th>Malawi</th>
<th>Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Norms and Regulations</td>
<td>Moderate: water safety plans required but health absent</td>
<td>Moderate: mechanisms in place from Public Health Act, but outdated</td>
<td>High: Sanitation is incorporated within Ministry’s policy infrastructure</td>
</tr>
<tr>
<td>2. Intersectoral Policy and Coordination</td>
<td>Low: Crisis-oriented coordination; Health staff rarely attend existing initiatives</td>
<td>Moderate: Some coordination; recent shift in sanitation responsibilities to MoIWD of concern regarding coordination of roles</td>
<td>High: Long history of intersectoral collaboration, though attention has waned; new plan includes increased priority on intersectoral action</td>
</tr>
<tr>
<td>3. Health Facilities</td>
<td>Low: many facilities sanitation poorly functioning or nonexistent</td>
<td>Low: many facilities sanitation poorly functioning or nonexistent</td>
<td>Moderate: some facilities sanitation poorly functioning</td>
</tr>
<tr>
<td>4. Disease-Specific and Integrated Programs</td>
<td>Low: network of female volunteers, but do not address sanitation</td>
<td>Moderate: network of health workers, sanitation exists on paper but not in practice</td>
<td>High: network of health workers and public health inspectors; although weaker than in past</td>
</tr>
<tr>
<td>5. Outbreaks</td>
<td>Low: Crisis-oriented</td>
<td>Low: Crisis-oriented</td>
<td>Moderate: ongoing prevention not as strong as in the past</td>
</tr>
<tr>
<td>6. Impacts, Threats, and Opportunities</td>
<td>Moderate: HMIS but not shared</td>
<td>Moderate: HMIS but not shared</td>
<td>Moderate: HMIS but collaboration is weak</td>
</tr>
</tbody>
</table>

As discussed under function four (Disease-specific and integrated programs), informants recognized that sanitation-related health education was important but lacking, especially in Nepal and Malawi. Informants also asserted that previous initiatives place greater emphasis on integrating sanitation and health efforts. Indeed, programs from the 1980s and 1990s, such as HESP and CDD, centered on sanitation and health. Other programs such as IMCI included sanitation as one component of a multi-pronged approach to
management. Several participants asserted that, in conjunction with an historical increased health ministry emphasis on sanitation, historical use of sanitation was also higher.

In contrast to current approaches in Nepal and Malawi, Sri Lanka’s health ministry has long integrated sanitation within its primary health delivery system, established in the 1920s (CCPSL, 2000). Sri Lanka’s current Health Master Plan (2007–2016) continues the long-standing approach of including sanitation within both disease-specific and preventive programs.

As shown in the qualitative research findings, sanitation-related health education is lacking, particularly within the health ministries that did not focus on preventive measures, one of the foci of PHC delivery as described in the Alma Ata convention (WHO, 1978). As defined in Chapter 1, three levels exist for primary health care: selective, transitional, and comprehensive. If sanitation education or increased intersectoral collaboration is more likely to be addressed in countries with an increased PHC orientation, as defined in the Alma Ata Declaration, perhaps sanitation use is also increased. The next section presents the quantitative analysis for this mixed methods research.

**Quantitative Analysis of PHC and Sanitation Use**

To determine if a relationship exists between health ministry engagement in sanitation and sanitation use, the quantitative analysis investigates the relationship between PHC, one measure of health engagement, and sanitation use. If a health ministry places emphasis on increased levels of PHC, then prevention-oriented mechanisms such as sanitation should have higher priority. As a result, sanitation use could also be higher.

The quantitative research tested two hypotheses:
**H1.** Developing countries with higher level primary health care delivery systems in 1990 and 2000 have increased sanitation use in 2008.

**H2.** Higher levels of PHC is associated with increased progress in sanitation use in developing countries from 1990 to 2008.

Several indicators are available to evaluate a country’s level of PHC (Rohde et al., 2008). To investigate the hypotheses, I used indicator data to compare the level of primary health care (i.e., selective to comprehensive) to sanitation use from the WHO/UNICEF JMP dataset.

**Aggregate country trends**

PHC indicator data from 1990 (60 countries) and 2000 (83 countries) were used to determine large-scale trends regarding the relationship between PHC levels and sanitation use between 1990 and 2008 in developing countries. Because the hypotheses focus on trends over time, comparisons were made for the eighteen-year span between 1990 and 2008 and the eight-year span between 2000 and 2008. The statistical analyses performed were descriptive statistics, correlation coefficient, and analyses of variance (ANOVAs); other analysis employed was general trend analysis. The discussion is divided into two sections to address the hypotheses. The first section examines the relationship between the level of PHC and sanitation use between 1990 and 2008; the second section analyzes trends from 2000 to 2008.

**PHC levels and sanitation use.** To investigate H1 (i.e., developing countries with higher level primary health care delivery systems in 1990 and 2000 are likely to have

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5 1990 is the earliest year and 2008 is the latest year for which WHO/UNICEF JMP sanitation use data are available
increased sanitation use in 2008), this section reviews the relationship between PHC levels and sanitation use trends between 1990 and 2008.

First, the descriptive statistical analysis explored the average (mean) and median level of sanitation use for 1990 and 2008 in the subject countries (see Table 8). In 1990, the average percentage of the population using improved sanitation was lowest in countries using selective PHC (29%), and higher in countries with transitional (55%) and comprehensive PHC (76%). Similarly, in 2008 increased sanitation use corresponded to increased PHC: countries with selective PHC averaged 40% sanitation use, countries with transitional PHC had 65% sanitation use, and comprehensive PHC countries had 86% average use of improved sanitation.

Table 8. Changes in Mean and Median Improved Sanitation Use from 1990 to 2008

<table>
<thead>
<tr>
<th>Level of PHC</th>
<th>1990</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Selective (n=25)</td>
<td>29</td>
<td>26</td>
</tr>
<tr>
<td>Transitional (n=23)</td>
<td>55</td>
<td>54</td>
</tr>
<tr>
<td>Comprehensive (n=12)</td>
<td>76</td>
<td>72</td>
</tr>
<tr>
<td>All countries (n=60)</td>
<td></td>
<td></td>
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</tbody>
</table>


A correlation analysis examined the strength of the relationship between selected country-level health, economic, education and development indicators and sanitation use. Data are from 1990, 2000, and 2008 based on the premise that these country-level indicators (independent variable) might influence sanitation use in 2008 (dependent variable).

In this analysis, the strongest significant variables associated with the use of improved sanitation in 1990, 2000, and 2008 were the percent of births attended by skilled health staff (1990, 2000, and 2008), percent of one year olds receiving DTP vaccinations.
(1990, 2000, and 2008), GNI per capita (1990, 2000, and 2008), and health expenditures per capita (1990, 2000, and 2008). Importantly, the “percent of births attended by skilled health staff” indicator is also the indicator used to represent the PHC level for countries examined in this study. Other strong variables were government effectiveness (2008), ratio of females to males in secondary enrollment (2000 and 2008), and net ODA received (1990, 2000, and 2008). Interestingly, the ODA received per capita did not show a strong correlation.

<table>
<thead>
<tr>
<th>% Births attended by skilled health 1990 (N= 58)</th>
<th>Pearson Correl.</th>
<th>0.703</th>
<th>0.660</th>
<th>0.621</th>
</tr>
</thead>
<tbody>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% Births attended by skilled health 2000 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.743</td>
<td>0.719</td>
<td>0.679</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% Births attended by skilled health 2008 (N= 10)</td>
<td>Pearson Correl.</td>
<td>0.767</td>
<td>0.739</td>
<td>0.720</td>
</tr>
<tr>
<td>p. value</td>
<td>0.01</td>
<td>0.015</td>
<td>0.019</td>
<td></td>
</tr>
<tr>
<td>% 1 yr olds DTP3 immunizations 1990 (N= 57)</td>
<td>Pearson Correl.</td>
<td>0.662</td>
<td>0.674</td>
<td>0.674</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% 1 yr olds DTP3 immunizations 2000 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.624</td>
<td>0.674</td>
<td>0.693</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% 1 yr olds DTP3 immunizations 2008 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.515</td>
<td>0.558</td>
<td>0.579</td>
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<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>GNI per cap 1990 (N= 55)</td>
<td>Pearson Correl.</td>
<td>0.688</td>
<td>0.670</td>
<td>0.647</td>
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<tr>
<td>p. value</td>
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<tr>
<td>GNI per cap 2000 (N= 57)</td>
<td>Pearson Correl.</td>
<td>0.740</td>
<td>0.725</td>
<td>0.698</td>
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<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>GNI per cap 2008 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.721</td>
<td>0.700</td>
<td>0.668</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Gvt.effectiveness est. 1996 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.391</td>
<td>0.408</td>
<td>0.416</td>
</tr>
<tr>
<td>p. value</td>
<td>0.002</td>
<td>0.001</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Gvt.effectiveness est. 2000 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.419</td>
<td>0.439</td>
<td>0.447</td>
</tr>
<tr>
<td>p. value</td>
<td>0.001</td>
<td>0.001</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Gvt.effectiveness est. 2008 (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.510</td>
<td>0.526</td>
<td>0.524</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1990 Ratio of F/M secondary enrollment (%) (N= 38)</td>
<td>Pearson Correl.</td>
<td>0.426</td>
<td>0.429</td>
<td>0.417</td>
</tr>
<tr>
<td>p. value</td>
<td>0.008</td>
<td>0.007</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>2000 Ratio of F/M secondary enrollment (%) (N= 47)</td>
<td>Pearson Correl.</td>
<td>0.582</td>
<td>0.573</td>
<td>0.558</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2008 Ratio of F/M secondary enrollment (%) (N= 43)</td>
<td>Pearson Correl.</td>
<td>0.512</td>
<td>0.541</td>
<td>0.553</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1990 Net ODA received (% of GNI) (N= 56)</td>
<td>Pearson Correl.</td>
<td>-0.465</td>
<td>-0.484</td>
<td>-0.484</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1998 Net ODA received (% of GNI) (N= 56)</td>
<td>Pearson Correl.</td>
<td>-0.401</td>
<td>-0.401</td>
<td>-0.382</td>
</tr>
<tr>
<td>p. value</td>
<td>0.002</td>
<td>0.002</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>2000 Net ODA received (% of GNI) (N= 56)</td>
<td>Pearson Correl.</td>
<td>-0.362</td>
<td>-0.406</td>
<td>-0.424</td>
</tr>
<tr>
<td>p. value</td>
<td>0.006</td>
<td>0.002</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>1990 Net ODA received per capita (current US$) (N= 57)</td>
<td>Pearson Correl.</td>
<td>0.003</td>
<td>-0.007</td>
<td>0.007</td>
</tr>
<tr>
<td>p. value</td>
<td>0.981</td>
<td>0.96</td>
<td>0.957</td>
<td></td>
</tr>
<tr>
<td>2000 Net ODA received per capita (current US$) (N= 57)</td>
<td>Pearson Correl.</td>
<td>-0.239</td>
<td>-0.215</td>
<td>-0.171</td>
</tr>
<tr>
<td>p. value</td>
<td>0.074</td>
<td>0.109</td>
<td>0.202</td>
<td></td>
</tr>
<tr>
<td>1995 Health expenditure per capita (current US$) (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.595</td>
<td>0.594</td>
<td>0.577</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2000 Health expenditure per capita (current US$) (N= 58)</td>
<td>Pearson Correl.</td>
<td>0.664</td>
<td>0.655</td>
<td>0.635</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2008 Health expenditure per capita (current US$) (N= 57)</td>
<td>Pearson Correl.</td>
<td>0.654</td>
<td>0.635</td>
<td>0.611</td>
</tr>
<tr>
<td>p. value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
### Table

<table>
<thead>
<tr>
<th>Year</th>
<th>Health Expenditure, Total (% of GDP) (N=)</th>
<th>Pearson Correl.</th>
<th>p. value</th>
<th>Correl. is significant at the 0.01 level (2-tailed)</th>
<th>Correl. is significant at the 0.05 level (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>57</td>
<td>0.125</td>
<td>0.355</td>
<td>Bold numbers</td>
<td>Underlined numbers</td>
</tr>
<tr>
<td>2000</td>
<td>58</td>
<td>0.17</td>
<td>0.201</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>57</td>
<td>0.139</td>
<td>0.303</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bold numbers** indicate the Correl. is significant at the 0.01 level (2-tailed).

**Underlined numbers** the Correl. is significant at the 0.05 level (2-tailed).


Because a regression or other sophisticated analysis could not be performed due to data limitations, an analysis of variance (ANOVA) was used to further examine the interaction between PHC level and sanitation use. The ANOVA of the interaction between PHC level in 1990 and sanitation use in 2008 showed a significant difference in means between all PHC levels: between comprehensive and selective (p =.000), between selective and transitional (p =.000), and between comprehensive and transitional (p =.045; see Table 10).
Table 10. ANOVA Addressing the Relationship Between a Country’s Level of Primary Health Care in 1990 and the Percentage of a Country’s Improved Sanitation Use in 2008 (n = 60)

<table>
<thead>
<tr>
<th>Level of PHC</th>
<th>Countries</th>
<th>Mean Percentage of Country’s Population Using Improved Sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selective</td>
<td>26</td>
<td>39.4</td>
</tr>
<tr>
<td>Transitional</td>
<td>22</td>
<td>66.0</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>12</td>
<td>85.7</td>
</tr>
<tr>
<td>All countries</td>
<td>60</td>
<td>58.4</td>
</tr>
</tbody>
</table>

ANOVA

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>19570.766</td>
<td>2</td>
<td>9785.383</td>
<td>19.616</td>
<td>.000</td>
</tr>
<tr>
<td>Within groups</td>
<td>28433.967</td>
<td>57</td>
<td>498.842</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>48004.733</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Tukey follow-up test for multiple comparisons showed that:
1. the difference in means between comprehensive and selective countries was statistically significant at p = .000;
2. the difference between selective and transitional countries was statistically significant at p = .003; and
3. the difference between comprehensive and transitional countries was statistically significant at p = .045.


The ANOVA generated to examine the interaction between PHC level in 2000 and sanitation use in 2008 also showed similarly significant differences between all PHC levels:

between comprehensive and selective (p = .000), between selective and transitional (p = .003), and between comprehensive and transitional (p = .000; see Table 11).
Table 11. ANOVA Addressing the Relationship Between a Country’s Level of PHC in 2000 and the Percent Improved Sanitation Use in 2008 (n = 83)

<table>
<thead>
<tr>
<th>Independent Variable (Groups):</th>
<th>Level of PHC</th>
<th>Region</th>
<th>Mean Percentage of Country’s Population with Use of Improved Sanitation</th>
</tr>
</thead>
</table>
| PHC and progress in sanitation 1990–2008. To investigate H2 (i.e., higher level of PHC is associated with increased progress in sanitation use in developing countries from 1990 to 2008), this section reviews the relationship between PHC levels and changes in sanitation use between 1990 and 2008.

First, a descriptive analysis evaluated mean and median changes in improved sanitation use between 1990 and 2008 for the aggregate countries sorted by PHC (see Table 12). For each of the PHC groups, average sanitation use increased by 10–11%. Sanitation use increased from 29% in 1990 to 40% in 2008 for countries with selective PHC (increase of 11 percentage points), from 55% in 1990 to 65% in 2008 for countries with transitional PHC (increase of 10 percentage points), and from 76% in 1990 to 86% in 2008 for countries with comprehensive PHC (increase of 10 percentage points).

Unlike the average results, the median results fluctuated among PHC groups, indicating some skew in the country data. In countries with selective PHC, the median increased from...
26% in 1990 to 32% in 2008 (increase of 6 percentage points); in countries with transitional PHC, the median increased from 54% in 1990 to 70% in 2008 (increase of 16 percentage points); and in countries with comprehensive PHC, the median increased from 72% in 1990 to 91% in 2008 (19 percentage points). While the average increase in sanitation use between 1990 and 2008 was almost identical among the PHC groups, the median increase for each group between 1990 and 2008 was lowest for the selective PHC countries, and highest in the comprehensive PHC countries.

Table 12. Measures of Central Tendency and Variation in Improved Sanitation Use from 1990 to 2008

<table>
<thead>
<tr>
<th>Level of PHC</th>
<th>1990 % Improved Sanitation</th>
<th>2008 % Improved Sanitation</th>
<th>Percentage Point Difference from 1990 to 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Selective (n=25)</td>
<td>29</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>Transitional (n=23)</td>
<td>55</td>
<td>54</td>
<td>65</td>
</tr>
<tr>
<td>Comprehensive (n=12)</td>
<td>76</td>
<td>72</td>
<td>86</td>
</tr>
<tr>
<td>All countries (n=60)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


A correlation analysis determined the strength of the relationship between various country-level health, economic, education, and development indicators and the percent increase in sanitation use from 1990 to 2008. Table 13 shows the correlation coefficient results. In this analysis, none of the variables showed a strong correlation with the percent increase in improved sanitation.

