Himalayan Health Exchange:
A Model for Assessing Community Needs and Establishing a
Child-to-Child Hand Hygiene Curriculum

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Section 1: Introduction

The Zanskar Valley in the Himalayas of northern India is one of the most remote locations in the world, perched well above 10,000 feet in elevation and cut off by harsh weather for 8 months of the year. The villagers in this valley live in geographic and cultural isolation, with few of the amenities of modern life, including health care access and public health education and infrastructure. The Himalayan Health Exchange and its founder, Ravi Singh, are working to improve the health care access for people in the Zanskar Valley and other regions of the Himalayas. The burden of disease on this population provides evidence of a need for public health education in addition to improved health care access. This paper proposes a model which can be used to better assess the hygiene and overall health needs of the Zanskar Valley population, and to begin implementation of a plan seeking to reduce the burden of preventable infectious diseases through hand hygiene. This plan will use an approach based on the principles of Community-Based Participatory Research (CBPR). CBPR is a research framework in which community individuals and/or organizations are involved with all possible levels of the research and program planning. By increasing the active participation of the community in the research and planning, the subjective experience, including local resources and burdens of the community and environmental factors (ie. social or physical inequities) are better integrated into research outcomes and future programs.¹

The Development of the Himalayan Health Exchange

The Himalayan Health Exchange (HHE) is a health outreach program in the Indian Himalayas which evolved from the resources, ambitions, and work of its founder, Ravi Singh.²
organization provides an ideal foundation on which to create a public health needs assessment and program for the relatively inaccessible trans-Himalayan region of India. The existing program provides transportation to remote villages, interpreters, food, and housing for medical volunteers and program staff. In addition, Singh provides an established relationship with village leaders, regional and state government representatives, and medical networks. The mission of HHE is to “provide medical and dental care to the underserved people living in remote regions of the Indian Himalayas.” However HHE does not include a more general public health focus in its mission or activities, despite widespread needs in the patient population visited on the expeditions. A brief history of the organization below further explains this apt match between HHE and a public health endeavor in the Indian Himalayas.

Figure 1. Regions of the State of Jammu and Kashmir

Singh’s family is well-established in Shimla, a small influential city in the north Indian state of Himachal Pradesh. Coming of age in this setting nurtured an interest in the spectacular natural world around him which, when combined with his father’s entrepreneurial nature, led Singh to
begin organizing expeditions into the Himalayas. After being mistaken as “Dr. Ravi” for giving an ailing man ibuprofen and arranging a ride to a hospital, Singh was inspired to use the medical connections from his time in Atlanta, Georgia, along with his personal and family network in India, to organize medical expeditions into the far reaches of the Himalayas staffed by American medical students and physicians. The first trip in 1996 garnered so much enthusiasm from the local population seeking care, Singh’s team was overwhelmed. However in each subsequent year Singh improved and eventually expanded the program. He added dental teams, increased the size of the trips and the numbers of patients seen, and expanded geographically with eight medical trips into Himalayan regions currently including the Leh district of Ladakh, Kargil district of Ladakh, Himachal Pradesh, and Sikkim, (Figure 1) in addition to medical anthropology trips.2,3

With the expansion of HHE, Singh’s available resources to help the Himalayan population also grow. The expedition-generated profits (student participants pay for this structured elective experience) support a special needs school in Himachal Pradesh and an orphanage in Tabo, Spiti. In 2001 Singh started Project Heart, a program which began by funding education about early treatment for streptococcal pharyngitis and valve replacement for patients with progressing rheumatic heart disease, and now includes annual surgical trips to the Himalayas to perform the necessary valve replacements.3 Singh’s most recent project involves the creation of a foundation to build the Himalayan Health Center, a new hospital in Manali (northern Himachal Pradesh near Ladakh) to provide accessible medical care to the underserved people of the outer Himalayas. His ambitions reach far beyond these current projects, and include visions of building and staffing backcountry clinic outposts and establishing the existing hospital in Leh (capital of Ladakh) as an educational hospital with international students, residents, and attending physicians.2 An added
public health assessment and intervention fits in with Singh's other work as an essential piece of improving health through an ecological model, as described further in Section 4.

The primary focus of this project was to incorporate a public health element into the medical camps of Himalayan Health Exchange. Currently each trip takes about 20 medical or dental students, in addition to physician supervisors. Over the course of the 3-4 week trips the teams travel to different villages in a region of the Himalayas; setting up mobile health clinics for one to three days. Singh communicates with the state health department and local leaders to ensure the timing and care is coordinated with local health care systems and cultures. Most villages in each trip are visited annually and the team will often see the majority of the village residents in addition to individuals traveling hours or days by foot from nearby villages.²

During the average 3-4 week trip to Spiti, the students and physicians see approximately 1200 patients, though 1600-1800 patients generally attend the 12 total clinic days during the 4 week trip to the Zanskar Valley which is longer.³ At any given clinic, patients enter a triage tent/room first where their vital signs and a chief complaint are recorded. They then move to one of the medical tents where medical students complete a focused history and physical with the help of a translator. At each tent, a physician supervises 2-3 medical students. The nature of the care supplied at the clinic is determined primarily by patient demand and resources immediately available. The most common presenting problems are acute respiratory infections, vision problems, skin problems, and anemia. Also seen are minor traumas, diarrheal disease, and complications of chronic disease including hypertension and heart disease. Most ailments are handled with donated pharmaceuticals and supplies consisting primarily of vitamins, antibiotics, basic wound care supplies, eye glasses and a selection of chronic disease medications. In the case of emergencies transportation and appointments at the nearest hospitals are arranged.²
The established structure of the clinics, the population they draw, the human and material resources of HHE, and the ample free time Singh keeps in the schedule provide an excellent infrastructure for a needs assessment and program implementation. In general HHE participants do not gather data of any type, nor do they distribute any general public health information, including hygiene education.