Analysis of variance was another statistical test used to examine H2. The ANOVAs created to explore the interaction between PHC levels (for both 1990 and 2000) and the percentage point increase in sanitation use for 2008 showed no statistically significant differences in means (.988 and .315, respectively) among the levels of PHC (see Tables 14 and 15).
### Table 13. Correlation Between Country Variables and the Percent Increase in Improved Sanitation Use from 1990 to 2008

<table>
<thead>
<tr>
<th>Variables</th>
<th>Countries Analyzed</th>
<th>Pearson Correl.</th>
<th>p. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Births attended by skilled health 1990</td>
<td>58</td>
<td>-0.073</td>
<td>0.588</td>
</tr>
<tr>
<td>% Births attended by skilled health 2000</td>
<td>58</td>
<td>-0.009</td>
<td>0.944</td>
</tr>
<tr>
<td>% Births attended by skilled health 2008</td>
<td>58</td>
<td>0.319</td>
<td>0.369</td>
</tr>
<tr>
<td>% 1 yr olds DTP3 immunizations 1990</td>
<td>57</td>
<td>0.193</td>
<td>0.149</td>
</tr>
<tr>
<td>% 1 yr olds DTP3 immunizations 2000</td>
<td>58</td>
<td><strong>0.353</strong></td>
<td>0.007</td>
</tr>
<tr>
<td>% 1 yr olds DTP3 immunizations 2008</td>
<td>58</td>
<td><strong>0.313</strong></td>
<td>0.017</td>
</tr>
<tr>
<td>GNI per cap 1990</td>
<td>55</td>
<td>0.018</td>
<td>0.893</td>
</tr>
<tr>
<td>GNI per cap 2000</td>
<td>57</td>
<td>0.029</td>
<td>0.831</td>
</tr>
<tr>
<td>GNI per cap 2008</td>
<td>58</td>
<td>0.017</td>
<td>0.899</td>
</tr>
<tr>
<td>GE. EST 1996</td>
<td>58</td>
<td>0.169</td>
<td>0.204</td>
</tr>
<tr>
<td>GE. EST 2000</td>
<td>58</td>
<td>0.184</td>
<td>0.166</td>
</tr>
<tr>
<td>GE. EST 2008</td>
<td>58</td>
<td>0.165</td>
<td>0.216</td>
</tr>
<tr>
<td>1990 Ratio of female to male secondary enrollment (%)</td>
<td>38</td>
<td>0.043</td>
<td>0.797</td>
</tr>
<tr>
<td>2000 Ratio of female to male secondary enrollment (%)</td>
<td>47</td>
<td>0.022</td>
<td>0.881</td>
</tr>
<tr>
<td>2008 Ratio of female to male secondary enrollment (%)</td>
<td>43</td>
<td>0.219</td>
<td>0.158</td>
</tr>
<tr>
<td>1990Net ODA received (% of GNI)</td>
<td>56</td>
<td>-0.165</td>
<td>0.225</td>
</tr>
<tr>
<td>1998Net ODA received (% of GNI)</td>
<td>56</td>
<td>-0.035</td>
<td>0.8</td>
</tr>
<tr>
<td>2000Net ODA received (% of GNI)</td>
<td>56</td>
<td><strong>-0.271</strong></td>
<td>0.043</td>
</tr>
<tr>
<td>1990 Net ODA received per capita (current US$)</td>
<td>57</td>
<td>0.013</td>
<td>0.922</td>
</tr>
<tr>
<td>2000 Net ODA received per capita (current US$)</td>
<td>57</td>
<td>0.139</td>
<td>0.303</td>
</tr>
<tr>
<td>1995 Health expenditure per capita (current US$)</td>
<td>58</td>
<td>0.089</td>
<td>0.507</td>
</tr>
<tr>
<td>2000 Health expenditure per capita (current US$)</td>
<td>58</td>
<td>0.075</td>
<td>0.578</td>
</tr>
<tr>
<td>2008 Health expenditure per capita (current US$)</td>
<td>57</td>
<td>0.027</td>
<td>0.84</td>
</tr>
<tr>
<td>1995 Health expenditure, total (% of GDP)</td>
<td>57</td>
<td>0.031</td>
<td>0.82</td>
</tr>
<tr>
<td>2000 Health expenditure, total (% of GDP)</td>
<td>58</td>
<td>0.086</td>
<td>0.521</td>
</tr>
<tr>
<td>2008 Health expenditure, total (% of GDP)</td>
<td>57</td>
<td>-0.011</td>
<td>0.934</td>
</tr>
</tbody>
</table>

**Bold numbers** indicate the Correl. is significant at the 0.01 level (2-tailed).

**Underlined numbers** the Correl. is significant at the 0.05 level (2-tailed).

Table 14. ANOVA Addressing the Relationship Between a Country’s Level of PHC in 1990 and the Percentage-Point Increase from 1990 to 2008 in the Share of a Country’s Improved Sanitation Use (n = 60)

<table>
<thead>
<tr>
<th>Level of PHC</th>
<th>Countries</th>
<th>Mean Percentage-Point Increase from 1990 to 2008 in the Share of a Country’s Population Using Improved Sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selective</td>
<td>26</td>
<td>10.9</td>
</tr>
<tr>
<td>Transitional</td>
<td>22</td>
<td>10.6</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>12</td>
<td>10.4</td>
</tr>
<tr>
<td>All countries</td>
<td>60</td>
<td>10.7</td>
</tr>
</tbody>
</table>

ANOVA

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2.330</td>
<td>2</td>
<td>1.165</td>
<td>.013</td>
</tr>
<tr>
<td>Within groups</td>
<td>5295.854</td>
<td>57</td>
<td>92.910</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5298.183</td>
<td>59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Table 15. ANOVA Addressing the Relationship Between a Country’s Level of PHC in 2000 and the Percentage-Point Increase in the Share of Improved Sanitation Use from 2000 to 2008 (n = 83)

<table>
<thead>
<tr>
<th>Level of PHC</th>
<th>Countries</th>
<th>Mean Percentage-Point Increase in the Share of a Country's Population with Improved Sanitation Use from 2000 to 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selective</td>
<td>28</td>
<td>4.8</td>
</tr>
<tr>
<td>Transitional</td>
<td>25</td>
<td>5.6</td>
</tr>
<tr>
<td>Comprehensive</td>
<td>30</td>
<td>3.7</td>
</tr>
<tr>
<td>All countries</td>
<td>83</td>
<td>4.6</td>
</tr>
</tbody>
</table>

ANOVA

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>51.746</td>
<td>2</td>
<td>25.873</td>
<td>1.173</td>
</tr>
<tr>
<td>Within groups</td>
<td>1763.917</td>
<td>80</td>
<td>22.049</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1815.663</td>
<td>82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One final analysis used to examine H2 consisted of comparing countries by the increase in PHC levels between 1990 and 2000 to the increase in sanitation use between 1990 and 2008 (Table 16).

**Table 16.** Measures of Central Tendency and Variation Addressing the Relationship Between the Change in a Country’s Level of PHC in 1990 – 2000 and the Percentage-Point Increase in the Share of Improved Sanitation Use from 1990 to 2008 (n = 59)

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (n = 16): Selective PHC 1990 and 2000</td>
<td>10.1</td>
<td>7.5</td>
<td>-9 to 34</td>
</tr>
<tr>
<td>Group 2 (n = 10): Selective PHC 1990 and Comprehensive 2000</td>
<td>12.3</td>
<td>11.5</td>
<td>-3 to 27</td>
</tr>
<tr>
<td>Group 3 (n = 7): Transitional PHC 1990 and 2000</td>
<td>12.4</td>
<td>13</td>
<td>0 to 33</td>
</tr>
<tr>
<td>Group 4 (n = 13): Transitional PHC 1990 and Comprehensive 2000</td>
<td>11.8</td>
<td>8.5</td>
<td>0 to 24</td>
</tr>
<tr>
<td>Group 5 (n = 13): Comprehensive PHC 1990 and 2000</td>
<td>8.7</td>
<td>10</td>
<td>0 to 21</td>
</tr>
</tbody>
</table>


Across all 5 groups the mean and median showed a bell curve distribution, with Group 3 (transitional PHC 1990 and 2000) showing the highest mean increase in sanitation use and Group 5 showing the lowest. Group 3 also had the highest median increase in sanitation use, and Group 1 the lowest median increase. Groups 1 and 2 had the highest range in increased sanitation (43 points) use while Group 5 had the smallest range (21 points). Four of the countries in Groups 1 and 2 had negative growth in sanitation use.

Given the data limitations, the statistics analysis options were measures of tendency and variation, correlation analysis, and ANOVA. As noted in Chapter 3, insufficient data are available to perform a multivariate analysis. In the face of limited statistical analysis, other options exist. As Edward Tufte, a noted expert in the field of visual display of quantitative information, asserts, “The world is complex, dynamic, multidimensional; the paper is static, flat” (Tufte, 1983). Tufte advocates the use of dimensionality and density as design strategies to portray information, stating, “To clarify, add detail” (1983).
Using Tufte’s principles to further investigate the trends shown, Figure 11 provides a visual overview of the relationship between PHC level (shown in the circles), sanitation use in 1990 (x-axis), and increased sanitation use between 1990 and 2008 (y-axis). As shown, countries using comprehensive PHC in 1990 and/or 2000 were highly likely to have > 60% sanitation use. Guatemala is the exception, with selective PHC in both 1990 and 2000, but a fairly high sanitation use in 1990 (60-79%) and an increase of 10-19 percentage points between 1990 and 2008. Thirteen countries increased sanitation use by >20 percentage points over the eighteen-year timeline. For these countries, 50% were selective PHC, 31% were transitional PHC, and 15% used comprehensive PHC. Lower income countries (according to World Bank 1990 classification, unless noted otherwise) were distributed throughout the results, with one general exception: only one country with >80% use in 1990 was a low-income country (Syria). Of particular interest, almost all the countries with >20 percentage point increase in use from 1990 - 2008 were lower income countries.
**Figure 11.** Sanitation use in 1990 compared to increased sanitation use, 1990 to 2008, compared to PHC Level in 1990 and 2000.  
CHAPTER 5
DISCUSSION

Historical evidence suggests that health ministries promoted sanitation use through education and latrine distribution programs (Roemer, 1991; Saywell, 1998), but over time, health and sanitation functions diverged. Quite often in developing nations, responsibility for sanitation use is now blurred, with roles overlapping and confused between the health and sanitation ministries, and even local governments. Little research exists regarding how health sector engagement in sanitation relates to sanitation use in developing countries. In this mixed methods investigation, a qualitative multi-case study uses the health sector functions framework to analyze data from three case studies of Malawi, Nepal, and Sri Lanka. These countries exhibit different levels of primary health care, sanitation use, and incorporation of sanitation within the health sector functions. The quantitative analysis examines the relationship between the level of primary health care and sanitation use from 83 case study developing countries.

The qualitative analysis offers evidence that a public health orientation is associated with increased use of the health sector functions, as seen in the case of Sri Lanka. In addition, application of all six functions constitutes an important first step toward an “institutionalization of sanitation.” The quantitative analysis examines the relationship between the level of primary health care and sanitation use in 83 case study developing
countries. Although limited in scope, the quantitative analysis revealed mixed results regarding the relationship between level of PHC and increased sanitation use.

Mixed methods research allows the researcher to test for consistency between different kinds of data. According to Patton (2002), finding inconsistencies offers the “opportunity for deeper insight into the relationship between the inquiry approach and the phenomenon under study.” The mixed methods approach provides the researcher with the opportunity to develop creative strategies to investigate data, designing studies and generating analyses (Patton, 2002). The following sections discuss the qualitative and quantitative findings, and subsequently a mixed methods synthesis of results.

**Qualitative Findings**

The qualitative research analyzed a rich set of data from interviews and focus groups sessions in the three case study countries. Participants were from health ministries, sanitation ministries, in-country NGOs, and external support agencies. Eight key findings emerged from the synthesis of the qualitative data.

**Finding #1: We forgot what we knew: sanitation has fallen off the health ministry’s priority agenda.** The multi-case study results confirm findings described by Bartram (2008) and Bartram and Cairncross (2010) that despite the role of sanitation in public health, over the past several decades most health ministries began neglecting preventive health measures such as sanitation. For example, priorities in Nepal shifted from primary health care and prevention-oriented programs in the eighties and nineties to the current focus on selective PHC interventions (Kharkee & Jha, 2010). As noted by participants and confirmed in the literature (Winch, 2002), Malawi formerly used programs such as IMCI to integrate sanitation. However, not all health ministries omit sanitation from policies and programs.
Historical evidence indicates that in the early to mid-twentieth century, sanitation was actively addressed within some health ministries: “Ministries of Health often provide, for a subsidized price, the concrete slab that facilitates latrine construction” (Roemer, 1991). In concert with local governments, Sri Lanka’s health ministry supports provision of latrines to families who could not otherwise afford them. Sri Lanka incorporated preventive health tenets into its system nearly a century ago and has not transitioned away from that approach. “The hookworm campaign, begun in 1916 [with Rockefeller Foundation assistance], was important in that it stressed the need for public health, sanitation and personal hygiene and for strengthening the preventive health system” (Perera, 1985). Other countries that have a longstanding history of incorporating sanitation functions within the health ministry include Cuba, Costa Rica, Japan, and Mexico (Dominguez, 1977; Rosero-Bixby, 1991; Katsuda et al., 2011; and Sepulveda, 2006).

**Finding #2: Silos are pervasive, and a strong need for increased intersectoral collaboration exists.** The need for increased intersectoral collaboration, also addressed in the Alma Ata declaration, was a strong component of the interview discussions. Participants from health ministries and other agencies throughout the interviews indicated that their departments and agencies operated alone with minimal efforts to coordinate across sectors, or even across departments within the same agency. The consequences of lack of collaboration can be far-reaching. By failing to consider opportunities to leverage health gains, poor sanitation continues and disease outbreaks can occur. Isolated activities by individual organizations can inhibit “any major effort at comprehensive, large-scale change” (Kania &

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6 WHO's first chief of Social and Occupational Health
Kramer, 2011). Further, as shown in the case study findings, health ministries are not the only organizations that have failed to initiate collaborative efforts.

Today, there is minimal collaboration between the health and sanitation sectors in developing countries. As Rehfuess, Bruce, and Bartram (2009) noted, “the health system is ill-equipped to engage with the [sanitation] sector.” In addition, leadership and support, both at the national and ministerial levels, plays an essential role in setting policy direction and priorities. In some cases, leadership is also influenced by external donor funding priorities. Sanitation ministries, external support agencies, international NGOs all can strive to increase intersectoral and interagency coordination, at both the national and regional levels. The Mexico study provides evidence of strong intersectoral collaboration mounted to increase sanitation in response to cholera's re-emergence into the Western hemisphere (Sepulveda, 2006). As shown in Mexico, institutional support for intersectoral collaboration falls under national level policy. However, as shown in the case studies and in the literature, the roles of multiple sectors and associated responsibilities are often poorly defined. This problem, which exists at both the national and district levels, is compounded by lack of well-defined leadership roles. (Poverty Environment Partnership, 2008).

**Finding #3: Myriad opportunities exist to integrate sanitation into existing disease-specific and integrated programs.** Over the past two decades, most health initiatives have focused on disease-specific interventions (Atun et al., 2010), and often overlooked opportunities to address integrated approaches. However, disease-specific and integrated programs are not necessarily mutually exclusive. As Atun et al. (2010) noted, each type of program typically includes some components of the other, and each approach has a valuable contribution to offer. For example, HIV/AIDS programs focus on antiretroviral therapy.
People living with HIV/AIDS (PLWHA) are particularly susceptible to unsafe WaSH. Safe WaSH interventions are proven to alleviate suffering from diarrheal diseases up to 40% (Lule et al., 2005).

Disease management solutions commonly focus on chemotherapy (vaccinations), or managing symptoms through means such as oral rehydration therapy, with minimal reference to the importance of preventive, proactive mechanisms such as sanitation. For example, a recent article in The Lancet on diarrheal disease management makes only a single passing reference to prevention (Santosham et al., 2010). The diarrheal disease policy adopted by Kenya's Ministry of Sanitation in 2010 also makes only a brief/cursory mention of the importance of sanitation (KMoS, 2010). Most recently, sanitation continues to be "pushed back" in favor of vaccines and medicines. On January 30, 2012, numerous major governmental and foundation donors and 13 pharmaceutical companies announced the London Declaration on Neglected Tropical Diseases (NTDs), a new, coordinated push to accelerate progress toward eliminating or controlling 10 NTDs by 2020. Donor commitments focused on medical interventions, with recipient countries challenged to address sanitation. As shown in the literature NTDs are best managed in the long run through integrated measures (Wang et al., 2009; Curtale, 2010).

Finding #4: Training health professionals in the business of public health and health education is lacking. Following a clinical medicine training approach, doctors and other health practitioners are trained to detect and cure diseases. Yet minimal attention is paid to preventive medicine. The disparity between clinical medicine and preventive, or public health-oriented, medicine has existed for over a hundred years. In the early 1900s, the Rockefeller Foundation encouraged the integration of a public health practicum into medical
trainings (Ruis & Golden, 2008). Similarly, the case studies revealed no evidence of public health trainings being provided to physicians and other health professionals.

In contrast to doctors, community health workers are more likely to receive prevention-oriented training and to implement prevention-oriented practice requirements. However, as confirmed in the multi-case studies and in the literature (Atun, et al., 2010), over the past two decades, community health workers have been required to focus on disease-oriented interventions. In some cases, health workers may resent extra duties, perceiving sanitation efforts as an additional responsibility. In spite of this, research shows that community health workers can increase their efficiency by using prevention-oriented education approaches such as the Community Health Club model (Waterkeyn, 2010).

Finding #5: A culture of health helps promote the institutionalization of sanitation.

Recent literature argues that when hygiene has high cultural importance, sanitation use increases (Waterkeyn, 2010; Mara, 2011). This is evidenced in Sri Lanka, where sanitation is institutionalized. Sanitation is integrated as a preventive measure within the PHC system and is rarely addressed as a separate issue. Throughout the country, local Pradeshiya Sabhas educate citizens about the importance of sanitation use. In Sri Lanka, sanitation has evolved from a special issue of concern to a normal function: actions regarding sanitation use are the status quo. In contrast, sanitation has not become the modus operandi in Nepal and Malawi. As one participant noted, “Culture is also an issue. The only toilet in a hotel in Accham was still free [early in the morning], so probably many still go and do their morning routine outside” (ESA242).

Finding #6: Outbreaks can provide a vehicle to integrate sanitation within the health sector functions and to increase sanitation use. As shown in the Yakima and Mexico
examples and in the informant interviews, outbreaks provide an opportunity to scale up sanitation use by enacting regulations, increasing outreach and education, and improving monitoring and surveillance (Casner, 2001; Sepulveda, 2006). Health professionals are well positioned to provide support in outbreak response. Similarly, health professionals can be leveraged to provide pro-active mitigation through utilizing different health sector functions, potentially reducing the severity of outbreaks, as discussed in the cases of 1995 volcanic eruption in Montserrat (Cooper & Tuitt, 1998) and the 2008 cyclone Nargis (Myint et al., 2011).

Finding #7: Public health and environmental health receive less priority in the selective and transitional PHC countries. As shown in the multi-case comparison and in the literature, public health and environmental health rarely receive attention in conventional health programs (Poverty Environment Partnership, 2008; Iyambo, 1992; Anwar, 2003). Although environmental health budgets may not require substantial funding, they do require ongoing attention, which can be difficult in the face of funding constraints (Poverty Environment Partnership, 2008).

Finding #8: Opportunities to increase sanitation integration exist across all three countries, and especially within the selective and transitional PHC-oriented case study examples. The health sector functions framework provides a means to assess what opportunities health ministries have to incorporate sanitation within the health sector functions. In Nepal and Malawi in particular, options exist to include sanitation within all six functions. While Sri Lanka has a Public Health Act with enforcement mechanisms and a robust planning process, gaps remain. Over time, the health inspectors’ responsibilities have shifted away from sanitation. Health facilities lack standards. Intersectoral collaboration with
the sanitation sector is rare. Opportunities remain to further integrate sanitation-related function within Sri Lanka’s health ministry’s policies and programs. By using the health sector functions framework, each country could initiate or enhance existing efforts to institutionalize sanitation.

**Quantitative Findings**

The qualitative analysis underscored the usefulness of the health sector functions framework, but the quantitative analysis did not offer definitive conclusions about trends and increased sanitation use in the relationship between level of PHC and sanitation use. Two findings emerged from the quantitative analysis, discussed below. After discussing the quantitative findings, the next section presents the mixed methods synthesis of the qualitative and quantitative analyses to further examine the relationship between health ministry engagement in sanitation and sanitation use.

**Finding #1: Developing countries on average with higher primary health care delivery systems had higher sanitation use in 1990 and 2008 compared to countries with selective PHC.** Countries with transitional or comprehensive PHC orientation had higher sanitation use in 1990 than countries using selective PHC. Sanitation use in 1990 ranged from an average of 29% in countries with selective PHC to 55% in countries with transitional PHC and 76% in countries with comprehensive PHC. In 2008, sanitation use ranged from an average of 40% in countries with selective PHC countries to 65% in countries with transitional PHC and to 86% in countries with comprehensive PHC. These finding confirm that an association exists between the level of PHC and sanitation use in 1990 and in 2008, but in all three PHC cases sanitation coverage is increasing.
As stated in the Declaration of Alma Ata, the original intent of the comprehensive PHC approach was to target sanitation as a preventive health measure:

Primary health includes at least: education concerning prevailing health problems and the methods of preventing and controlling them...[and] an adequate supply...of basic sanitation (WHO, 1978).

If countries with comprehensive PHC address sanitation as intended in the Declaration, sanitation use would presumably be higher. Health workers are well situated to educate about safe waste management practices and latrine use. In some countries, the Ministry of Health has even coordinated and sponsored the distribution of latrines (Roemer, 1991; Saywell, 1998). Although the results showed that a greater focus on comprehensive PHC is more likely to mean increased sanitation use, the limited data precluded the use of sophisticated statistical analyses to isolate the influence of other factors.

**Finding #2: Higher PHC is not associated with increased progress in sanitation use in developing countries from 1990 to 2008.** Results of the quantitative analysis provided little evidence that higher PHC is associated with increased progress in sanitation use in developing countries from 1990 to 2008. The mean results revealed only a 0.5% difference among PHC groups for improved sanitation between 1990 and 2008. The similarity of the improvements within groups likely explains why the correlation coefficient and ANOVA analyses also showed no significant results. Perhaps this increase indicates a more general secular trend – that as developing countries “progress” sanitation increases. Alternatively, sanitation progress could be due to increased efforts in the sanitation sector, divorced from health sector involvement.

The analysis comparing increasing levels of PHC between 1990 and 2000 to increased sanitation use from 1990-2008 (Table 16) provided no further insight into the
previous findings. Countries that were transitional in both 1990 and 2000 had the highest increased sanitation use. Perhaps this is because transitional countries are in the process of increased overall development. Countries that were comprehensive PHC in both 1990 and 2000 had the lowest progress. As a country reaches its development plateau, sanitation use is likely to be high and other priorities take precedence. This phenomenon was described by several informants, to the overall detriment of sanitation use. As priorities shifted the past two decades, sanitation receives less attention and usage is not 100 percent. As noted earlier, data limitations precluded the use of advanced statistical analyses to remove the influence of potential confounders.

**Mixed Methods Integration of Qualitative and Quantitative Results**

*Mixed methods question: How does health ministry engagement in sanitation relate to sanitation use in developing countries?*

In mixed methods research, a synthesis of findings from the two methods is used to compare the results from the qualitative analysis to the quantitative results. The qualitative analysis consisted of a multi-case comparison of what health ministries in Nepal, Malawi, and Sri Lanka do to incorporate sanitation within the health sector functions. The quantitative analysis compared higher PHC level in 83 developing countries to increased sanitation use from 1990 to 2008.

The multi-case comparison examined three health ministries that each use different approaches to integrate sanitation into health ministry policy, planning, and functions, matched to the level of primary health care: selective (less integration), transitional (medium integration) and comprehensive (high integration). As described by Kharkee and Jha (2010), the selective PHC country, Nepal, embraces a mostly medical, curative approach to disease management within the health ministry. In Nepal, the current medicalized focus is different.
than was the focus in the late eighties (Kuratsuji, 1993). Although data could not be verified, informants also indicated that sanitation use in Nepal was higher in the past. Malawi, which has transitional PHC, with sanitation included “on paper” but not in practice, had moderate level of sanitation use. As with Nepal, informants from Malawi indicated that approaches to sanitation were previously integrated into health initiatives such as IMCI. While sanitation is more “institutionalized” in Sri Lanka, it receives less priority than previously. As with the other two countries, informants from Sri Lanka also indicated that sanitation use had been higher in the past.

The aggregate country (quantitative) analysis did not indicate higher progress in sanitation use based on a country’s level of PHC; the average percent increase was nearly identical for all three groups between 1990 and 2008 (ranging from 10.4 to 10.6 to 10.9 percentage points, respectively). The only result that showed an increase was the median, which demonstrated increased rates of progress for transitional and comprehensive countries (6, 16, and 19 percentage point increases, respectively). Although the median results provides additional insight into the data findings, the results in the analyses for H2 were mixed.

Despite the limited quantitative results relating PHC level to sanitation use, informants from all organizational categories (health ministry, sanitation ministry, in-country NGOs, and external support agencies) and all three case study countries recognized opportunities to increase the focus on sanitation within the health sector functions. For example, Nepal, currently emphasizes a curative health approach, ignoring many opportunities to integrate sanitation within the health ministry’s operational framework. In contrast, the literature and the qualitative research found that countries with comprehensive
PHC addressed sanitation more consistently within the health sector functions. Sri Lanka, the comprehensive PHC multi-case country, uses an integrated approach to primary health delivery that incorporates sanitation into several health sector functions. In Sri Lanka, underlying facilitators such as leadership, human resources, and community participation all support integrating sanitation within the health ministry’s operations.

Due to the lack of comprehensive data on sanitation policy, planning, and use of health sector functions, the extent to which sanitation is addressed in the quantitative analysis countries is unknown. However, the multi-case comparison shows that an increased emphasis on preventive health, especially by embracing the health sector functions, could result in a higher integration of sanitation and increased sanitation use. As discussed earlier, the Sri Lanka case study provides an example where sanitation is predominately integrated into health ministry policy, planning, and functions. In contrast, the selective and transitional PHC countries clearly had less integration of sanitation into the health sector functions and a lesser focus on sanitation within the health ministries.

**Limitations and Sources of Bias**

One of the premises of mixed methods research is that a qualitative or quantitative analysis alone does not capture the details and trends of the research topic. Combined together, the analyses complement each other and yield a more thorough analysis (Creswell, et al., 2004). However, both methods have weaknesses.

There are several potential weaknesses within the qualitative analysis. First, according to Stake (2006), multiple case study research should include 4-12 case studies. The time and data available for this study precluded the inclusion of additional case studies. Although the three case study countries provided solid examples of selective, transitional, and
comprehensive PHC and low/medium/high approaches to integrating sanitation within health policy, planning, and functions, additional case studies of countries from each approach could further illuminate the trends discovered here. The second limitation of the research is that the findings in this study employed secondary data. Data collected from a previous study provided the foundation for the qualitative research. If the data had been collected with the research questions used, perhaps additional insights could have been gained, although the original research provided insight into the use of most of the health sector functions. However, information was not specifically gathered to provide further insight into the health ministries’ influence on sanitation use.

Additional weaknesses in the qualitative research are associated with the data collection process. As described, the data were collected in focus group and individual interview settings. It is possible that individuals participating in the focus group discussions did not get a chance to voice their opinion, did not feel comfortable sharing their opinion, or phrased responses based on the presence of particular focus group members. For example, health ministry participants from different management levels may have provided different responses than if they were alone. In addition, the potential for interviewer bias exists if individuals said what they assumed the interviewer wanted to hear. Finally, the data could have been incomplete, or incorrectly recorded by the interviewers.

Another constraint on the qualitative research is that the author performed all of the interview data coding. To strengthen coding results, additional persons should also analyze the data, with an inter-rater reliability coefficient used to test the strength of the results. Additionally, although the research process included multiple observer sources, study findings might be stronger if they incorporated additional perspectives from within the health
ministry. The interview data contained few responses from health ministry professionals at the regional and local levels, and health practitioners did not participate in any interviews. Additionally, the perspectives of people engaged in the health sector, but from outside the health ministry, would also be valuable. In addition to the constraints on the qualitative research, the quantitative research also contains several limitations.

A number of limitations are associated with the quantitative research, particularly in relation to the data. The WHO/JMP sanitation usage data presented several challenges. First, the earliest data available on sanitation use were from 1990. As determined in the research, some countries started implementing PHC much earlier than 1990. Certainly some earlier data are available from in-country sources, but no cross-country aggregated data are available prior to 1990. Second, some country-level sanitation data were not available, reducing the number of countries included in the analysis. Third, it is not possible to separate the influence of the health ministry, or even the health sector as a whole, from the sanitation sector’s role in sanitation use. As a result, the data show overall increased usage regardless of the reason for the increase. The increased use could simply be a secular increase, attributed to development in general. Fourth, and importantly, timeline for different interventions could not be fully accounted for with the eight to ten-year gaps between data (i.e. 1990, 2000, and 2008). For example, interventions such as latrines can require significantly less time to implement than major infrastructure.

In addition to the sanitation data, the other fundamental data used for the analysis was the “percent of births attended by skilled health staff” indicator. As explained in Chapter 3, this is the indicator used to represent the PHC level for the countries examined in this study. The “skilled birth” variable may not accurately represent the level of PHC used by a country.
For example, in some areas health workers may provide prevention-related services that are not captured under the "skilled birth" indicator. In addition, some of the data had to be matched to the nearest year; for example, health worker data for 2000 would capture data provided for the years 1997 - 2004. As with the 1990 sanitation data, the skilled birth coverage data for 1990 were also limited. Many more countries showed comprehensive level of PHC in 2000 (n=29) compared to 1990 (n=12). Finally, the “skilled birth” variable levels used to determine relative selectivity in PHC may not follow the integration of sanitation into PHC.

For all data used, the accuracy of source data is not known. For example, some health information systems may not reliably measure data used to determine the “skilled birth” coverage. Furthermore, data are aggregated on a national basis and may not reflect regional variations. Also, the availability of sanitation use and health coverage data allowed analysis of a larger number of comprehensive PHC countries in 2000 (n = 29) than in 1990 (n=12), thus limiting the ability to compare progress over the 18-year timeframe studied.

Another limitation of the quantitative research lies within the analyses used. Insufficient data existed to conduct advanced statistical analyses to estimate the effect of PHC on sanitation use while controlling for other factors. Additionally, as noted in the discussion, while the mean results were similar, it was not possible to run an ANOVA on the median increased sanitation use, which in this case was much different than the mean sanitation use. Until better data are obtained, the research will have to rely on multiple sources of evidence to draw conclusions.

Finally, the research focused only on the health ministry’s role in addressing sanitation within the health sector functions. This scope is limited in two ways. First, the role
of other ministries—such as the Ministry of Finance, the Ministry of Public Works, and the Ministry of Education—in addressing sanitation was not explored. Second, evidence indicates that health gains increase when sanitation use is promoted in conjunction with clean water and adequate hygiene. Research on the combined use and promotion of sanitation, hygiene, and water within health sector functions will provide increased understanding of the opportunities and challenges for the spectrum of functions available to address water, sanitation, and hygiene. Further, research on the roles of different ministries in addressing sanitation is needed.

Conclusion

The qualitative multi-case study findings determined that sanitation was often excluded both from the health ministry’s use of health sector functions and from national level policies and planning processes, especially in the selective and transitional PHC countries. Health ministry professionals acknowledge the absence of sanitation within health sector functions, admitting that other disease-focused priorities exist, despite the extreme burden from poor sanitation. The quantitative analysis showed that although countries with higher PHC delivery systems were more likely to have increased sanitation use, progress in sanitation use between 1990 and 2008 did not always correspond with the level of PHC.

Integrating sanitation within a health ministry by using a framework such as the health sector functions could increase a country’s resilience to events such as natural disasters and disease outbreaks. Solutions targeted at a single function, such as including sanitation in a disease-specific program, may cause quick measurable results (Lawn, et al., 2008). However, single-solution approaches neglect other facets of the health sector
functions framework. Solutions that target multiple functions may provide a more lasting approach to sanitation.

Regardless of what ministry holds responsibility for sanitation, this research found that efforts are siloed with little coordination. Previous approaches using a public health orientation based within the health ministry, as shown in the literature and in the Sri Lanka case study, hold promising examples for countries wishing to increase their sanitation coverage.

In agreement with recent research (Bartram et al., 2010; Bartram & Platt, 2010; Cairncross et al., 2010), this study suggests that opportunities exist for health ministries to increase their engagement in sanitation. This dissertation expands recent literature by using the health sector functions framework to evaluate health ministry engagement in sanitation, and by examining the relationship between health ministry engagement in sanitation (via PHC level) and increased sanitation use. The health ministry’s amplified focus on sanitation could increase a country’s resilience to natural disasters, prevent outbreaks, and provide support for needed health gains. However, the scope of the qualitative research is limited to the health ministry’s role in institutionalizing sanitation within the health ministry itself. This research does not consider the efforts of other ministries (e.g. Minister of Finance, Public Works, and Education) to institutionalize sanitation within their ministries. The results show the need for more research regarding systematic efforts to address sanitation, both within the health ministry and within other ministries in developing countries.