Figure 2. States, Mountain Ranges, and Major Towns in Northern India
Zanskar Valley, Kargil District, Ladakh, India

Ladakh, often called “Little Tibet”, is the eastern region of the northernmost Indian State of Jammu and Kashmir. Jammu and Kashmir is situated directly north of Himachal Pradesh, and a region rich in culture, history, and geography. The Zanskar Valley resides between the Zanskar Range and the Greater Himalayan Range, in the southern portion of the Kargil District of Ladakh (see Figure 1 and 2). The treacherous geography and the harshness of the winter climate isolate Ladakh from India and the outside world for most of the year. Additionally a long history of contentious relations with neighbors to the west (Pakistan) and east (China, formerly Tibet) have yielded a unique cultural setting in addition to political and cultural divisions. These contextual factors unite to create a unique and diverse culture, about which very limited information presently exists.

Rationale for Community Assessment and Hand Hygiene Interventions in the Zanskar Valley

In developing countries, especially in the underserved regions, infectious diseases including diarrhea and acute respiratory infections continue to be leading causes of death. Rural Ladakh follows this pattern. Additionally, the World Health Organization’s 2004 list of top 10 causes of death in low-income countries lists lower respiratory infections and diarrheal diseases as 1st and 3rd respectively, jointly representing nearly 5 million deaths annually. Diarrheal diseases most commonly affect children, and those from lower socio-economic classes are disproportionately affected (36% of deaths in low-income countries versus 1% in high income countries). The 2005-6 Demographic Health Survey for India from illustrates this burden with reported under-5 child mortality rates for the poorest rural population of India at 100.9/1000 children under 5, and
parents reported that 9% of children in rural settings had diarrhea within 2 weeks of when the survey was conducted.10 While Jammu and Kashmir data showed mortality rates of 50.2/1000 children under 5, there is reason to believe the polled groups are not representative of the population in discussion in this survey. According to first-hand accounts, none of the villagers seen on the HHE expedition have access to either piped drinking water or electricity,2 whereas the reported household profile for rural Jammu and Kashmir includes 42.7% with access to piped drinking water and 90.4% with electricity.11 This results in significant health risks for the target population, and indicates that the surveyed population may not be fully representative of the Zanskar Valley population. The fresh spring alpine water sources unlikely to be contaminated by significant human or animal waste somewhat counter this absence of access to treated water.2

The above data highlights the importance of investment in understanding and mediating the causes of poor outcomes in India and specifically Jammu and Kashmir, but leaves many questions still about the Zanskar Valley. These remote villages do not have electricity, plumbing, or regular access to health care. From the limited data available about this region, the population suffers higher infant mortality rates and shorter life expectancy than most of the world and India,12 with childhood diseases dominated by diarrheal disease, respiratory infectious and skin diseases. These health problems, largely represent preventable infectious disease and can be attributed to “a high rate of infectious and water borne diseases, poor environmental sanitation and hygiene, unsatisfactory nutritional status, lack of knowledge about health, and an unsatisfactory health care delivery system”.13 This covers the spectrum of public health topics, and emphasizes the need for educational and eventually infrastructural interventions in the communities such as latrine or water source engineering or even staffed clinics. Additionally, as described above, the unique geographic and cultural position of these isolated communities
reinforces the need for a community-based approach. The lack of understanding about the causes of infant mortality and other persistently poor health outcomes in Ladakh has led to increased research in this area in recent decades. Many researches have concluded that more information is needed about rural Ladakh at the village and household level. Even in areas where health system infrastructure has improved, significant improvements in health status were not found, for example, increases in use of prenatal care and hospital births did not significantly improve birth outcomes.

**Hygiene-Based Curriculums**

For decades hygiene-based curriculums have been a staple of public health outreach in developed and developing countries alike. International organizations including the United Nations Children’s Fund (UNICEF), the International Water and Sanitation Center (IRC) and the World Health Organization (WHO) have an extensive history of continued investment in sanitation and hygiene projects, and a variety of manuals exist to help guide leaders in community participatory hygiene and sanitation programs. This emphasis derived primarily from strong scientific evidence for the relationship between improved hygiene and sanitation and decreased incidence of infectious diseases, particularly diarrheal disease and acute respiratory infections. These two manifestations of infectious disease represent a high burden of disease internationally despite the extensive knowledge available on minimizing their transmission through improved hygiene and sanitation.
Purpose of this Paper

The purpose of this paper is to outline a hygiene-oriented community assessment and program model for the villages of Zanskar Valley in the northern Indian Himalayas. To effectively explain the need for these measures, the paper will review existing data on the population and the proposed hygiene interventions.

Section 2: Literature Review

This section will review in greater detail the evidence for the burden of infectious disease present in Ladakh and specifically the Zanskar Valley populations. Further it will examine the effects of hygiene-based program interventions, with a focus on a child-centered peer-education approach. This includes addressing the current trends and evidence on Child-to-Child (CtC) programs for changing child and community behavior around public health issues.

Burden of Disease in Zanskar Valley, Ladakh Village Populations

Search Strategy

I performed a Pub Med search using the terms “Ladakh”, “Zanskar”, “Kargyak OR Kargiak OR Kargiakh”. This returned 50 articles after title and abstract review basing inclusion on relevance to native, non-tourist population, with population health-oriented articles. The results showed trends towards studies on infectious disease, pulmonary pathology (primarily due to indoor air pollution), and nutritional status, and only one article addressed general health measures, noting the most common causes of morbidity and mortality in infants and children. Expanding the Pub Med search to include terms encompassing other high altitude rural
communities (various Boolean combinations of “high altitude” “morbidity” “mortality” “rural” and “Andes”) did not yield further relevant results. An additional search of the Indian Medlar Centre, an India-based database of 38 Indian journals, using the term “Ladakh” yielded 3 results including 1 article meeting criteria for useful information on burden of disease information on Ladakh.

In addition to the database search, I searched on the World Health Organization (WHO) website, and the Demographic and Health Surveys (DHS) website. The WHO provided reports on global burden of disease, and burden of disease at national levels (though as the Introduction describes, the general Indian population is not representative of the rural Ladakh population). Search of the DHS website led to the three National Family Health Surveys of India. These surveys provide an overall picture of various health measures including child morbidity and mortality in India overall, as well as some breakdown by state, as outlined in previous data.

A search of the UNC library catalogue revealed the book of the published proceedings of The Fourth International Colloquium on Ladakh (1989) and Modern Ladakh: Anthropological Perspectives on Continuity and Change, both of which inform on cultural and historical backgrounds of Ladakh. Manual bibliographic searching also yielded no additional accessible and pertinent references. The Indian census website provided additional demographic information (http://www.censusindia.gov.in/).

Evidence for Burden of Disease in Rural Ladakh and Zanskar Valley

This extensive literature review reveals the scarcity of specific knowledge on the health risk factors and statistics for the rural populations of the outer Indian Himalayas and Ladakh, with almost no data available specific to the Zanskar region. As Rehman et al. reinforce “some efforts have been made to analyze the incidence of disease in [Jammu and Kashmir], but they have mostly
concentrated on the Kashmir Valley and Jammu region. Ladakh Division which differs from Jammu and Kashmir regions has been left out from such studies.  

In addition, with globalization and increased tourism, coupled with cultural and political changes in recent decades the gap between the influential urban elite and the rural farming and subsistence areas has widened. This gap results in research representation and resource allocation disparities within the state of Jammu and Kashmir, which can fuel "a substantial gap in mortality and disability" within the region. This reinforces the case for needs assessment and program plans focused on the Ladakh in general and the Zanskar Valley, as presented in section 1.3 of this paper.

Effect of Hand Washing Programs on Disease Burden

Search Strategy

A Pub Med search of "hand washing" OR "hand hygiene" yielded 1814 articles. To filter results and narrow to hand hygiene articles related to diarrhea, the primary disease burden the intervention seeks to mitigate, I narrowed the search to "hand washing" OR "hand hygiene" AND (diarrhea OR diarrhoea) limited to English language and reviews, meta-analysis, and randomized controlled trials. This yielded 18 articles including a Cochrane Database Systematic Review, "Hand washing for preventing diarrhoea". The same search replacing the diarrhea terms with "respiratory infection OR ARI" yielded 54 articles including a useful review with meta-analysis by Aiello et al. Manual bibliographic reviews and examining Pub Med related articles yielded two more useful articles, one connecting improved hygiene and infection reduction by Aiello and Larson, and another meta-analysis assessing effect of hand washing on diarrhea in the community by Curtis and Cairncross. Additionally adjusting the original search to include combinations of the terms "international" "developing nations" or "high altitude" yielded additional articles that
provide information on hand washing programs specific to regions or villages with notable similarities to those in Ladakh. Specifically, Stephen Luby and colleagues conducted a series of household level interventions in Patagonia,$^{28,31}$ and a joint publication on hand washing behaviors in Peru provide useful insight to both outcomes and barriers to improved outcomes through hygiene-centered programs.$^{32}$

In addition to establishing the efficacy of hand washing for prevention, the inaccessibility of soap in rural Ladakh necessitates establishing that rubbing agents including ash or dirt are roughly equivalent to soap. To assess the evidence available I conducted a Pub Med search on "hand washing" OR "hand hygiene" OR "handwashing AND (ash OR "rubbing agent*" OR dirt), which yielded 30 results, with two relevant articles by Hoque and colleagues.$^{33,34}$ Neither "related articles" on Pub Med nor manual bibliography searches uncovered any additional relevant articles.

**Effect of Hand Washing Programs on Infectious Disease Burden**

A 2002 Lancet systematic review by Allison Aiello and Elaine Larson reviews 53 studies (30 interventional, and 23 observational) on the relationship between hygiene and health. The reviewers conclude that better personal and environmental hygiene reduces the spread of infection, leading to a conclusion that "hygiene interventions other than infrastructure implementation are important for preventing infections."$^{35}$ This statement is further supported by the Curtis and Cairncross systematic review which focuses on the effect of hand washing on transmission of diarrhea in the community. They found that hand washing could decrease the risk of diarrhea by 46%, and estimated that approximately 1.1 million diarrhea-caused deaths could be averted by hand washing.$^{24}$ Most recently a Cochrane Systematic Review on "the effect of interventions to promote hand washing on diarrhoeal episodes in children and adults," found that
these interventions can reduce diarrhea by approximately one third, making the effect roughly equivalent to that of providing clean water in low income areas.\textsuperscript{21, 25}

In 1991 Hoque and Briend did a small randomized controlled trial in Bangladesh comparing the efficacy of various hand washing agents in Bangladesh with an outcome of estimated fecal hand contamination count. 20 women participated in the study, with each assigned over the course of 5 days to each arm of the trial: no hand washing (control), water only, ash, mud, and soap. The trial did not detect a significant difference in the various rubbing agents of ash, mud, and soap (due in part to the small size of the trial), but all three interventions yielded a significant improvement over no washing and washing with only water.\textsuperscript{34} Hoque followed this study five years later with a large two-part observational and experimental study that reinforced these findings. The experimental arm controlled for variation in hand washing procedures including rubbing frequency, type of water used, amount of water used, and drying location or technique, and again found that rubbing agents outperformed no rubbing agents in reduction of fecal count. Ash rubbing outperformed soil and soap, though this difference was not significant. Hoque et al. also found that more rubbing (at least 6 "rubbings"), rinsing with safer water, and drying in air or with a clean cloth all significantly decreased the total fecal coliform count on the subjects' hands.\textsuperscript{33}

Together these studies indicate that, even in the absence of improved infrastructure of clean water or latrines improvement, behavioral interventions focused on hand hygiene can have a significant impact on incidence of childhood and adult diarrheal disease and respiratory infections, with resultant decrease in mortality in these populations.

\textbf{Evidence for Child-to-Child Hygiene Interventions}

\textit{Search Strategy}
A PubMed search on “child to child” restricted to English returned 81 articles, 24 of which addressed Child-to-Child (CtC) approach behavioral interventions based on an initial abstract review. However, none of the returned articles are more recent than 1997. Of these 24 articles, 7 of them either were published in India or written about communities/programs in India. At least 3 of the described programs address hygiene. Unfortunately only one article is an intervention study, with mostly case studies or articles of recommendation. Examination of the “Related Articles” revealed no intervention studies or more recent articles. This absence of articles later than 1997 led to a concern that the CtC approach is in current use, but under another description without specific references within the title or text to “child to child”.