The final chapter provides a plan of action for health ministries to incorporate sanitation within the health sector functions. It also suggests enhancements to the health sector functions framework and discusses areas for further research.
CHAPTER 6

PLAN FOR CHANGE

Chapter Overview

This chapter builds on the research findings to provide a Plan for Change to increase the engagement of health ministries in addressing sanitation within the health sector functions. Three areas are included: Part I provides a Plan for Change for health ministries to address sanitation based on the health sector functions framework. The suggestions offer different strategies for different target audiences based on the roles in policymaking that a particular audience plays; Part II reviews the health sector functions framework and recommendations for enhancement; Part III examines additional research needed to explore the role the health ministry and other ministries can play in institutionalizing sanitation in developing countries.

Part I: Application of the Health Sector Functions Framework

National government policies have weakened the capacity for health ministries to address the “public” component of public health. Instead of a focus on preventive, or public health orientation, health ministries often focus instead on medical services. Public health systems, workers, and related activities are often subsumed into the health ministry, receiving little attention or funding. As the study findings suggest, especially the literature review and key informant interviews, a comprehensive, multi-pronged approach is needed to increase the health ministry’s focus on sanitation. For the purposes of this Plan for Action, the health
sector functions framework provides a tool to assess functional gaps within a country’s health ministry.

**Kingdon’s Policy Windows Theory of Change**

Kingdon’s Policy Windows Theory of Change—which lies on the premise that three streams (problem, policy, and political) “converge” to open a policy window of opportunity—facilitates understanding of why issues get elevated to priority attention (Kingdon, 1995). Each of these streams has unique attributes regarding an issue. First, in the problem stream, the issue is recognized as a significant problem. Second, in the policy stream, advice is regarded as “good advice” at a given time. The final stream, the political stream, considers the wider environment of elections, government changes, and public opinion. These three streams converge to open the “policy window” that offers the opportunity for increased attention and action.

The problem stream involves three components: naming the situation; describing the situation as troublesome but manageable; and placing the situation within the scope of other problems. These steps require an understanding of causal links (Devlaux & Mangez as cited in Jones, 2009) between different components of the problem.

The policy stream also involves three components: testing ideas for feasibility, acceptability and relevance. The policies must be achievable, relevant to decision-makers’ accountability structures, and effective. The policy stream requires understanding the formal rules and what policies are already in place (Devlaux & Mangez, 2008 as cited in Jones, 2009).

To place a particular issue on the policy agenda, the third stream—the political stream—is essential. The political stream comprises political issues, such as interest group
campaigns, changes in public opinion, or changes of administration (Kingdon, 1995). Though the three streams are mostly separate, when the three converge to open a window, policy “entrepreneurs” must work quickly to seize the opportunity before the window closes (Guldbransson & Fossum, 2009).

Policy entrepreneurs, or advocates, can be politicians, civil servants, lobbyists, researchers, or private persons. Once an issue gets on the agenda, such advocates must be prepared with solutions. Solutions should be easily available for policymakers (Guldbransson & Fossum, 2009). To be prepared to act, Kingdon (1995) recommends study of the issue to understand the issue’s magnitude by using indicators of its existence and to promote feedback. This study uses the health sector functions framework to determine gaps and participant interviews to collect feedback. The following section describes the application of study results to a plan for change using Kingdon’s windows.

Application of the study results to a plan for change

1. Problem stream. This study examined the perceptions of health professionals regarding barriers in addressing sanitation within health sector functions. Over the past few years, the lack of sanitation promotion by health ministries has become a noticeable gap among particular actors. For example, while health professionals themselves acknowledged the importance of sanitation in the participant interviews, they did not see it as within their responsibilities: “[There is] competition of so many diseases that the sector lost focus” and “Health is interested in curative not preventive action.” Participants acknowledged the need for and benefits of increased collaboration across sectors, while also describing facilitators and barriers. The focus of the Plan for Change is to increase the health ministry’s engagement in sanitation, based on the health sector functions. While this research examined
country case studies in Nepal, Malawi, and Sri Lanka, the Plan for Change can be adapted for application in any developing country.

As shown in Table 17, the two strategies within the problem stream are 1) to increase awareness of economic and health consequences of poor sanitation and 2) to increase awareness of the gaps in the health sector functions. The target audience for the first strategy is national leadership, including the President and the Ministers of Finance and Health. Because the Minister of Finance controls all Ministry budgets, it is essential to present the economic gains achieved by addressing sanitation. The information vehicle, a one-pager policy paper focused on the financial benefits of sanitation, should be country-specific. The target audience for the second strategy, to increase awareness of gaps in the health sector functions, focuses on Health ministry leadership at the national, district, and local levels. Depending on a particular MOH’s structure, the target staff should be senior management within the public health or environmental health division. Other target audiences for Strategy 2 are leadership from relevant Ministries such as Sanitation, Infrastructure, and Education; WASH sector organizations, external support agencies, academia, and non-governmental organizations. As acknowledged in the participant interviews, each of these entities can play a role in supporting implementation of the health sector functions. A published paper on “Health Sector Roles in WASH” (Bartram and Platt, 2010) reviews the health sector functions framework so that gaps can be determined for a particular country (see Appendix E). In addition, short case studies can be provided based on country-specific engagement in the health sector functions. As noted, Kingdon’s problem stream focuses on identification of the issue. Solutions are addressed in the policy stream.
### Table 17. The Plan for Change

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<th>Strategy</th>
<th>Target Audience</th>
<th>Information Vehicle</th>
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<td><strong>PROBLEM STREAM</strong></td>
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| 1. Increase awareness of the economic and health consequences of poor sanitation | • National leadership  
• Minister of Finance  
• Minister of Health | One-page policy paper |
| 2. Increase awareness of gaps in health sector functions (issue as a problem) | • Minister of Health,  
• Senior national, district, and local public/environmental health staff  
• WASH ministry and WASH sector organizations  
• Education and other country-specific ministries  
• External support agencies (e.g. WHO, World Bank, etc.)  
• NGOs and INGOs | Published paper on “Health Sector Roles in WASH” (Bartram and Platt) adapted as needed |
| **POLICY STREAM** | | |
| 3. Solutions for gaps in health sector functions | • Minister of Health  
• Senior national, district, and local public/environmental health staff  
• WASH ministry and WASH sector organizations  
• Education and other country-specific ministries  
• External support agencies (e.g. WHO, World Bank, etc.)  
• Academia  
• NGOs and INGOs | Published paper on “Health Sector Roles in WASH” (Bartram and Platt) adapted as needed  
Country-specific case studies |
| 4. Continue research to determine evidence base | • Academia  
• External support agencies  
• NGOs and INGOs | Assessment of research needs |
| **POLITICAL STREAM** | | |
| 5. Increased knowledge of issue, gaps, and solutions for civil society | • Advocates  
• NGOs | Collateral materials  
Conference Presentations |
| 6. Personal influence on sector activities regarding issue of WASH in health sector functions | • Determine target country “agents of change” in the government  
• Consultants  
• Advocates  
• WASH and Health sector staff  
• ESA staff | One on one advocacy  
“Health Sector Roles in WASH” |
| 7. Ongoing advocacy for inclusion of WASH in health sector functions | • Advocates  
• NGOs | One on one advocacy  
Updated resources |

2. **Policy stream.** The policy stream provides solutions to address the issue. The third strategy in the Plan for Action (Table 17) is to provide solutions for gaps in the health sector
functions. The same target audience for Strategy 2 (identification of gaps in the functions) is the target audience for Strategy 3. Each of these players has the opportunity to influence one or more of the health sector functions (listed in Table 18), as shown in Figure 12. The “Health Sector Roles in WASH” paper offers practical examples for each of the functions.

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<tr>
<th>Recommendations and Stakeholders</th>
<th>Health Functions</th>
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<tr>
<td>1. Leverage relationships across all relevant agencies to support increased sanitation,</td>
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</tr>
<tr>
<td>2. Provide public health to higher levels of health sector decision-making by including public and/or environmental health directors in upper management.</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>3. Provide mechanisms, incentives, trainings for health professionals to promote sanitation via messages shared during patient consults and in patient education materials.</td>
<td>1 4</td>
</tr>
<tr>
<td>4. Include sanitation-related diseases in health surveillance systems; use data to inform planning and to support intervention assessments; use effectiveness evidence to guide resource allocations (human and financial).</td>
<td>2 5 6</td>
</tr>
<tr>
<td>5. Promote sanitation and hygiene within child health (IMCI) and HIV/AIDS, and disease-specific programs (e.g., MCH, MIH), (continued).</td>
<td>4</td>
</tr>
<tr>
<td>6. Include sanitation use and coverage type as performance indicators in health management information systems.</td>
<td>5 6</td>
</tr>
<tr>
<td>7. Use epidemiological data on sanitation-related diseases to target vulnerable areas and populations, and to establish research needs.</td>
<td>5 6</td>
</tr>
<tr>
<td>8. Establish or support existing community health promotion programs and link service delivery programs.</td>
<td>4</td>
</tr>
</tbody>
</table>

**Figure 12.** Recommendations for integrating sanitation within health sector functions and relevant stakeholders.
**Table 18. Health Sector Functions and Health Sector Roles**

<table>
<thead>
<tr>
<th>Function</th>
<th>Corresponding Health Sector Roles</th>
</tr>
</thead>
</table>
| 1. Norms and Regulations | ● Develop health-protecting standards and regulations appropriate to the country’s social, economic, and environmental circumstances  
● Monitor implementation and contribution to population health |
| 2. Intersectoral Policy and Coordination | ● Build the capacity to track and influence major policies that impact health  
● Employ formal mechanisms for health impact assessments  
● Establish effective multi-disciplinary collaboration |
| 3. Health Facilities | ● Set standards for health care facilities  
● Budget for structural improvements and capacity-building to encourage staff behavioral changes  
● Enforce compliance through an independent oversight function |
| 4. Disease-Specific and Integrated Programs | ● Integrate environmental determinants (e.g., sanitation use) into health professional curricula  
● Incorporate environmental health actions into health programs  
● Work with partners to raise awareness |
| 5. Outbreaks | ● Maintain expertise to advise on and conduct outbreak investigations  
● Test, implement, and revise procedures, in cooperation with other actors  
● Update regulations and policies accordingly |
| 6. Impacts, Threats, and Opportunities | ● Seek evidence for causal associations between environmental factors (e.g., absence of sanitation) and health  
● Assess potential values and harms of technology innovations and policy development |

*Source: Rehfuess et al., 2009*

For Nepal, Malawi, and Sri Lanka this research identified existing gaps within the health sector functions as discussed in Chapter 3 and shown below. Strategy 4 of the Plan for Change, to continue research to determine the evidence base for use of the health sector functions, is targeted to academia, external support agencies and policy-oriented non-governmental organizations. These entities can support follow-up of the preliminary assessment of research needs as described later in this section. To facilitate this, I would work with individuals from relevant organizations to facilitate their development of research proposals. I would also determine potential funding sources and strategies for pursuit of funds. Over time, information learned from ongoing research and evaluation will help to determine not only how to implement the functions, but also whether specific functions should be pursued over others.
3. Political stream. The final stream in Kingdon’s framework, the political stream, refers to the wide environment of public opinion. Strategies 5 – 7 of the Plan for Action are designed to inform and influence public opinion through several different target audiences and information vehicles. The fifth strategy—to increase knowledge of the issue, gaps, and solutions—targets advocates and NGOs. Individuals can use their increased understanding to subsequently act as extensions of policy entrepreneurs. Current interventions for the goal are continued use of the “Health Sector Roles” paper, presentations, and other outreach vehicles such as blogs and social media. The sixth strategy, to use my personal influence regarding the issue of WASH in health sector functions, entails determining and reaching out to change agents within a particular country, and working with them to proactively determine opinion on strategies for policy and implementation. In-country change agents would provide an “internal” vehicle to support and advocate for change implementation. I would work with internal agents to seek other influential players within relevant organizations. Establishing opinion and strategy among the relevant entities ahead of the opening of a window increases the opportunities for consideration, adoption, and implementation.

The final strategy—to engage in ongoing advocacy for including sanitation within the health sector functions—focuses on continued interaction with advocates and NGOs to “keep a pulse” on what is happening with regard to the issue. Information vehicles will include not only one-on-one advocacy but also updated resources as my understanding of the opportunities and obstacles faced with implementing the health sector functions changes over time. The next section reviews the first round of enhancements to the health sector functions framework, based on the research findings presented in Chapter 3.
Part II: Enhancements to the Health Sector Functions Framework

The research suggested that health sector functions require the support of several underlying facilitators, as discussed in the results and shown in Figure 13 below.

Figure 13. Health sector functions and facilitators with national support mechanisms. Source: Platt, 2012 and Rehfuess et al., 2009.

To also support the health ministry’s capacity to effectively implement the functions, two primary elements are needed at the national level–policy and planning. To support the health ministry’s ability to integrate sanitation within health-related policies and programs, Table 19 describes the responsibilities of national leaders. Table 19 also provides suggested expansion to the health sector role definitions based on the research findings.

The health sector functions make up three essential steps, or processes: policy and planning, implementation, and results and evaluation (see Figure 14). Each of these steps
provides a critical piece of the framework needed to support an institutionalized approach to sanitation.

Figure 14. Processes supported by the health sector functions.  
Source: Platt, 2012 and Rehfuess et al., 2009.

Table 19. Expanded Definitions of Health Ministry Roles and Underlying National Support Mechanisms

<table>
<thead>
<tr>
<th>Health Sector Function</th>
<th>Corresponding Health Ministry Roles</th>
</tr>
</thead>
</table>
| 1. Intersectoral Policy and Coordination | Build the capacity to track and influence major policies that impact health  
● Employ formal mechanisms for health impact assessments  
● Establish effective multi-disciplinary collaboration to support the provision of sanitation where needed |
| 2. Norms and Regulations | Develop health-protecting standards and regulations appropriate to the country’s social, economic, and environmental circumstances  
● Monitor and enforce implementation and contribution to population health. Ensure that enforcement staff are technically competent, fair and effective |
| 3. Health Facilities | Set standards for health care facilities  
● Budget for structural improvements and capacity-building to encourage staff behavioral changes  
● Enforce compliance through an independent oversight function |
| 4. Disease-Specific and Integrated Programs | Integrate environmental determinants (e.g., sanitation use) into health professional curricula  
● Incorporate environmental health actions into health programs to inform, educate, and empower people about health issues and options to access sanitation  
● Work with partners to raise awareness  
● Mobilize community partnerships to identify and solve sanitation-related health problems |
| 5. Disease Outbreaks | Maintain expertise to advise on and conduct disease outbreak investigations  
● Test, implement, and revise procedures, in cooperation with other actors  
● Update regulations and policies accordingly |
<table>
<thead>
<tr>
<th>National-level support mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Policy</strong></td>
</tr>
<tr>
<td>• Develop laws and policies that support individual and community health efforts. Relevant areas include finance, civil society, community participation, and public health.</td>
</tr>
<tr>
<td>2. <strong>Planning</strong></td>
</tr>
<tr>
<td>• Monitor sanitation status to identify areas of concern.</td>
</tr>
<tr>
<td>• Develop plans that prioritize targets by disease burden and support individual and community health efforts.</td>
</tr>
</tbody>
</table>

*Source: Rehfuess et al., 2009 and selected components of National Public Health Performance Standards from Institute of Medicine, 1988.*

**Part III: Implications for Further Research**

This research provided insight into several areas of study that are needed to explore the role of health systems, ministries, and professionals in institutionalizing sanitation within a country.

**Health ministry functions.** The research findings showed that substantial opportunities exist to integrate sanitation into health ministry functions. To further explore the potential for institutionalization, additional case studies are needed across other developing countries. To address intersectoral collaboration, case studies of successful intersectoral collaborations between health and sanitation are needed. In addition, lessons learned from collaborations in other disciplines to create a model framework such as “collective impact” as described by Kania and Kramer, 2011. The disease-specific and integrated programs function can be explored in terms of how to connect national policy and local approaches to address sanitation at the local level. To examine the health facilities function, research is needed regarding the availability, use, enforcement, and effectiveness of WaSH-protecting health facilities regulations and standards around the world. The outbreaks function should be investigated in terms of how health worker involvement in sanitation...
influences resilience. Research how local governments support local health department actions to promote sanitation use.

**Primary health care.** Additional research is needed on primary health delivery systems to establish how sanitation is addressed in comprehensive PHC systems. Research could compare reductions in open defecation vs. PHC levels, and whether comprehensive PHC countries are more likely to embark on the “sanitation ladder.” Considerations also include looking at whether countries with an integrated approach are more likely to have functioning sanitation in health facilities, and whether integrated approaches such as HESP or CDD influence sanitation use over time.