To attempt to identify unpublished materials and online organizations that promote the CtC approach, I performed a Google search on “child to child”. This led to the Child-to-Child website (www.childtochild.org) with links to 2 literature reviews for the CtC approach, one for pre-1995,36 and one for 1995-200737. The more recent review included 2 quantitative and 5 qualitative studies on the impact of CtC activities, 3 surveys, 2 meeting reports, 2 published articles on CtC approaches, 4 unpublished theses, and 5 Child-to-Child (organization) publications. Although the author did not specify his search strategy, the selection criteria specified greater than anecdotal accounts, publications from university, library borrowing systems, or the Child-to-Child Trust office, exclusion of training and trip reports and all publications before 1995. The older review summarizes a variety of small quantitative and qualitative reviews, only three (out of 11) of which I was able to locate via targeted PubMed searches.

A search of the UNC library catalog for “child to child” returned the book, Children as Partners for Health and thesis from 1987 entitled “Child to Child program to prevent and control diarrheal disease”. Additionally, the Google search along with review of website literature
recommendation and manual review of bibliography reveals a significant number of Case-Study oriented books on CtC Programs. I chose to use *Children as Partner for Health* because of its publication independent of the Child-to-Child Trust, a detailed explanation of the CtC history, philosophy and framework, and the inclusion of a variety of detailed case studies with a summary of lessons learned from them.

**Evidence for the Efficacy of the Child-to-Child approach**

CtC is an approach for health promotion and community development which evolved since its inception in 1978. The basic principles of the approach involve children’s participatory learning and empowerment to help change and better their communities.\(^{37,38}\) CtC will be described in greater detail in Section 4 below.

As evidenced in my own search results and the summary of Babul’s literature review above, there is very limited quantitative evaluation of CtC, and only slightly more qualitative evaluation.\(^{37,38}\) This paucity of evaluation can be attributed to an array of difficulties including the diversity of the programs implemented, variable social and environmental factors in a given program, diverse confounders in an increasingly global public health environment, and important project goals and benefits that may not be realized for a generation or more making outcome measurement difficult.\(^{38}\) In fact, one of the greatest strengths of the framework, the adaptability for various cultures and settings, creates the greatest barrier for effective large-scale review and analysis of its success. Despite this, reviews and case studies have attempted to give legitimacy to this approach by focusing on the expected intermediate markers for future health outcomes: knowledge, attitudes, and behaviors (KAB).

While noting the absence high quality controlled trials, the earlier Lansdown (1995) review summarizes a variety of evaluations of CtC work. All programs evaluating on student knowledge in
the targeted areas found quantitative evidence of improved knowledge. Improvement in health-related practices varied from one program to the next, with a program in Kenya showing vast improvements in vaccination rates (this project was then replicated), another estimating thousands of saved school absences in India (Joseph 1980 via Lansdown), while a third showed changed behavior in students and teachers in Uganda. The piecemeal nature of this review, combined with the qualitative nature of the evaluations makes final interpretation of results somewhat difficult. At the time of the review, there appeared to be a consensus among participants in CtC programs that it is a worthwhile approach. There also appeared to be adequate evidence that CtC approaches did increase the knowledge base for participant students, although the magnitude of effect on community behavior needs further investigation.

The second CtC Trust commissioned review, by Farah Babul (2007), only located 2 quantitative evaluations of CtC programs, neither of which were available via Pub Med or Google Scholar. The first study examines teaching styles without looking at effectiveness of CtC versus control or other strategies. The second study seeks to evaluate the impact of a Zanzibar CtC program on community KAB. The program and study involved 44 schools over a 5 year period. Health knowledge and habits improved, though changes in attitudes changes were less clear. Schools with the CtC program had higher KAB scores than control schools, in addition to a decrease in absenteeism. Community health knowledge also improved, although it was not clear whether outside factors confounded this result. Of potential additional use, teachers felt teaching through “drama” was best-received by the students. This study also noted some shortcomings and associated future recommendations, including a preference for formal integration into the school system, a more teacher-friendly project/curriculum, and better outreach to the community at large (Komba 1996 via Babul 2007).
Three of the five qualitative studies reviewed by Babul translate well to the CtC hygiene project proposed for Ladakh. The review of these studies reinforced positive results already mentioned above. A project in Pakistan found improvement in health-promoting environments in the school setting, student initiated health behaviors, and teacher confidence and health knowledge (Carnegie and Khamis, 2002 via Babul 2007). Another in Tajikistan which focused on hygiene related education found that they "successfully motivated teachers to teach health" and positively affected children's knowledge, attitudes, and behaviors (Smith, 2001 via Babul 2007).

Babul's last and most intensive qualitative review discussed a 1997 evaluation of a CtC program in Nepal. This study had the strongest evidence for improved health knowledge, and evidence of attitude and behavioral changes to the point of children showing leadership in performing "health checks" and maintaining a clean school setting. Interviews provided qualitative evidence of decreased infection rates due to improved hygiene, along with improved attendance. Children expressed increased confidence about discussing health with their families, and families reflected this confidence in their perception of their children's capabilities. However, similar to the Komba study reviewed above, the authors noted that improved teacher investment was essential for maximizing the effectiveness of the intervention (Zaveri et al., 1997 via Babul 2007).  

A third piece of Babul's review summarizes results of the Survey of Child-to-Child activities Worldwide offering persuasive data on the broad reach and support of the CtC approach. Although far from comprehensive for worldwide CtC projects, the survey compiles information from 90 groups. The resulting data highlight that most CtC programs focus on water and sanitation, fueled by a recent sharp growth in interest in these topics. Agencies that increasingly emphasize the CtC approach with their support and outreach include Plan International, Water4People, USAID, Save the Children, Water Aid, Bernard Van Leer, Health Link, Cafod, and
Although few of the above studies look specifically at hand hygiene, many CTC-based hygiene programs exist, most commonly based out of schools. For this year's Global Hand washing day coming in October, UNICEF is focusing specifically on the efforts and successes of CTC type programs, noting "the potential of children as agents of handwashing behavior change", and citing successful programs in Nigeria, Indonesia, and Malawi.42

Pridmore and Stephens reviewed many of the same studies as Lansdown and Babul, again discussing the inadequacy of quantitative data for reasons of feasibility, while reinforcing the evidence for effectiveness based on intermediate markers. They reference a qualitative and quantitative review of process and impact sponsored by the Aga Khan Foundation in India in 1993 (Evans, not available via AKF website, Pub Med, Google Scholar, or library catalogue) as "the most comprehensive evaluation of Child-to-Child projects to date."38 This Evans review concludes Child-to-Child was effective and sustainable, as well as recommending program elements to increase effectiveness.

The majority of the Pridmore and Stephens book consists of critical case studies of CTC projects around the world including Nepal, Mexico, the United Kingdom, Botswana, Uganda, and Ghana. From this broad perspective, built on a strong foundation of knowledge about the CTC approach, the authors articulate a series of observations and implications for future CTC implementers. First, understanding of social, cultural and environmental contexts is essential for appropriate adaptation of the specific program, and "robust planning frameworks" will "increase the relevance and effectiveness of health education" used in a participatory community approach.38 This includes recognition of the existing role children play in the social structure of the community, and adjusting the expectations of child roles and responsibilities to meet that norm. In some cases where children have particularly low status, the "child rights" foundation of
the CtC philosophy might need specific targeting within the community alongside the educational empowerment within the program itself. Involvement of other influential community members, including parents and teachers, initiates this process of bringing to the community to the same page with these goals. Pridmore and Stephens discuss the implementation of and advocacy for CtC programs and an impetus for larger educational policy change and curriculum reform. Though it is beyond the immediate scope of this program plan, especially prior to the community assessment conducting in concert with the program implementation, this vision is very relevant for the future of the larger rural Ladakhi community.

Conclusion

In summary, little quantitative data is available specific to our target population. As low-income, rural villages with poor access or absence of health facilities, piped water sources, sewage systems, electricity, indoor ventilation/chimneys, among other risk factors, they are likely to have a high burden of diarrheal and respiratory diseases. The limited literature available supports this assumption, but local community assessments would be beneficial to reinforce it and better focus future programs. This infectious disease burden disproportionately affects child morbidity and mortality, and could be partially mitigated with simple educational and behavioral change interventions. The literature shows that hand washing successfully decreases the morbidity and mortality of these diseases, and interventions targeting hand hygiene education and behavioral change are an effective means of increasing adequate hand hygiene practices. While the evidence is limited for the long term effectiveness of CtC programs for hygiene interventions, intermediate outcomes show strong results with well-planned programs, and many major organizations such as UNICEF invest heavily in these programs.
Section 3: Community Assessment

Community Context Overview

The villages of the Zanskar Valley lie in a geographically, culturally, and politically isolated region. Most of the limited study of Northern Indian Himalayans does not focus on the people of the Zanskar Valley, nor do most government and NGO programs. The mix of religion and culture combined with anomalies that often develop in geographically isolated villages highlights the necessity of a community assessment to understand current practices and motivation behind current practices in order to facilitate effective programs.

Geography

The Himalayan Mountains form the highest mountain range on earth, containing 9 of the 10 highest peaks in the world, and separating the Indian subcontinent from the Tibetan Plateau. The Himalayas are generally divided into three bands based on topography: the Sub-Himalayas, the Middle/Inner Himalayas, and the Great Himalayas, in order of increasing overall elevation as you travel northeast away from the Gangetic Plan (Indian subcontinent). Due to the harshness of the climate and geography, the Great Himalayas, with peaks averaging over 6,100 meters (20,000 ft), remains one of the few truly isolated areas left in the world.43 Ladakh, lying primarily north of the Great Himalayan Range, sits on the highest plateau of Jammu and Kashmir, cut-off from the outside world for half the year due to harsh winter conditions and impassible mountainous terrain.

The Zanskar Valley is located in the Kargil district of western Ladakh, in the trough between the Zanskar Range and the Greater Himalayas. The Greater Himalayas on the southern side of the Zanskar Valley isolate it from the rest of India.43 It is the most isolated of the trans-Himalayan valleys, with access via the Pensi-la pass (4400 meters/14,436 ft) open only June to mid-October.
due to extremely heavy snowfall, and no paved roads. Despite the short growing season of approximately 4 months, these villages situated at an elevation over 10,000 feet are agricultural communities, growing barley, wheat, peas, and maintaining livestock. The highest settlements struggle to even grow these hardy crops. Water supply, coming from snow and glacier melt, determines the size of the villages.

Not surprisingly, these geographic factors are most influential in forming the context for this community intervention. The geography shapes all other contextual factors in one way or another: The harshest winters in the world impose time constraints for population study and interventions, unless the research team has the resources and invitation to stay in the villages through the winter. The limited health and travel infrastructure possible in the land of 20,000 foot+ peaks limits health care access. The restricted growing season combined with minimal trading capabilities with the outside world limits nutritional intake and diversity. Limited interaction with outside cultures maintains local traditions, cultures, and socioeconomics. While all of these geography-related factors are important, I will highlight a few of particular importance below, examining other factors in addition to geography.

The political and cultural environment

Geography and low population density play major roles in this relative neglect, however culture and the related politics are also significant. Ladakh occupies the eastern region of the state of Jammu and Kashmir, a state notorious for its disputed status between India and Pakistan since the two nations achieved independence in 1947s (see Figure 3). The western Kashmir region and the disputed Northern Areas (Baltistan) received a great deal of attention due to their crucial location for ancient trade routes connecting Pakistan and China (including what is now the highest paved road in the world, the Karakoram Highway). Additionally, noting Ladakh’s cultural
and historical ties to Tibet, China began disputing the eastern border in the 1960's. For decades much of eastern Ladakh was off-limits due to the border dispute China around the Aksai Chin region. Despite these political tensions maintaining Ladakh's strategic importance for India it left Ladakh in political neglect as far as population research and programs.