**Barriers and facilitators.** Another area of research entails investigation of the facilitator/barriers to using the health sector functions. While the research presented determined the presence of facilitator/barriers (leadership, human resources, information systems, financing, and community participation), little understanding exists of which facilitators are essential for progress and which can be “managed” with less attention. In regards to health professional capacity building, research on the curricula for practitioners would be useful, as would examining the evolution of health practitioner roles such as the Environmental Health Officer/Public Health Inspector. For example, over time roles evolve, other responsibilities are acquired, and now many "sanitarians" focus on food inspections, while sanitation has fallen off the radar.

**Other ministry functions and institutional arrangements for sanitation.** A final area of research would investigate the role of other ministries in influencing sanitation. Because of the intersectoral nature of sanitation, several ministries within a country—such as finance, education, infrastructure—can influence policy and programs. Each ministry has the
opportunity to contribute to the institutionalization of sanitation. Some countries situate sanitation within the health ministry. Most countries have transferred the sanitation responsibility to the infrastructure-oriented ministry. Additional research is needed to explore what institutional arrangements best support the long term implementation of sanitation infrastructure and adoption of behavior changes around using safe sanitation.
APPENDIX A

LITERATURE REVIEW KEYWORDS / SEARCH TERMS

Search Terms - The databases were searched using a combination of terms and keywords as outlined in the table below:

<table>
<thead>
<tr>
<th>Search Term(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minister of health OR Health sector OR Health system OR Health ministry OR</td>
</tr>
<tr>
<td>Ministry of public health AND Sanitation OR Sanitation OR Latrine AND Latrine</td>
</tr>
<tr>
<td>Health Sector Role AND Sanitation OR Sanitation OR Latrine</td>
</tr>
<tr>
<td>Health Sector Role OR Health System Role AND Sanitation OR Sanitation OR</td>
</tr>
<tr>
<td>Latrine AND Enabling environment OR Sustainability OR Sustainable OR Sustaining</td>
</tr>
<tr>
<td>Primary health care OR preventive care OR prevention AND Sanitation OR Sanitation</td>
</tr>
<tr>
<td>OR Latrine AND Latrine AND Enabling environment OR Sustainability OR Sustainable</td>
</tr>
<tr>
<td>OR Sustaining</td>
</tr>
</tbody>
</table>

I conducted a systematic literature review to identify previous research regarding the engagement of health ministries (or sectors or systems) in sanitation and the relationship with sanitation use. I searched these databases: Medline, Embase, ProQuest Dissertations, Academic Search Premier, ISI Web of Knowledge, and Environmental Sciences and Pollution Management. I looked up citations in the literature. I set up automated alerts in PubMed and ProQuest Dissertations to receive ongoing electronic notifications of new literature. Finally, I consulted experts in the field of health systems and primary health care and in sanitation to identify relevant unpublished research.

Literature Review Criteria for Inclusion/Exclusion:
The inclusion criteria for this review were limited to those that discussed the engagement of health ministries or health sectors, including health workers or other health professionals, in policies or programs that included sanitation. Articles were included if they originated from credible sources such as peer-reviewed journals, health organizations. Availability of articles in English and full text were also criteria for inclusion. No date limitations were placed on the review. Exclusion criteria included those articles focused on non-human waste aspect of sanitation such as food sanitation or garbage-related sanitation. In addition, non-English articles were excluded.
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Source</th>
<th>Abstract Summary/Paraphrase</th>
<th>Methods/Study Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agarwal SP.</td>
<td>Health sector in India--progress, challenges and the way forward.</td>
<td><em>J Indian Med Assoc.</em> 2005 Dec;103(12):692, 694, 696-8 passim.</td>
<td>Legislations enacted to protect life and personal liberty; India’s constitution holds fundamental right to healthcare, Preventing major outbreak following disasters is another area of challenge. To meet challenges to the health system needs multipronged approach, focusing on finance, HR, research and social factors like sanitation</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Albionico M, Shamlaye N, Shamlaye C, Savioli L.</td>
<td>Control of intestinal parasitic infections in Seychelles: a comprehensive and sustainable approach.</td>
<td><em>Bull World Health Organ.</em> 1996;74(6):577-86.</td>
<td>Intestinal parasitic infections major Seychelles public health problem since 1925: Seychelles Intestinal Parasite Control Program Integrated into the well-established primary health care system, the program employs a comprehensive strategy: - periodic chemotherapy of school children, - intense health education, and improvement of sanitation 44% reduction in the prevalence after 2 years Seychelles’ integrated program can be seen as a model for other developing countries.</td>
<td>Case control</td>
</tr>
<tr>
<td>Anwar WA.</td>
<td>Environmental health in Egypt.</td>
<td><em>Int J Hyg Environ Health.</em> 2003 Aug;206(4-5):339-50.</td>
<td>Egypt’s MOH recognized nexus of economic development/environment/health, MOE also initiated regs and enforcement Communicable and non-communicable diseases caused by deficient sanitation services and issues with sewage system construction, design and maintenance</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Aye TT, Siriarayapon P.</td>
<td>Typhoid fever outbreak in Madaya Township, Mandalay Division, Myanmar, September 2000.</td>
<td><em>J Med Assoc Thai.</em> 2004 Apr;87(4):395-9.</td>
<td>1-3% typhoid attack rate; Risk factors included poor latrines and latrines near river (*&quot;most&quot; households unsanitary latrine), Post outbreak: Disease Control Implementing Committee mitigation measures included latrine repair and improved surveillance for early detection and education on prevention</td>
<td>Case control</td>
</tr>
<tr>
<td>Birt CA.</td>
<td>Establishment of primary health care in Vietnam.</td>
<td><em>Br J Gen Pract.</em> 1990 Aug;40(337):341-4.</td>
<td>PHC strategy in 1986 closely followed Alma Ata tenets; sanitation one of 10 goals targeted for 1990 Along with the 3000 community health centers, community health workers provide basic treatment and health education from their homes, Describes pediatric center project that promotes the active participation of people in an environmental hygiene program, and a diarrhea control program Established new med school specializing in PHC</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Braveman PA, Roemer MI.</td>
<td>Health personnel training in the Nicaraguan health system.</td>
<td><em>Int J Health Serv.</em> 1985. 15 (4), 699-</td>
<td>Article reviews the status of health personnel training in Nicaragua and the integration of these programs into planning for the health system. The “Unified National Health System” of Nicaragua was established in 1979. This system</td>
<td>Descriptive</td>
</tr>
</tbody>
</table>
prioritized the development of health professions training programs appropriate to its special needs and principles. Much in the new system emulates policies of Cuba, especially the emphasis on public education, models for personnel training and community-oriented primary care.

Community Environmental Health Assessment in Peru’s Desert Hills and Rainforest

Ministry of Health established the General Directorate of Environmental Health (DIGESA), and the Urban Environmental Health Project is an effort to develop the ability of local communities to address EH problems.

Health is determined not only by medical care but also by determinants outside the medical sector. Public health approach is to deal with all these determinants of health which requires multi sectoral collaboration and inter-disciplinary coordination. This high burden of disease, disability and death can only be addressed through an effective public health system. Growth of public health in India has been very slow due to low public expenditure on health, very few public health institutes in India and inadequate national standards for public health education. Recent years have seen efforts towards strengthening public health in India in the form of launch of NRHM, upgrades to health care infrastructure as per IPHS, initiation of more public health courses in some medical colleges and public health institutions and strengthening of public health functional capacity of states and districts.

"Do It Now!" Yakima, Wash, and the campaign against rural typhoid.

Typhoid outbreak 5x average in rural Washington; "Do It Now" sanitation campaign. Typhoid rates dropped dramatically as multi-pronged strategy, including mass mobilization by women’s civic groups. Yakima showed that the country needed a more comprehensive public health system that addressed urban and rural problems.

Risk factors for shigellosis in Thailand.
Int J Infect Dis. 2006 Nov;10(6):425-33..

A matched case-control study to investigate potential risk factors for shigellosis. To reduce shigellosis in this setting, authors recommended several interventions, including improved sanitation (especially latrines), and health education.

Montserrat. Managing health care in a volcanic crisis.

Community health workers used vigilant surveillance (e.g. daily monitoring of shelter health practices) and mass media education to avoid outbreak. MOH advises on sewage spacing.

Comparison of surgical care deficiencies between US civil war hospitals and present-day hospitals in Sierra Leone.

A team of local and international surgeons used the WHO Tool for Situational Analysis to Assess Emergency Surgical Care to quantify surgical capacity in Sierra Leone. These data were compared to data collected from the Medical and Surgical History of the Civil War, the authors concluded that US Civil War facilities are equivalent and in many ways superior.

The School Health Programme in Behera: an integrated helminth control programme at governorate level in Pilot

Pilot Integrated school health program for helminth control used since 1988; article evaluates pre-post monitoring results. For mutual benefit, recommends integrating into existing programs, gradually and in steps; emphasis that health education
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Journal</th>
<th>Year</th>
<th>Pages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garner P, Thomason J.</td>
<td>Setting standards for primary health services.</td>
<td></td>
<td></td>
<td></td>
<td>Descriptive</td>
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</tbody>
</table>

Large-scale chemotherapy considered an affordable, feasible and effective strategy for the control of schistosomiasis in most endemic countries. However, data from Egypt confirm that chemotherapy alone has failed to break the cycle of transmission in high-risk communities. Authors implemented integrated control strategies aimed at a permanent improvement in sanitation and living conditions in endemic areas.

India’s over-stretched public health care system grapples with deficiencies in linking collateral health determinants, gross shortage and non-utilization of infrastructure, financial and human resources.

Revitalizing the existing primary health care infrastructure under the National Rural Health Mission (NRHM) will bring about the long overdue architectural corrections in the health care sector.

NRHM is based on the principles of decentralisation of the health system, community empowerment, and the panchayati raj institutions.

Effective integration of health concerns with other health determinants like sanitation, hygiene and nutrition through district health plan is being made.

After 2 years of implementation of the National Bilharzia Control Programme by the Ministry of Health, the general prevalence dropped from 47.2% to 21.9%. The peak prevalence rate has shifted downwards in magnitude (40.4% compared to 72.1%) and backwards over the age scale (5-14 in contrast to 15-19 years age group). Redistribution of various infection grades has taken place.

However, the incidence rate remained nearly the same before and 2 years after implementation of the programme (18.7 and 18.1%, respectively).

The non-changing high incidence rate indicates that the knowledge, attitude and practice (KAP) of the population concerning water contact have not yet changed. Insufficient improvement in environmental sanitation may be a contributing factor. Continuation of serious efforts in case finding and treatment is recommended, with special emphasis on schoolchildren. This should be coupled with an intensive health education programme.

Clear performance guidelines, appropriate resources, supportive supervision, and appropriate training are needed to help primary health workers to uphold high-quality care, and which supervisors use to monitor the performance of
<table>
<thead>
<tr>
<th>Title</th>
<th>Abstract</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trop Doct. 1993 Oct;23(4):147-8.</td>
<td>The standards are part of the National Health Plan. These standards allow health workers to understand what they need to do and supervisors to know on what to focus, and guard against inappropriate health infrastructure development in areas where local politicians are active in sectoral investments. Examples of standards: <strong>The community health worker’s house must have a tin roof, an external tank, and a latrine.</strong></td>
<td>Descriptive</td>
</tr>
<tr>
<td>Goh KT, Teo SH, Tay L, Monteiro EH.</td>
<td>An outbreak of typhoid was reported in a large psychiatric institution in Singapore. The outbreak was brought under control by strict measures which included maintaining a high standard of environmental sanitation.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Grant JP.</td>
<td>Jim Grant asserted that the lack of knowledge transfer from health professionals to society is one of the primary causes of easily preventable deaths, and that one of the most pressing problems in the health system is the lag between modern knowledge and its use in the community. This is caused by the inadequate scientific study of methods to apply this knowledge to society, and the poor training of health personnel to apply these methods.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>IPPF. Evaluation and Management Audit Department</td>
<td>Its 1st major task included a survey of parasite infestation, between 1985 and 1987. Field educators carried out activities and implemented environmental sanitation measures. Community participation deemed essential (women’s clubs). Results included a downward trend in parasitosis in Fiwale and Kapata.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Iyambo N.</td>
<td>Namibia’s government recognizes that the health of the population depends on national economic development as well as the state of education, housing, agriculture, sanitation, and communication.</td>
<td>Descriptive</td>
</tr>
<tr>
<td>Kamineni VV, Turk T, Wilson N, Satyanarayana S, Chauhan LS.</td>
<td>An advocacy, communication and social mobilisation project for Tuberculosis control was implemented and evaluated in Odisha state of India. The purpose of the study was to identify the impact of project interventions including the use of village health sanitation committees to promote TB control efforts. Results revealed that a combination of factors including the involvement of Interface NGOs, coupled with increased training and engagement of front line health workers and community groups, and dissemination of community based resources, contributed to improved awareness and knowledge about TB in the targeted districts. The expanded use of advocacy, communication and social mobilization activities in TB control has resulted in a number of benefits. These include bridging pre-existing gaps between the health system and the community through support and coordination of general health services stakeholders, NGOs and the community. Implications for future studies are that a comprehensive and well planned range of ACSM activities can enhance TB knowledge, attitudes and behaviours while also mobilizing specific community groups to build community efficacy to combat TB.</td>
<td>Rapid assessment and response methodology</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Reference</td>
</tr>
<tr>
<td>-----------</td>
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</tr>
<tr>
<td>Karungula, J.</td>
<td>Measures to reduce the infant mortality rate in Tanzania</td>
<td>Int J Nurs Stud. 1992 May; 29(2): 113-7.</td>
</tr>
<tr>
<td>Katsuda N, Hinohara Y, Tomita K, Hamajima N.</td>
<td>Structure and roles of public health centers (hokenjo) in Japan.</td>
<td>Nagoya J Med Sci. 2011 Feb;73(1-2):59-68.</td>
</tr>
<tr>
<td>F. Kazibwea, B. Makangab, C. Rubaire-Akiikic, J. Ouma, C. Kariuki, N.B. Kabatereinea, B.J. Vennervalda, D. Rollinson, J.R. Stothard</td>
<td>Transmission studies of intestinal schistosomiasis in Lake Albert, Uganda and experimental compatibility of local Biomphalaria spp.</td>
<td>Parasitol Int. 2010 May; 59(1):49-53; March 2010</td>
</tr>
<tr>
<td>Kuratsuji T.</td>
<td>The joint JMA-JICA project in Nepal.</td>
<td>Acta Paediatr Jpn. 1993 Dec;35(6):571-5.</td>
</tr>
<tr>
<td>Lakshminarayanam S.</td>
<td>Role of government in public health: Current scenario in India and future scope.</td>
<td>J Family Community Med. 2011. Jan;18(1):26-30.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Description</td>
</tr>
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<td>-------------</td>
</tr>
<tr>
<td>Muldoon KA, Galway LP, Nakajima M, Kanters S, Hogg RS, Bendavid E, Mills EJ</td>
<td>Health system determinants of infant, child and maternal mortality: A cross-sectional study of UN member countries.</td>
<td>Cross-sectional</td>
</tr>
</tbody>
</table>

The government in influencing population health is not limited within the health sector but also by various sectors outside the health systems. Important public health sector areas for action include health system strengthening, human resource development, capacity building and regulation; other sectors social determinants of health like sanitation, education, improving community participation and governance issues.

Making public health a shared value across the various sectors is a politically challenging strategy, but such collective action is crucial. Lakshminarayanan S, 2011.

Umati is a nongovernmental and nonprofit voluntary family planning organization which pioneered family planning activities in Tanzania in 1959. Umati assists the Ministry of Health in many efforts. The integrated project aims to compensate for some of the deficiencies inherent in the MCH program. To attract and sustain the interest and active participation of community members, project should respond to other community needs. Parasite control and nutrition have been selected as priority health concerns. The integrated project must have community ownership; local channels include the local steering committee; the project volunteers; the Family Planning Association of Tanzania; MCH unit of the government; the government environmental sanitation unit; primary schools; religious institutions; the village government (Mamuya, 1985).

This study explored risk factors associated with Diarrhea and upper respiratory tract infections (URTIs) among children in Sembabule district, Uganda. The prevalence of diarrhoea among children was 40.3%. A child not immunized (odds ratio [OR] 2.8, p < 0.001), absence of latrine in a house (OR 1.4, p < 0.03). “To reduce the burden of disease among children in this district, an integrated package of immunization services and other childcare programs need to be implemented in addition to improved personal and environmental hygiene. There is also a need to design well-focused health-education messages to improve treatment-seeking behavior for childhood diseases.”

Water and sanitation recognized as long term measures for diarrheal control, that must be implemented in phased manner. India MOH: using ORS as an interim strategy to diarrhea control; enacting mass production. Long-term measures to address diarrhea include sanitation, surveillance, and research (Misra, 1981).

Authors examine the association between health system indicators and mortality rates. Mixed effects linear regression models to investigate the strength of association between outcome and explanatory variables, Modelled infant mortality rate (IMR),
### Introducing regular behavioural surveillance into the health system in India: its feasibility and validity.