Figure 3. Disputed Areas of Jammu and Kashmir

Eventually, recognizing the need for investment in this area, the Indian government built 2 roads and an airport in Leh. Eventually Ladakh was opened to tourism, which has become an increasingly important part of the summer economy. Currently the brief tourist season provides the only significant contact outside their communities, and has brought little benefit. The influx of tourist resources has the potential to be accompanied by infectious diseases from non-alpine settings. These infectious agents from more densely populated areas with less clean water sources could threaten to raise the burden of diseases transmitted by poor hygiene practices.
In addition to these national political issues, Ladakh’s disputed borders result in a unique combination of cultural and genetic mixing and cultural divisions. Over a millennium ago Tibetan expansion reached into the area, and today the people bear more physical and cultural resemblance to Tibetans than the Indians to the south. As shown in Figure 4, Ladakhis primarily practice Tibetan Buddhism (the dark orange is the Leh district of Ladakh). Influence from the western area bordering Pakistan in more recent centuries has resulted in pockets of Islam, particularly in the more western Kargil district of Ladakh. This can be seen in the circled Kargil district on the figure, which includes the Zanskar Valley in the southern portion where the population is mixed Tibetan Buddhist and Muslim. Due to its location central in the state of Jammu and Kashmir, Kargil, including the Zanskar Valley experience both eastern Tibetan Buddhist and western Muslim Shia influence. Understanding this cultural context at a village level will be important for effective communication and understanding of health practices. For example, traditional Tibetan medicine is common throughout Ladakh, even in areas with biomedical access. However Ladakhi health practices tend to mix various medical approaches, in what Bhasin describes as “medical pluralism [including] Lamaism, Shamanism, scholarly Amchi medicine, and allopathy.” Many of the resulting widespread beliefs include supernatural causes of disease with resulting “demand for magico-religious remedies.”

Despite this mixing of culture in practices around health, the religious cultural divide is strong. The state government of Kashmir governs Ladakh on certain areas, but as of 1995 the Ladakh Autonomous Hill Development Council governs certain elements of the regions affairs separate (including health care) from the state of Kashmir. The Development Council was created in response to Ladakhi complaints of political neglect due to cultural and religious difference from predominantly Muslim Kashmir.
This political history sets the background for the current public health state in Zanskar Valley. While the government is not opposed to interventions in this area, government initiated public health measures have been sparse historically as a part of the described "neglect." As a result, the baseline public health education and practices of the population are poorly known; a status which likely hides costly gaps in human health measures. These trends appear to be changing as increased tourism raises international interest in Zanskar and Ladakh. Correspondingly, Singh sees that the State governments are willing to support his work. On a more local level, Singh reports that his teams are warmly welcomed every year. However, the HHE team does not have a strong sense of the communities' perceptions of their greatest health needs. This limitation reinforces the need for a community assessment parallel to the initial program plan.

Figure 4. Religions in Jammu and Kashmir, Kargil District of Ladakh circled.49
Health system factors

The limited health-related resources in the region can be seen in the sparse health infrastructure accessible to the population. The only urban area of Ladakh with a major hospital, Leh, has 150 beds ill-equipped to serve the greater populations of the region, measured at 236,539 in the 2001 Census (approximately 119,000 in Kargil District and 117,000 in Leh District). The geographic isolation provides a larger impediment to access than a bed shortage with a primarily rural population living many days travel away from the hospitals, frequently in villages with no vehicle access. Only 13% of the population lives in “urban” areas (Kargil pop 10,657 and Leh pop. 28,639). Even villages with roads are only accessible during the 4-6 summer months. There are also community-based resources scattered throughout Ladakh, with the 2001 census recording 104 medical facilities in Kargil and 105 in Leh district. However the condition of the facilities, not to mention staffing and maintaining supplies for basic medical services is difficult to know, and coordination and oversight is limited at best. Even with staff and supplies, most villagers are still days away from health care on foot trails.

Time Constraints

This hygiene model must operate with an understanding of a number of time constraints. First and most prominent is the time limitations imposed by the above-discussed extreme climate and geography. When the roads close and travel becomes impossible at the end of the summer, the changes in the village culture and daily life in Ladakh and the Zanskar Valley are as extreme as the weather. Although little is known about the details of life in the colder portion of the year, it is likely that most activities move indoors, eating patterns change, hygiene behaviors change, and interaction with other people and livestock is restrained to closer quarters. Without access to this information, an effective program targeting this population during the winter months simply is not
feasible. Because the Ladakhi resources, lifestyle, and challenges of the winter are completely different than the summer for, a winter program plan requires different strategies from non-winter programs.

**HHE as a program collaborator**

In addition to the climate-imposed time frame, the time frame is limited to the length of the HHE expeditions. In general, four to five villages will be visited during the expedition, with two to three days at each village. Any assessment and program will have to be initiated, adjusted, and completed in that time frame. Because of this restrictive time window, the community assessment and program plan would need to be carried out concurrently, adjusting appropriately as further information is available. The same villages will be visited in future years, allowing for long-term evaluation and continued program development. The opportunity to return annually via HHE-sponsored trips somewhat mitigates this negative. If the program is successful in implementation, outcomes, and if Ravi Singh is convinced of its value as a long-term commitment, the larger existing HHE program may provide a potential framework for realistic future expansion.