**Nongkynrih B, Anand K, Pandav CS, Kapoor SK.**

Authors developed a surveillance system to assess the 'risk factors' at the community level using the routine healthcare system.

Health workers collected data on behavioural risk factors such as sanitation access during the annual health census from December 2003 to February 2004. Authors compared the data related to individual behaviour with that of a survey of non-communicable diseases risk factors done in the same area, with no significant differences in results.

Health workers can use the routine healthcare system for behavioral surveillance.

### Are there any changes in burden and management of communicable diseases in areas affected by Cyclone Nargis?

**Myint, Kaeuwkungwa, Singhasivanon, Chaisiri, Panjapiyakul, Siriwan, Mallik, Nyein, and Mu.**

While Myanmar's incidence of diarrhea, dysentery and ARI increased post-Nargis, the incidence rate for other diseases and mortality rates did not increase, and normal disease patterns resumed by 2009.

Authors concluded that health services and prevention and control measures in the affected area mitigated what could have been a far more severe health impact.

However, most focus group participants were not interested in the health education provided, leading the authors to conclude that further study was needed to identify ways to increase IEC effectiveness. *Myint, Kaeuwkungwa, Singhasivanon, Chaisiri, Panjapiyakul, Siriwan, Mallik, Nyein and Mu, 2011*

### Continuing education. The experience of Tanzania.

**Pemba S, Ndeki S.**

The continuing education program in Tanzania aims, as part of primary health care (PHC) training, to provide leadership in planning, implementing, and monitoring PHC training; and to implement PHC educational activities.

The program was initiated in 1981 under the Ministry of Health until funding ceased in 1986. In 1988, the Danish International Development Authority funded the integration and decentralization of continuing education into the existing health system for all 6 zones.

Career-based training for health workers was emphasized. Methods involved distance learning and institutional training.

Distance learning modules included environmental sanitation and water, and diarrheal diseases.

Lack of funds, lack of qualified staff, inadequate support, and misdirected practices are limitations of continuing education. *Pemba and Ndeki, 1994*

### How the integrated project was promoted in Tanzania.

**Rukonge AD.**

Family planning information is fully integrated with education about sanitation and nutrition. The IP staff in Masama trained 43 of the 90 traditional birth attendants (TBAs). UMATI, NGO involved in integration project. The NSC facilitated IP approach because it *understood the relationship between family planning and parasite control*. It developed regional links with the Ministry of
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title/Details</th>
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<tr>
<td>Sayasone, Mak, Vanmany, Rasphone, Vounatsou, Utzinger, Akkhavong, Odermatt</td>
<td>Helminth and intestinal protozoa infections, multiparasitism and risk factors in Champasack province, Lao People's Democratic Republic. PLoS Negl Trop Dis 2011. 5(4) e1037</td>
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</tr>
<tr>
<td>Shahidah KN.</td>
<td>Hepatitis A vaccines.</td>
</tr>
<tr>
<td>Citation</td>
<td>Title</td>
</tr>
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<tr>
<td>Shearley, Adelaide E</td>
<td>The societal value of vaccination in developing countries</td>
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Discusses potential of remote sensing (RS) techniques, coupled with geographical information systems (GIS), to improve understanding of the epidemiology and control of schistosomiasis in Africa

Progress has been made in mapping the prevalence of infection in humans and the distribution of intermediate host snails. More recently, Bayesian geostatistical modelling approaches have been utilized for predicting the prevalence and intensity of infection at different scales.

Risk profiling can be achieved by taking into account information on people's socio-economic status; furthermore, future efforts should incorporate data on domestic access to clean water and adequate sanitation, as well as behavioural and educational issues.

Selective PHC may provide a cost-effective interim intervention for LDCs

Schistosoma japonicum is a significant cause of morbidity in China. The authors evaluated a comprehensive control strategy in two intervention villages and two control villages where annual synchronous chemotherapy is routinely used.

New interventions included improving sanitation by supplying tap water and building lavatories and latrines, providing boats with fecal-matter containers, and implementing an intensive health-education program.

After three transmission seasons, the rate of infection in humans decreased from 11.3% to 0.7% in one village and from 4.0% to 0.9% in the other (P<0.001 for both comparisons).
A comprehensive control strategy was highly effective and has been adopted as China’s national strategy to control schistosomiasis (Wang, L., Guo, Wu, X., Chen, Wang T., Zhu, Zhang, Steinmann, Yang, Wang, S., Wu, Wang, Hao, Bergquist, Utzinger, and Zhou, 2009).

<table>
<thead>
<tr>
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<td>Yayemain D, King JD, Debrah O, Emerson PM, Aboe A, Ahorsu F, Wanye S, Ansah MO, Gyapong JO, Hagan M.</td>
<td>Achieving trachoma control in Ghana after implementing the SAFE strategy. <em>Trans R Soc Trop Med Hyg.</em> 2009 Oct;103(10):993-1000. Epub 2009 Mar 14.</td>
<td>To eliminate trachoma by 2010 Ghana’s Health Service implemented the SAFE strategy in 2001. In total, 74,225 persons from 12,679 households were examined. Prevalence of trachomatous inflammation-follicular in 1-9 year-old children was 0.84% (95% CI 0.63-1.05, range of point estimates by district 0.14-2.81%) and prevalence of trichiasis in adults aged ≥15 years was 0.31% (95% CI 0.24-0.38, range by district 0.00-1.07%). An estimated 4950 persons have trichiasis, of whom 72.6% are aged ≥or = 60 years and 71.4% are women. Latrines were observed in 11.6% of households. Authors concluded that active trachoma is no longer a public health problem due to implementation of the SAFE strategy. Recommendations include continued health education and sanitation advocacy along with continued surveillance to ensure maintenance.</td>
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How health professionals can leverage health gains from improved water, sanitation and hygiene practices

Abstract
Emerging evidence suggests that widespread failure in coordination and collaboration between the health and WaSH sectors contributes to the substantive disease burden associated with inadequate water, sanitation and hygiene (WaSH). This results in missed opportunities at every level starting with access to water and sanitation and adequate hygiene practices in primary health facilities. This paper describes the application of an established health system functions framework to the WaSH sector and summarizes examples of successful health system action including the roles played by diverse health professionals.

BACKGROUND
Throughout the world, human populations are wholly dependent on healthy environments in order to survive and thrive. Since ancient times, access to safe water, sanitation and hygiene (WaSH) has enabled individuals and populations to shift their focus of activity from survival to other critical pursuits such as education and income generation. Despite this fundamental role in health and development, a significant portion of the world’s population remains without access to safe water and sanitation, and suffers daily from the resulting disease burden.

A recent report by the World Health Organization (WHO) and UNICEF states that nearly 900 million people (13% of the world’s population) remain without access to an improved source of drinking water, such as a protected well or spring, while three times that amount, 2.6 billion (39% of the world’s population), remain without basic sanitation, such as a latrine at home. The disease burden that results is significant: the WHO estimates that more than 9% of the disease burden and 6% of deaths could be prevented by improving WaSH (Table 1).

Children suffer the most, as 25% of global mortality of children aged 0–14 is associated with unsafe water, inadequate sanitation or insufficient hygiene, with the distribution of the disease burden polarized in developing countries.

INTERNATIONAL INITIATIVES
Over recent decades international policy initiatives have directly confronted the inadequate WaSH...
Table 1

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Children 0-14 years</th>
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<td>Population (‘000)</td>
<td>6,224,985</td>
<td>1,630,140</td>
<td>1,366,887</td>
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<td>Total deaths (‘000)</td>
<td>57,029</td>
<td>11,045</td>
<td>13,430</td>
<td>43,599</td>
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<tr>
<td>Total DALYs* (‘000)</td>
<td>1,420,126</td>
<td>544,534</td>
<td>213,574</td>
<td>1,276,552</td>
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<td>Total WaSH-related deaths (‘000)</td>
<td>3,575 (6.3%)</td>
<td>3,011 (25%)</td>
<td>73 (0.5%)</td>
<td>3,503 (8%)</td>
</tr>
<tr>
<td>Total WaSH-related DALYs* (‘000)</td>
<td>135,748 (6.1%)</td>
<td>117,789 (22%)</td>
<td>1,861 (9.9%)</td>
<td>133,887 (10%)</td>
</tr>
</tbody>
</table>

*A weighted measure of deaths and disability

Health sector opportunities and obstacles

Sectors, systems and silos

Like many other sectors, the health sector suffers the “silo” effect, whereby individuals, programmes and organizations become focused on a particular mission and operate in isolation. In the case of health and WaSH, there are significant associated risks of under-performance because many desired actions are implemented by non-health sector actors, and because specific health requirements may not be adequately addressed by generic WaSH activities. A framework that relates the understanding of the roles of individuals to the larger system of promoting public health through WaSH and other services can help identify opportunities for the health systems and the professionals within it to leverage health gains (Figure 1).

Inter-sectoral policy

Because investments, programmes and interventions to improve WaSH involve agencies from diverse sectors, advancing WaSH efficiently requires active coordination and, where beneficial, collaborative action to both improve health and to increase investments by other sectors. Health sector roles include tracking and influencing policy and establishing effective multi-disciplinary collaborations. In order to be effective, leadership and commitment from the top

Service provision to tackle the associated adverse health, poverty and environmental impacts. The 1980s were declared the International Drinking Water Supply and Sanitation Decade with the city (and unachieved) goal of “water and sanitation for all”. In 2002, the United Nations (UN) Conference on Environment and Development adopted Agenda 21, a blueprint for action that included the human health and environmental health connection. At the turn of the millennium, world leaders signed the Millennium Declaration – in effect a global contract to tackle poverty given tangible focus through the UN Millennium Development Goals (MDGs). MDG target 7c is to reduce by half (between 1990 and 2015) the proportion of people without sustainable access to safe drinking water and basic sanitation. The impact of efforts to reduce the WaSH-related burden of disease has been undermined by the slow progress in identifying and implementing interventions that are effective, sustainable and scalable. The quest for such solutions has importance far beyond human health, cost-effective WaSH investments exist which also reduce healthcare costs to both households and health systems, generate productivity gains due to improved health, and result in substantive time savings. In the case of WaSH interventions in developing regions, the value of these benefits far exceeds the cost of the required interventions. Despite its profound influence on health, there has been an overall decline in the attention given to WaSH by health systems and by health professionals. The most frequent explanation given by health professionals when taking to the present authors has been a strong recognition of the importance of WaSH for health but little recognition of its relevance to their day-to-day work. In a recent interview, one author was told: ‘it is everybody’s business and therefore no one’s business.’

Minimal research literature exists on the roles that the health sector can play in improving environmental health. However, a framework developed by Rothfus et al. accepts that six specific health sector functions are needed to secure health gains (Figure 1); these are discussed below, looking at their application to attaining and sustaining safe WaSH and examining the required health sector capacities and constraints that impose more effective interaction on WaSH as a determinant of health.

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For the purposes of the paper the WHO’s definition is used: “A health system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as those health-improving activities. A health system is therefore more than the pyramid of public owned facilities that deliver personal health services. It includes intersectoral action by health staff…”

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Figure 1
Health sector functions framework

Primary leadership and direct action

Environmental health in healthcare facilities

Environmental health in health programmes

Outbreaks of environment-mediated diseases

Response to emerging threats and opportunities

Health in inter-sectoral policies

Primary coordination and cooperation with other sectors

Environmental norms and regulations


and engagement at all appropriate levels is required.

Mechanisms for inter-sectoral policy development to improve health through safe water, sanitation and hygiene include tools such as the health impact assessment (HIA) process. HIAs provide a means to systematically and holistically assess the health impacts of policies, plans and projects – important because individual sectors often lack information and the tools to understand the impacts of their policies and actions on human health. Even interventions that seem likely to benefit health, such as dam construction and irrigation, can adversely affect health by changing disease vector habitats, for instance. Historically, the health sector has played an important role in advancing sanitation, for example, during the sanitary revolution of the 19th century, without directly bearing the associated costs. More recently, health professionals in Brazil collaborated with the public works ministry to facilitate the installation of safe water and sanitation infrastructure during the establishment of Brasilia, thereby ensuring a healthy foundation for the newly relocated capital in the 1950s.

Advocating across agencies and organizations for improvements in policies, practices and financing provides the health sector with a financially prudent means to improve health through the actions of others. Multi-sectoral policy initiatives, however, require leadership, commitment from the top decision makers and engagement at all appropriate levels in order to be successful.

Norms and regulations
Health sector roles in advancing WaSH include developing standards and regulations to encourage the adoption of practices, technologies and products that can improve health. One such practice is monitoring to ensure the expected improvements are achieved. Ongoing review of standards and regulations also allows periodic updating to reflect new understanding and enable incremental improvement. Almost all countries worldwide have some form of drinking-water quality standard or guideline. While establishing a standard does not directly lead to safe water, it has in some cases proven to be an effective lever when combined with oversight by an independent regulator. For example, the Drinking-Water Inspectorato of England and Wales has reported year-on-year compliance improvements with standards. More recently this has also developed into mechanisms such as water supply plans, which include risk assessment and preventive management of drinking-water supplies.

Sanitation norms and regulations in developing countries in particular provide the opportunity to achieve substantial gains in health when actively promoted and monitored. Their development provides a tool to be used for education, incentives and targeted implementation of requirements. For example, the use of
unsafe pan latrines (where excreta are manually removed) was banned by the Accra Metropolitan Assembly (Ghana) in 2009 with a compliance deadline of early 2010. As well as a clear target date, this plan included subsidized toilets as an incentive for compliance. In early 2010 the Assembly issued a reminder about the requirement and warned citizens that offenders would be prosecuted after the deadline.14 Accra’s government used the regulatory mechanism to educate citizens about the unsafe use of pan latrines, offer incentives and target implementation by warning of impending deadlines.

The development of appropriate norms and standards provides a mechanism for health systems to leverage health gain by influencing other actors. By pitching the requirement at a level that balances health benefit with cost (including both the costs of regulation and the costs of implementation), health agencies and professionals have the potential to optimize the use of available resources to health gain. Regrettably, experience shows that this mechanism is inadequately used in both developed and developing countries15 and there is therefore great scope for further improvements that depend on health systems having adequate capacities to participate in development and in some cases engage directly in monitoring of compliance and/or supporting implementation of these norms.

**Disease-specific and integrated programmes**

Safe Wash interventions should be incorporated into both disease-specific and integrated primary healthcare (PHC) programmes. Moreover, through their daily interactions, most health professionals have opportunities and arguably responsibilities to advance Wash-related components in their daily interactions.

Safe sanitation and facial hygiene are requirements for preventing trachoma, the leading global cause of preventable blindness. Trachoma, common in the US and Europe in the 19th century, was eliminated by improved Wash. Trachoma was addressed in a disease-specific programme called the GET2020 (Global Elimination of Blinding Trachoma) campaign, in which the first three countries (Mexico, Morocco and Oman) to eliminate trachoma included environmental prevention in their strategies. In the early 1990s Pakistan launched a comprehensive integrated healthcare. Lady health workers, community health workers trained to deliver primary care, provide education about the use of safe sanitation and hygiene practices to reduce Wash-related diseases. In an evaluation of the programme’s effectiveness, staff documented several significant community health improvements: infant mortality from diarrhoea disease declined from 33% to 15%, and diarrhoea-related deaths in children aged 1–4 decreased from 52% to 14%. The availability of flush and pit latrines also increased during the study period from 15% to 19%.16 The health sector’s opportunity here is to incorporate environmental determinants into curricula and programmes and thereby increase awareness and improve safe Wash-related behaviours.

In discussions with health professionals, it is clear that safe Wash plays a direct role in programme delivery in most, if not all, programmes — whether disease-specific such as trachoma or HIV/AIDS, or horizontal such as Integrated Management of Childhood Illness. Yet it is uncommon for Wash to components to be explicitly addressed in programme design. This may itself be a reflection of silo-programming whereby Wash is perceived to be the responsibility of “someone else”, it is not tackled. Such exclusion is unlikely to lead to optimum health outcomes since the demands of specific programmes may also be specific and inadequately captured elsewhere. Thus, for example, targeting PLHAs (people living with HIV/AIDS) with household water treatment and latrines has been shown to decrease their diarrhoea risk by 25% and 31%, respectively; coupled with the use of soap for handwashing, the number of days ill was reduced up to 42%.14

**Health facilities**

The costs of healthcare-acquired infections are high. Inadequate Wash can play a substantive role in propagating infections, whereas adequate facilities, services and behaviour can contribute substantially to disease prevention. Kenya’s former Ministry of Health (now the Ministry of Public Health and Sanitation) implemented waste management procedures in healthcare facilities around the country. Dr James Nyikal, Director of Medical Services, noted: “Infection prevention costs a lot of money, but it pays off.”15 Health facility managers have the responsibility to ensure adequacy of facilities, to require safe hygiene practices by staff and to encourage, and if necessary enforce, compliance. Researchers in Stuttgart, Germany reported a critical care unit in which comprehensive disinfection was unable to control 10–12 pseudomonal infections per month — which were associated with significant treatment and inpatient costs. Fitting filters to all taps reduced the rate of infection to less than one per month and is associated with a net saving as the costs of filters was significantly less than that of the avoided antibiotic therapy alone.16 Dilapidated buildings and poorly functioning water supplies and latrines exacerbate the cycle of disease and increase the risk of preventable infection. In addition, a strategic opportunity is lost to provide an example for health-protecting practices in homes, schools and other local settings. In both urban and rural areas, health centres can serve as models for the use of safe water, well-maintained and functioning toilets, and proper hygiene practices.