**Theory and Rationale for Community Based Participatory Research (CBPR)**

A program plan should be based on extensive knowledge of the targeted population characteristics, the relevant environmental factors, and the population ideas and preferences. As described above, non-residents have limited accessibility to that information for the small communities of the Zanskar Valley. Research, or a community assessment, serves to fill in those gaps, thus informing immediate program implementation and future planning.
In the recent past, the predominant research construct in the public health community has been trending away from the positivist view. This view approaches public health as a simplistic cause and effect relationship in which an objective reality can be identified and then manipulated to improve conditions and outcomes. More recently, researchers increasingly emphasize that “individuals are embedded within social, political, and economic systems that shape behaviors and access to resources necessary to maintain health”. (Israel) Further, these systems represent subjective realities within a complex environment that positivist approaches to research do not adequately address. Practitioners struggle between gaining knowledge that has legitimacy in the global public health community (typified by the randomized controlled trial) and knowledge that effectively facilitates action and change within the target community based on that particularly community reality. This struggle has produced participatory research approaches, including those described as community based participatory research (CBPR). CBPR specifically arose in response to researcher and practitioner calls for more “integration of research and practice... increased attention to the complex issues that compromise the health of people living in marginalized communities... and increased sensitivity to and competence in working within diverse cultures.”

While these principles provide a rationale for any community-level research, characteristics specific to the Zanskar Valley communities and HHE make a CBPR strategy essential to a successful community assessment and program plan. In addition to the complexity described in the context section, the extreme isolation of the Zanskar Valley villages from western culture and science ensures a sizable gap in the communities’ subjective realities relative to those of the researchers and HHE participants. While objective data could be effectively obtained using a more scientifically rigorous study design, the utility of that data for program implementation would be limited by the villagers’ knowledge and attitudes about the subject matter. Using CBPR, we will
create theory “grounded in social experience,” which will result in validation of the villagers’ subjective experience and thus be more effective as a foundation for a program plan. The practical need to do the community assessment alongside the program implementation further supports the use of CBPR, which allows more natural integration of research and practice than other research methods more removed from the population. The core tenets of CBPR also include community involvement in research and program design and implementation. The implementation of research and program plan described here carefully includes both children and village leaders in their process. The unavoidable geographic separation during planning, along with the limited time in the villages during the HHE expedition unfortunately limits the level of ideal villager participation in the research and program planning.

Specifically, we will use multiple methods of participatory rural appraisal (PRA), a type of CBPR used for a variety of rapid information gathering in rural communities. The particular techniques of mapping and seasonal diagramming originated from what Robert Chambers describes as agroecosystem analysis, which focuses on the overlap of system or ecological thinking with patterns in space, time, relationships, or decisions. Chambers goes on to reflect that “evidence to date shows high validity and reliability of information shared by local people through PRA compared with data from more traditional methods.”

Study Limitations

As in any research, there is room for bias in these methods. It is possible that researcher bias will guide the questions, answers and interpretation of answers. The PRA methods are designed to allow the participants to share their own ideas. I have attempted to design each PRA assessment so as to allow their perspective to be voiced before pursuing any particular topics.
driven by my research interests. Additionally, my choice of survey questions creates an implicit value and focus on some issues above others. Because time and resources do not allow the use of more comprehensive surveys, I believe this is unavoidable. In order to mitigate this bias, I will use questions pulled directly from existing national and internationally used surveys (see Section 3-4: surveys).

The language barrier potentially poses significant problems for this research. Singh has assured me that his best interpreters will be available during non-clinic hours (clinics are in the afternoon), however my inability as the researcher to speak Hindi or the local dialect prohibits me from knowing whether the interpreter is creating bias in the translation of either the questions or the responses. While there is not time or venue for a formal training, I will have a discussion with all potential interpreters before survey distribution about the importance of precise and neutral translation. Additionally in the case of villagers literate in Hindi, there will be a Hindi survey available.

**Study Methods**

The primary methods involved will be household surveys and PRA using village mapping and seasonal diagramming. This combines qualitative and quantitative methods creating a body of information to inform the appropriateness of the concurrent project implementation, while establishing baseline quantitative data and knowledge on the community’s hygiene, water sanitation, and health status for future evaluation. The PRA methods will gather both quantitative and qualitative data, in addition to creating a sense of community investment in the research and program by involving the community in the research gathering and analysis. The surveys, which can be conducted in concert with the PRA methods, will provide quantitative data from a
convenience sample of village households. The PRA methods will provide a spectrum of information from quantitative to qualitative, thus offering immediate program implementation benefits, offering needed insight about seasonal effects on health and resources, providing a map with dated information on village resources, demographics, and health data, and generating community-based priorities and analysis.\textsuperscript{54}

Each method is described below and listed in Table 1, including the participants, resources, and type of information gathered. For the PRA methods involving work with particular people including the school children, the HHE staff arriving ahead of the team will ask if this is permissible.

**Village Mapping with Transect Walks**

Though village mapping and transect walks are two separate PRA strategies, they work hand in hand. A village map is exactly what its name describes, a map of a village drawn by its residents depicting locations and resources they find important, in addition to researcher identified priorities (ideally these areas overlap). Transect walks offer supplemental information for the village map, and involve walking the village with a few individuals and discussing the map with reference to health, resources, and village priorities or problems.\textsuperscript{54}

Using the PRA method of a village map includes identifying who draws the map, how, and what is on it. Ideally this will include men and women playing differing roles in the community (ie. chief, teacher, farmer), however due to time and resource constraints, incorporating this activity into the program with the school children will be most efficient. With the help of the teacher and interpreter, I will ask them to draw a map of their village, labeling on it what they consider the most important locations and resources. Once they have done this, I will ask them to additionally label locations important to our study and program objectives: Homes with or without latrines, water sources, and homes where children have had severe or deadly diarrheal disease. I will
request 1-2 hours with a few individuals, ideally the village chief or teachers in the school, to participate in a transect walk after the lesson or the following morning. This exercise allows for further clarification on village culture and resources, continued conversation on details of the map (often correcting misunderstandings), and is particularly apt for exploring the community’s perceived concerns, prioritized resources, and health problems. Additionally specific questions related to seasonal diagramming (see below) are easily incorporated into this exercise.54

The flexibility of this method is its greatest strength. If the village is relatively small, we can provide paper and pencil to draw. If the village is larger, or the participants prefer it, they can just draw the map on the ground (and I will transcribe it). Anyone can help create the village map, from the school children, to the teacher, to the village chief, which may prove a useful fact for actual execution of the study. The end result includes both a map with useful quantitative information on it, but also a conversation with the map drawer(s) providing useful qualitative information about the values, resources, and problems in the village.54