**Disease outbreaks**

Outbreaks of Wash-associated diseases occur in developed and developing countries worldwide. Outbreak costs may be high — whether in terms of direct health impacts, the burden of mobilising investigation and response, or the adverse impact on those perceived to bear responsibility. Both large and small communities may be affected, even in
How health professionals can leverage health gains from improved water, sanitation and hygiene practices

Understanding impacts, threats and opportunities
Optimizing public health implies objectively assessing the impacts and sustainability of existing health-related programmes: seeking evidence for new or unrecognized threats that may require new or amended interventions; and exploring the potential for new or newly applied interventions to protect and improve health. Collection of data and use of information is critical in these roles.

While the availability of adequate water and sanitation services is often perceived as a relatively well-understood risk factor of principal concern in developing nations, experience shows periodic emergence of new threats, for example related to changes in the way in which the environment is managed or technologies are used in provision of water and sanitation services. Legionellosis is now a well-recognized pneumonic illness, although when first discovered in Philadelphia in 1976 (when it caused an outbreak of pneumonia at an American Legion Convention, infecting 221 people and killing 34) it represented an entirely new challenge to both clinical and environmental microbiologists. Such emergence of new health concerns is far from rare.

Cryptosporidium spp. provide a specific challenge to drinking-water management because their oocysts are environmentally resilient and resistant to chlorine disinfection; similarly, the role of environmental transmission on the SARS epidemic of 2002–2003 indicated that the causal coronavirus was far more environmentally resilient than had been assumed. Active exploration to identify potential unrecognized and emerging causal associations is not specific to water and sanitation but should beneficially encompass it.

The challenge of collecting and sharing information is critical to increase resource efficiency. Surveillance systems maintained by health and by environmental sectors can be shared and combined to create comprehensive data systems; improving ongoing information and communication programmes will be key. Solid information management systems allow professionals to identify trends and new areas needing research.

CAPACITIES AND CONSTRAINTS
Minimal literature addresses the components needed for health systems to function. Reich and McKee analyze three key components for health systems: financing, information, and the health workforce. The WHO’s Everybody’s Business presents six building blocks to strengthen health systems. The present authors argue that five key capacities determine the success of the six health sector functions: leadership, financing, human resources, information systems, and community participation.

The adequacy of these capacities determine the ability of health professionals to fully use the functions to support a viable health system. Inadequate capacities are constraints that impact a system’s progress in protecting and improving public health. Following is a description of the five capacities and their role in supporting the health sector functions.

Leadership
‘Leadership starts from the top’ might initially seem a platitude. However, leaders are the cornerstone of a thriving health system; they mobilize others and provide the stability to support the execution of health sector functions. Kenya’s Minister of Public Health and Sanitation, the Hon Beth W Mugo, is driving the push to reduce health disparities in her country caused by myriad issues including unsafe water and sanitation. Whatever the level – national, ministerial, regional – poor leadership distorts focus and leads to stagnation or decline. As discussed in the 12 June 2010 issue of The Lancet, due to ‘political quagmire’, Nepal’s healthcare system is suffering significantly, such that hospitals have even been shut down.

Community participation
Community participation takes on many forms to support local needs and concerns. Community-oriented groups organize to address local concerns – be they to build a local water system in India or to monitor water quality in the US. Sri Lanka has long embraced community participation in health issues.

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Participation in local water and sanitation projects; a recent example is the post-tsunami recovery project in the district of Galle. Villagers are monitoring and implementing the infrastructure and learning about safe WASH practices from local health workers. When community participation is not employed, health sector functions may not work as well or achieve only temporary results.

**Human resources**
A cadre of health workers is needed to optimize performance in each of the six health functions, as exemplified by Pakistan’s 100,000 lady health workers, who are the backbone of primary healthcare in Pakistan. Well-organized, trained and motivated workers use available resources to maximize health outcomes. Not only are increased numbers of health workers needed where systems are falling en masse, but training support and supervision are crucial. In a recent review of the information needs of healthcare workers in developing countries, Pakenham-Walsh and Bukech noted that an “information poverty” exists where workers do not get the information they need to perform their jobs well. Poor management and lack of maintenance were cited as core concerns in a recent study by Uganda’s Ministry of Health on the state of decay of healthcare facilities throughout the country.

**Information systems**
Robust information systems provide health workers with the data needed to make decisions to support and sustain each of the health sector functions. Reliable health informatics (acquisition, management and use of information in health) allows rapid detection, tracking and mitigation of WASH-related disease outbreaks such as cholera. Systems designed to easily share and distribute information allows decision making that increases the potential for proactive and long-term planning instead of crisis-driven reactionary measures.

**Financing**
Clear financing is needed to successfully execute the health sector functions. However, a world with increased competition for reduced financial resources encourages health professionals to seek creative solutions. Inter-sectoral partnerships can achieve multiple goals with limited funds. Handwashing awareness campaigns between health agencies and corporate sponsors, for example, can increase the understanding of causes of disease and ideally initiate a cycle of personal behaviour changes. Conducting outreach without exploring partnerships can result in missed opportunities to reach additional audiences with the same dollars.

**ROLES FOR HEALTH PROFESSIONALS**
Health professionals have the knowledge, opportunity and even leverage to help ensure that actions are taken. Many practical opportunities exist for health workers to incorporate WASH-related principles into their daily work. Actions include promoting understanding, implementing policy and evaluating results. Five actions that are easy to implement without substantial investment are listed below.

**How health professionals can advance health by engaging in WASH**

- Participate non-nosers: enact, implement and enforce minimum standards for WASH in all types of healthcare facilities including both physical facilities and their safe functioning and patient safety and infection control measures.
- Review curricula and in-career development for all health professionals to ensure relevant and usable WASH components are incorporated.
- Update clinical practice guidelines: When patients present with diseases associated with poor WASH practices, offer long-term preventive solutions in addition to immediate treatment.
- Provide patient education materials in healthcare settings such as waiting rooms and clinics.
- Actively speak louder than words: remember in your daily interactions that you can model safe WASH-related practices to those around you.

**CONCLUSION**
Safe water, sanitation and hygiene are cornerstones of public health. Evidence indicates that active engagement of health systems in WASH yields substantive, long-lasting and cost-effective health gains. The functional classification developed by Rahmues et al., which identifies specific roles for health sector professionals relevant in both developed and developing countries, can be applied to WASH. Overlaying capacities onto the functions has the potential to provide a means to identify and target areas that need strengthening to improve the implementation, impact and sustainability of WASH-related initiatives. Health professionals have a crucial role and opportunity to incorporate WASH into their everyday practices and use their individual actions and influence to increase the momentum for safe WASH throughout the world.
How health professionals can leverage health gains from improved water, sanitation and hygiene practices

References


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APPENDIX C

INFORMANT INTERVIEW QUESTIONNAIRE USED FOR QUALITATIVE ANALYSIS

(Conducted February - March 2010)

Institutional Arrangements for Sanitation: What can and should the health sector do?

1. How do you view the current state of the Burden of Disease in [subject country]: what are the most common diseases?
2. How is the Health sector engaged in reducing the diseases concerned?
3a. Is sanitation or environmental health adequately considered in the Health policy, or in intersectoral policies? How frequently are standards revised and who is involved in the revision?
   3b. What relevant professional accreditations exist? Are there certifications for sanitation-related products such as latrines?
4a. Are there protective norms and regulations in place to promote sanitation, reduce the risk of diarrhoea outbreaks? (role of health, role of watsan, role of education)
4b. How is compliance with these regulations and standards monitored or assessed? Who or what agency determines compliance?
5a. Intersectoral coordination and/or leadership; Is there a Sanitation Council or other high level group charged with improving health by addressing sanitation issues? What ministries or agencies are included? Are there any written agreements among entities with responsibility for sanitation protection?
   5b. Describe health sector involvement in partnerships convened to target sanitation issues, education, or programs. Partnerships would include collaborations among government agencies at multiple levels, as well as civil society, to implement or enhance sanitation programs?
6a. Are health impact assessments required or undertaken for substantive sanitation projects? Which health system entities are involved?
6b. What are the strengths and weaknesses of the current approach? What works well/could work well? What are the challenges?
7a. Does the health sector operate or participate in an environmental health surveillance system to investigate outbreaks?
7b. What would you advise the Government to make the promotion of sanitation at scale more effective: health/physical planning/education?
8. Can you tell me something about the role of Sanitation and Environmental Health in disease specific and integrated health programmes? What outreach mechanisms are used? For example, self-help groups, social marketing, workshops?
9. Describe requirements for sanitation in health care facilities including hospitals, doctor’s offices, dental clinics, community health clinics, nursing homes, and other care settings. Are these stipulated in regulation/standards or formal guidance? What behavioral practices such as handwashing are required?
APPENDIX D

QUANTITATIVE DATA ANALYSIS SOURCES
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<th>Definition</th>
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<td>DEF1, DEF2, DEF3</td>
<td>Proportion of Urban population in 1990, 2000, 2008 disposing human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces or with solid waste</td>
<td>WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation</td>
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<tr>
<td>DEF 4, DEF5, DEF6</td>
<td>Percent of Urban population in 1990, 2000, 2008 disposing human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces or with solid waste</td>
<td>WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation</td>
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<td>DEF7, DEF8, DEF9</td>
<td>Proportion of Rural population in 1990, 2000, 2008 disposing human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces or with solid waste</td>
<td>WHO / UNICEF Joint Monitoring Programme for Water Supply and Sanitation</td>
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### HEALTH2

**Gvt health $ as % of total health spending in 2000**

Public health expenditure in 2000 consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation.

World Health Organization National Health Account database (www.who.int/nha/en) supplemented by country data.

### HEALTH3

**Total health spending as % of GDP in 2000**

Total health expenditure in 2000 is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation.

World Health Organization National Health Account database (www.who.int/nha/en) supplemented by country data.

### HEALTH4

**Gvt health spending as % of total gvt spending 2000**

Public health expenditure in 2000 consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds.

World Health Organization National Health Account database (www.who.int/nha/en) supplemented by country data.

### HEALTH5

**gvt spending on health per cap $ 2000**


WHO NHA database.
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<td>% 1 y/o DTP3 1990, 2000, 2009 Child immunization measures the percentage of children ages 12-23 months who received vaccinations before 12 months or at any time before the survey. A child is considered adequately immunized against diphtheria, pertussis (or whooping cough), and tetanus (DPT) after receiving three doses of vaccine. Data is for 1990, 2000 and 2008.</td>
<td>WHO and UNICEF (<a href="http://www.who.int/immunization_monitoring/routine/en/">http://www.who.int/immunization_monitoring/routine/en/</a>)</td>
</tr>
<tr>
<td>HEALTH9, HEALTH10</td>
<td>% mothers 4+ antenatal 2009 and 2000 The percentage of women aged 15-49 with a live birth in a given time period that received antenatal care four or more times. Data is for 2000 and 2009.</td>
<td>WHO and UNICEF compiles empirical data from household surveys. At the global level, data from facility reporting are not used.</td>
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<tr>
<td>HEALTH11, HEALTH12</td>
<td>% mothers 1+ antenatal 2009 and 2000 The percentage of women aged 15-49 with a live birth in a given time period that received antenatal care provided by skilled health personnel (doctors, nurses, or midwives) at least once during pregnancy. Data is for 2000 and 2009.</td>
<td>WHO and UNICEF compiles empirical data from household surveys. At the global level, data from facility reporting are not used.</td>
</tr>
<tr>
<td>HEALTH13, HEALTH14, HEALTH15</td>
<td>% births attended by skilled staff 1990, 2000, 2009 Births attended by skilled health staff are the percentage of deliveries attended by personnel trained to give the necessary supervision, care, and advice to women during pregnancy, labor, and the postpartum period; to conduct deliveries on their own; and to care for newborns.</td>
<td>UNICEF, State of the World's Children, Childinfo, and Demographic and Health Surveys by Macro International.</td>
</tr>
</tbody>
</table>
**POV1**

% pop < $1.25/day

Population below $1.25 a day is the percentage of the population living on less than $1.25 a day at 2005 international prices. As a result of revisions in PPP exchange rates, poverty rates for individual countries cannot be compared with poverty rates reported in earlier editions.

World Bank, Development Research Group. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are from the Luxembourg Income Study database. For more information and methodology, please see PovcalNet (http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp).

**AID4**

ODA % of gross national income 2009

Net official development assistance (ODA) for 2009 consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent). Development Assistance Committee of the Organisation for Economic Co-operation and Development, Geographical Distribution of Financial Flows to Developing Countries, Development Co-operation Report, and International Development Statistics database. Data are available online at: www.oecd.org/dac/stats/idsonline. World Bank GNI estimates are used for the denominator.

**AID7**

ODA per capita 2009

Net official development assistance (ODA) per capita for 2009 consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent). Data are in current U.S. dollars for 2009. Development Assistance Committee of the Organisation for Economic Co-operation and Development, Geographical Distribution of Financial Flows to Developing Countries, Development Co-operation Report, and International Development Statistics database. Data are available online at: www.oecd.org/dac/stats/idsonline. World Bank population estimates are used for the denominator.
EDUC1  % pop tertiary ed  Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.


EDUC2  % fem 2nd ed  Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers.


EDUC5  Girls to boys ratio primary and secondary ed 2009  Ratio of girls to boys in primary and secondary education is the ratio of the female to male gross enrollment rates in primary and secondary school in 2009.


ECON7  Income share lowest 10% 2009  Percentage share of income or consumption is the share that accrues to subgroups of population. Data for 2009.

World Bank, Development Research Group. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are from the Luxembourg Income Study database. For more information and methodology, please see PovcalNet (http://iresearch.worldbank.org/PovcalNet.jsp).
Income share by highest 10%, 2009

Percentage share of income or consumption is the share that accrues to subgroups of population indicated by deciles or quintiles. Data for 2009.

World Bank, Development Research Group. Data are based on primary household survey data obtained from government statistical agencies and World Bank country departments. Data for high-income economies are from the Luxembourg Income Study database. For more information and methodology, please see PovcalNet (http://iresearch.worldbank.org/PovcalNet/index.jsp).
Appendix E

How health professionals can leverage health gains from improved sanitation practices

The information presented in this brief is based on research conducted in collaboration with the Water Institute at UNC and WaterAid. To explore health ministry involvement in promoting sanitation, we conducted country case studies in Nepal, Malawi, and Sri Lanka. Researchers conducted over sixty field interviews of health and sanitation stakeholders. We explored health ministry roles and responsibilities using a framework of six essential health sector functions.

This study provides insights into options for health ministries to support sanitation. Sanitation can be integrated within policies and strategies designed to address ongoing health interventions, such as nutrition programs, maternal and child health programs, and disease-specific initiatives such as HIV/AIDS and trachoma control programs. Policymakers can require safe sanitation facilities within health buildings. Health workers and educators can teach about the impacts of unsafe sanitation. Information specialists can track sanitation-related health trends to substantiate targeted policies and programs. Stronger intersectoral collaborations would reduce overlap and increase efficiency. Some actions can be adopted at minimal cost. Other actions will require partnerships and additional resources. This report provides a wide-ranging list of achievable options that can be prioritized and implemented over time.

Background

Throughout the world, human populations are wholly dependent on healthy environments in order to survive and thrive. Since ancient times, access to sanitation has enabled individuals and populations to shift their focus of activity from survival to other critical pursuits such as education and income generation. Despite this fundamental role in health and development, a significant portion of the world’s population remains without access to safe sanitation, and suffers daily from the resulting disease burden.

A recent report by the World Health Organization (WHO) and UNICEF states that 2.6 billion (39% of the world’s population), remain without basic sanitation, such as a latrine at home. The disease burden that results is significant: the WHO estimates that more than 9% of the disease burden and 6% of deaths could be prevented by improving access to safe water, sanitation, and hygiene (WaSH) (Table 1). Children suffer the most, as 25% of global mortality of children aged 0–14 is associated with unsafe water, inadequate sanitation or insufficient hygiene, with the distribution of the disease burden polarized to developing countries.

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i. Safe management of human excreta. Globally, most households hold sanitation is provided through one or other of diverse forms of latrine.
The impact of efforts to reduce the WaSH-related burden of disease has been undermined by the slow progress in identifying and implementing interventions that are effective, sustainable and scalable. The quest for such solutions has importance far beyond human health: cost-effective WaSH investments exist which also reduce healthcare costs to both households and health systems, generate productivity gains due to improved health, and result in substantive time savings. In the case of WaSH interventions in developing regions, the value of these benefits far exceeds the cost of the required interventions.

Despite its profound influence on health, there has been an overa\textsuperscript{il}ii decline in the attention given to WaSH by health systems and by health professionals\textsuperscript{il}. The most frequent explanation given by health professionals when talking to the present authors has been a strong recognition of the importance of WaSH for health but little recognition of its relevance to their day-to-day work. In a recent interview, one author was told: ‘It is everybody’s business and therefore no one’s business.’

Minimal research literature exists on the roles that the health sector can play in improving environmental health. However, a framework developed by Rehfuess et al.\textsuperscript{5} asserts that six specific health sector functions are needed to secure health gains (Figure 1); these are discussed below, looking at their application to attaining and sustaining safe WaSH and examining the required health sector facilitators and barriers that impede more effective interaction on WaSH as a determinant of health.

### Table 1

<table>
<thead>
<tr>
<th>Summary statistics on deaths and disability related to WaSH in 2002*</th>
<th>Total</th>
<th>Children 0-14 years</th>
<th>Developed countries</th>
<th>Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population ('000)</td>
<td>6,224,965</td>
<td>1,830,140</td>
<td>1,366,867</td>
<td>4,858,118</td>
</tr>
<tr>
<td>Total deaths ('000)</td>
<td>57,029</td>
<td>11,945</td>
<td>13,430</td>
<td>43,599</td>
</tr>
<tr>
<td>Total DALYs* ('000)</td>
<td>1,420,126</td>
<td>544,534</td>
<td>213,574</td>
<td>1,276,552</td>
</tr>
<tr>
<td>Total WaSH-related deaths ('000)</td>
<td>3,575 (5.3%)</td>
<td>3,011 (25%)</td>
<td>73 (5%)</td>
<td>3,503 (8%)</td>
</tr>
<tr>
<td>Total WaSH-related DALYs* ('000)</td>
<td>135,748 (9.1%)</td>
<td>117,789 (22%)</td>
<td>1,881 (9%)</td>
<td>133,887 (10%)</td>
</tr>
</tbody>
</table>

* A weighted measure of deaths and disability

### Opportunities and Obstacles

#### Sectors, systems and silos

Like many other ministries, the health ministry may suffer from the ‘silo’ effect, whereby individuals, programs and organizations become focused on a particular mission and operate in isolation. In the case of health and sanitation, there are significant associated risks of under-performance because many desired actions are implemented by non-health sector actors, and because specific health requirements may not be adequately addressed by generic WaSH activities. A framework that relates the understanding of the roles of individuals to the larger system of promoting public health through WaSH and other services can help identify opportunities for the health systems and the professionals within it to leverage health gains (Figure 1).

#### Function #1: Norms and regulations

Health ministry roles in advancing sanitation include developing standards and regulations to encourage the adoption of practices, technologies and products that can improve health. One such practice is monitoring to

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\textsuperscript{il} For the purposes of this paper the WHO’s definition is used: ‘a health system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as more direct health-improving activities. A health system is therefore more than the pyramid of publicly owned facilities that deliver personal health services. ... It includes inter-sectoral action by health staff ...’
ensure the expected improvements are achieved. Ongoing review of standards and regulations also allows periodic updating to reflect new understanding and enable incremental improvement.

Sanitation norms and regulations in developing countries in particular provide the opportunity to achieve substantial gains in health when actively promoted and monitored. Their development provides a tool to be used for education, incentives and targeted implementation of requirements. For example, the use of unsafe pan latrines (where excreta are manually removed) was banned by the Accra Metropolitan Assembly (Ghana) in 2008 with a compliance deadline of early 2010. As well as a clear target date, this plan included subsidized toilets as an incentive for compliance. In early 2010 the Assembly issued a reminder about the requirement and warned citizens that offenders would be prosecuted after the deadline. Accra’s government used the regulatory mechanism to educate citizens about the unsafe use of pan latrines, offer incentives and target implementation by warning of impending deadlines.

The development of appropriate norms and standards provides a mechanism for health systems to leverage health gain by influencing other actors. By pitching the requirement at a level that balances health benefit with cost (including both the costs of regulation and the costs of implementation), health agencies and professionals have the potential to optimize the use of available resources to health gain. Regrettably, experience shows that this mechanism is inadequately used and there is therefore great scope for further improvements that depend on health systems having adequate capacities to participate in development and in some cases engage directly in monitoring of compliance and/or supporting implementation of these norms.

Function #2: Inter-sectoral policy
Because investments, programs and interventions to improve sanitation involve agencies from diverse sectors, advancing sanitation efficiently requires active coordination and, where beneficial, collaborative action to both improve health and to increase investments by other sectors. Health ministry roles include tracking and influencing policy and establishing effective multi-disciplinary collaborations. In order to be effective, leadership and commitment from the top and at all appropriate levels is required.

Mechanisms for inter-sectoral policy development to improve health through safe water, sanitation and hygiene include tools such as the health impact assessment (HIA) process. HIAs provide a means to systematically and holistically assess the health impacts of policies, plans and projects – important because individual sectors often lack information and the tools to understand the impacts of their policies and actions on human health. Even interventions that seem likely to benefit health, such as dam construction and irrigation, can adversely affect health by changing disease vector habitats, for instance. Historically, the health sector has played an important role in advancing sanitation, for example, during the sanitary revolution of the 19th century, without directly bearing the associated costs. More recently, health professionals in Brazil collaborated with the public works ministry to facilitate the installation of safe water and sanitation infrastructure during the establishment of Brasilia, thereby ensuring a healthy foundation for the newly relocated capital in the 1950s.

Advocating across agencies and organizations for improvements in policies, practices and financing provides the health sector with a financially prudent means to improve health through the actions of others. Multi-sectoral policy initiatives, however, require leadership, commitment from the top decision makers and engagement at all appropriate levels in order to be successful.

Function #3: Health facilities
The costs of healthcare-acquired infections are high. Inadequate sanitation can play a substantive role in propagating infections, whereas adequate facilities, services and behaviours can contribute substantively to disease prevention. Kenya’s former Ministry of Health (now the Ministry of Public Health and Sanitation)
implemented waste management procedures in healthcare facilities around the country. Dr James Nyikal, Director of Medical Services, noted: ‘Infection prevention costs a lot of money, but it pays off.’ Health facility managers have the responsibility to ensure adequacy of facilities, to require safe hygiene practices by staff and to encourage, and if necessary enforce, compliance. Researchers in Stuttgart, Germany reported a critical care unit in which comprehensive disinfection was unable to control 10–12 pseudomonad infections per month – which were associated with significant treatment and inpatient costs. Fitting filters to all taps reduced the rate of infection to less than one per month and was associated with a net saving as the costs of filters was significantly less than that of the avoided antibiotic therapy alone.

Dilapidated buildings and poorly functioning water supplies and latrines exacerbate the cycle of disease and increase the risk of preventable infection. In addition, a strategic opportunity is lost to provide an example for health-protecting practices in homes, schools and other local settings. In both urban and rural areas health centers can serve as models for the use of safe water, well-maintained and functioning toilets, and proper hygiene practices.

Function #4: Disease-specific and integrated programs
Safe sanitation interventions should be incorporated into both disease-specific and integrated primary healthcare (PHC) programs. Moreover, through their daily interactions, most health professionals have opportunities to advance sanitation.

Safe sanitation is a requirement for preventing trachoma, the leading global cause of preventable blindness. Trachoma, common in the US and Europe in the 19th century, was eliminated by improved sanitation. Trachoma was addressed in a disease-specific program called the GET2020 (Global Elimination of Blinding Trachoma) campaign, in which the first three countries (Mexico, Morocco and Oman) to eliminate trachoma included environmental prevention in their strategies. In the early 1990s Pakistan launched a comprehensive integrated healthcare program. Lady health workers, community health workers trained to deliver primary care, provide education about the use of safe sanitation and hygiene practices to reduce sanitation-related diseases. In an evaluation of the program's effectiveness, staff documented several significant community health improvements: infant mortality from diarrhoeal disease declined from 33% to 15%, and diarrhoea-related deaths in children aged 1–4 decreased from 52% to 14%. The availability of flush and pit latrines also increased during the study period from 15% to 19%. The health ministry’s opportunity here is to incorporate environmental determinants into curricula and programs and thereby increase awareness and improve safe sanitation-related behaviours.

In discussions with health professionals, it is clear that safe sanitation plays a direct role in program delivery in most, if not all, programs – whether disease-specific such as trachoma or HIV/AIDS, or horizontal such as Integrated Management of Childhood Illness. Yet it is uncommon for sanitation components to be explicitly addressed in program design. This may itself be a reflection of silo-programming whereby because sanitation is perceived to be the responsibility of ‘someone else’, it is not tackled. Such exclusion is unlikely to lead to optimum health outcomes since the demands of specific programs may also be specific and inadequately captured elsewhere. Thus, for example, targeting PLHA (people living with HIV/ AIDS) with latrines has been shown to decrease their diarrhoea risk by 31%.

Function #5: Disease outbreaks
Outbreaks of Sanitation-associated disease occur worldwide. Outbreak costs may be high – whether in terms of direct health impacts, the burden of mobilizing investigation and response, or the adverse impact on those perceived to bear responsibility. Both large and small communities may be affected, even in developed nations; in 1993 the US city of Milwaukee (population 1.6 million) was sickened by an outbreak that affected an estimated 400,000 people; while an outbreak in 2000 in the Canadian community of Walkerton (population 5,000) sickened over 1,000 residents and resulted in seven deaths. Between 1991 and 2002 an average of 17 waterborne disease outbreaks a year were reported in the US.

Izindaba, the South African medical journal, reported a systems collapse in 2009 in the Eastern Cape due to deteriorating water and sewer infrastructure, failed water quality compliance monitoring, a lack of surveillance monitoring and equipment shortages. As a result the region experienced an unprecedented outbreak of diarrhoeal disease leading to over 80 child and infant deaths within a three-month period. The alarm was not sounded until several months later when a local money lender noticed an extraordinary number of grandmothers coming in to borrow monies for funeral expenses.
Public health surveillance – tracking and monitoring trends – is critically important and not given the consideration it deserves. For example, diarrhoeal mortality rates may be underreported due to confounding with other conditions such as HIV/AIDS and malaria.\textsuperscript{22} Health ministry roles include detecting, investigating and participating in (and sometimes leading) response and follow-up to sanitation-associated disease outbreaks. In order to fulfill these responsibilities, the health sector needs standard procedures – both generic within the ministry of health (as part of all cause planning) and also within local standing arrangements such as water treatment facilities, response plans and reporting agreements for significant treatment plant upsets. Outbreak follow-up also receives too little attention, despite the potential for substantive benefit. Understanding the causes of outbreaks can assist in both improving local prevention and recognizing recurring issues and problems to mitigate future events through wider policy or programming initiatives.

Function #6: Understanding Impacts, threats and opportunities
Optimizing public health implies objectively assessing the impacts and sustainability of existing health-related programs; seeking evidence for new or unrecognized threats that may require new or amended interventions; and exploring the potential for new or newly applied interventions to protect and improve health. Collection and use of information is critical in these roles.

While the availability of adequate sanitation is often perceived as a relatively well-understood risk factor of principal concern in developing nations, experience shows periodic emergence of new threats, for example related to changes in the way in which the environment is managed or technologies are used in provision of Sanitation services. Legionellosis is now a well-recognized pneumonic illness, although when first discovered in Philadelphia in 1976 (when it caused an outbreak of pneumonia at an American Legion Convention, infecting 221 people and killing 34) it represented an entirely new challenge to both clinical and environmental microbiologists.\textsuperscript{21} Active exploration to identify potential unrecognized and emerging causal associations is not specific to sanitation but should beneficially encompass it.

The challenge of collecting and sharing information is critical to increase resource efficiency. Surveillance systems maintained by health and by environmental sectors can be shared and combined to create comprehensive data systems; improving ongoing information and communication programs will be key. Solid information management systems allow professionals to identify trends and new areas needing research.

Facilitators and Barriers
Minimal literature addresses the components needed for health system success. Reich and Takemi\textsuperscript{22} analyze three key components for health systems: financing, information and the health workforce. The WHO’s \textit{Everybody’s Business} presents six building blocks to strengthen health systems.\textsuperscript{23} The research revealed five key facilitators that determine the success of the six health sector functions: leadership; financing; human resources; information systems; and community participation.

The adequacy of these facilitators determines the ability of health professionals to fully use the functions to support a viable health system. Inadequate facilitators are barriers that impede a system’s progress in protecting and improving public health. Following is a description of the five facilitators and their role in supporting the health sector functions.

Leadership
‘Leadership starts from the top’ might initially seem a platitude. However, leaders are the cornerstone of a thriving health system: they mobilize others and provide the stability to support the execution of health sector functions. Kenya’s Minister of Public Health and Sanitation, the Hon Beth W Mugo, is driving the push to reduce health disparities in her country caused by myriad issues including sanitation.\textsuperscript{24} Whatever the level – national, ministerial, regional – poor leadership distracts focus and leads to stagnation or decline. As discussed in the 12 June 2010 issue of \textit{The Lancet}, due to ‘political quagmire’, Nepal’s healthcare system is suffering significantly, such that hospitals have even been shut down.\textsuperscript{25}

Community participation
Community participation takes on many forms to support local needs and concerns. Community-orientated groups organize to address local concerns – be they to build a local water system in India or to monitor water quality in the US. Sri Lanka has long embraced community participation in local water and sanitation projects; a recent example is the post tsunami recovery project in the district of Galle. Villagers are monitoring implementation of the infrastructure and learning about safe sanitation practices from local health workers.\textsuperscript{26}
When community participation is not employed, health sector functions may not work as well or achieve only temporary results.

Human resources
A cadre of health workers is needed to optimize performance in each of the six health functions, as exemplified by Pakistan’s 100,000 lady health workers, who are the backbone of primary healthcare in Pakistan. Well-organized, trained and motivated workers use available resources to maximize health outcomes. Not only are increased numbers of health workers needed where systems are failing en masse, but training support and supervision are crucial. In a recent review of the information needs of healthcare workers in developing countries, Pakenham-Walsh and Bukachi noted that an ‘information poverty’ exists where workers do not get the information they need to perform their jobs well. Poor management and lack of maintenance were cited as core concerns in a recent study by Uganda’s Ministry of Health on the state of decay of healthcare facilities throughout the country.

Information systems
Robust information systems provide health workers with the data needed to make decisions to support and sustain each of the health sector functions. Reliable health informatics (acquisition, management and use of information in health) allows rapid detection, tracking and mitigation of sanitation-related disease outbreaks such as cholera. Systems designed to easily share and distribute information allows decision making that increases the potential for proactive and long-term planning instead of crisis driven reactionary measures.

Financing
Clearly financing is needed to successfully execute the health sector functions. However, a world with increased competition for reduced financial resources encourages health professionals to seek creative solutions. Inter-sectoral partnerships can achieve multiple goals with limited funds. Sanitation awareness campaigns between health agencies and corporate sponsors, for example, can increase the understanding of causes of disease and ideally initiate a cycle of personal behavior changes. Conducting outreach without exploring partnerships can result in missed opportunities to reach additional audiences with the same dollars.

Roles for health professionals
Health professionals have the knowledge, opportunity and even leverage to help ensure that actions are taken. Many practical opportunities exist for health workers to incorporate Sanitation-related principles into their daily work. Actions include promoting understanding, implementing policy and evaluating results. Five actions that are easy to implement without substantial investment are listed below.

How health professionals can advance health by engaging in Sanitation

- Prima non nocere: enact, implement and enforce minimum standards for sanitation in all types of healthcare facilities including both physical facilities and their safe functioning and patient safety and infection control measures
- Review curricula and in-career development for all health professionals to ensure relevant and usable Sanitation components are incorporated
- Update clinical practice guidelines: When patients present with diseases associated with poor sanitation practices, offer long-term preventive solutions in addition to immediate treatment
- Provide patient education materials in healthcare settings such as waiting rooms and clinics
- Actions speak louder than words: remember in your daily interactions that you can model safe sanitation-related practices to those around you

Conclusion
Sanitation is a cornerstone of public health. Evidence indicates that active engagement of health ministries in sanitation yields substantive, long-lasting and cost-effective health gains. The functional classification developed by Rehfuess et al., which identifies specific roles for health professionals, can be applied to sanitation. Overlaying facilitators onto the functions has the potential to provide a means to identify and target areas that need strengthening to improve the implementation, impact and sustainability of sanitation-related initiatives. Health professionals throughout developing countries have a crucial opportunity to use their individual actions and influence to increase the momentum for sanitation use.

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<thead>
<tr>
<th>No.</th>
<th>Author(s)</th>
<th>Reference</th>
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<td>31</td>
<td>Pakenham-Walsh N, Bukachi E.</td>
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</tbody>
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