Seasonal Diagramming

As outlined extensively in the introduction and the program context section, the extreme winter in Zanskar shapes a great deal of its culture as well as providing or withholding the people’s life-giving resources. Seasonal diagramming is another PRA method which seeks to inform outsiders about the variation in resources and lifestyle over the course of the year. The transect walks will provide a minimum of seasonal diagramming via questions during the village tour regarding issues such as seasonal variation in water sites of water availability, growing and harvest season, and times of years when health practices or illness burden changes. A more complete seasonal diagram involves making a list of the months of the year (or if they operate under a different calendar, use theirs), and asking specific questions about each month or season. This can
be incorporated into the program plan as a student activity, or if time is short in the classroom setting can be done with adult village members.54

Like the village mapping and transect walks, this will provide a combination of quantitative and qualitative data through factual information obtained, in addition to the knowledge gained through conversation necessary in the process of creating the diagram.

**Surveys**

A brief survey will be used to provide a quantitative data supplement the PRA strategies. There will be two versions of the survey, one to obtain household data, and the other to obtain village data. Both will focus on a combination of demographic information (household number, occupation, education level, etc.) and health-related information (water sources, latrines, fuel sources, household illness, etc.). All questions will be pulled from existing surveys in common use, resulting in a higher quality and more replicable survey. A method of convenience sampling will be used to distribute surveys. Available village leaders including chiefs and teachers will be asked to answer the village survey. Because there are not enough interpreters to staff the medical clinic and assist in survey translation at the same time, during the afternoon clinics we will ask for volunteers to return the following morning to fill out surveys.

The Demographic and Health Surveys (DHS) project, funded primarily by USAID and the WHO, keeps its Key Indicator Survey (KIS) available on the public domain. These surveys were “designed to help meet monitoring and evaluation needs of programs involved in population and health activities in developing countries, especially to produce data for small areas.” They are meant to be “short and relatively simple, but also to be able to produce indicators comparable to those from a nationally representative DHS.”55

both contain questions relevant to our study. Because these questions are deliberately comparable to DHS surveys used in India and over 200 other countries, data obtained through these KIS questions can be compared to national and international statistics published by the MEASURE DHS project.\textsuperscript{10,55}

The Ministry of Health and Family Welfare (MOHFW), Government of India (Gol), directed the International Institute for Population Sciences (IIPS) to conduct a variety of surveys over the past two decades, beginning with the National Family Health Survey. In 2005-6 they completed the NFHS-3, which is a household survey intended to provide estimates of population, nutrition, and health characteristics based on individual interviews.\textsuperscript{10} Many of these questions are similar to those found in the KIS surveys discussed above. The publication of the NFHS data includes national and state breakdown, again providing for good comparison of the data obtained during the assessment.

The MOHFW also sponsors, with funding from a variety of international aid groups, the District Level Household and Facility Survey (DLHS), which began in 1997 and just completed its third round. This survey focuses on reproductive and child health, and attempts to assess “utilization of services provided by government health care facilities”, the quality of these services, and “important indicators on maternal and child health.”\textsuperscript{56} These surveys go into more detail than the KIS and NFHS on issues surrounding child health and the village and household sanitation that might affect adult and child health. Additionally these surveys are in both Hindi and English. For this reason, when questions overlap between these surveys and the NFHS or KIS, we will use the DLHS question to minimize the difficulty of translation. All of these surveys are included in the Appendices.
### Section 4: School Hygiene Program Plan

#### Program Context

This hygiene education program model, along with the community assessment implemented in parallel, is designed to be completed as an arm of the existing HHE expedition to the Zanskar Valley each August. As seen in the above literature review, public health and medical professionals agree on the utility of hand hygiene programs to improve health. There have been numerous NGO and government efforts to improve hygiene throughout India. However, similar to the problem of limited data or research on the populations of the Zanskar Valley and Ladakh, these regions have benefited from few public health oriented programs. The relevant context for the program is outlined in detail in section 3.1 (Community Context Overview).

Working within the existing HHE structure provides both strengths and weaknesses in executing the assessment, program, and eventually the evaluation. The strengths, as outlined in section 1.1 (HHE) above, come in the form of practical resources including political networking, transportation and living resources, human resources, funding, and an established relationship
with the communities. The primary drawback of this structure is the limited time available for the assessment and intervention as described above in section 3-1 (HHE as collaborator).

**Prioritizing Program Issues**

The international community prioritizes minimization of infectious disease transmission, and has for decades now. At the 2000 Millennium Declaration 189 Heads of State government set eight Development Goals providing an important framework for prioritizing international health efforts. Number four declared the need to improve child mortality. The best strategy for this varies greatly from state to state, though in many developing countries hygiene is a key contributor. The WHO’s Healthy Villages Report, a guide for improving village community health, dedicates two chapters to hygiene. This focus is not surprising as diarrheal diseases incur high levels of morbidity and mortality among children in developing nations as do acute respiratory infections. WHO lists lower respiratory infections and diarrheal disease as two out of three of the top 10 causes of death in low income countries in 2004. Good hand hygiene is known to decrease incidence of both disease types. NGOs and governments frequently collaborate to address this priority, addressing infrastructure through improved water supply and sewage disposal, and behavior change through hygiene education. To reinforce this growing global consensus on the importance of hand washing, in 2008 a Cochrane Systematic Review on hand washing for diarrhea prevention concluded that “interventions promoting hand washing can reduce diarrhea episodes by about one-third.”

Over the past 15 years the Ministry of Health and Family Welfare of India has funded three nationwide surveys called the National Family Health Survey (NFHS), which “provides state and national information for India on fertility, infant and child mortality, the practice of family planning, maternal and child health, reproductive health, nutrition, anaemia, utilization and quality of health
and family planning services”. Comparison of the three surveys reveals decreasing child mortality, with the most recent (2005-6) under-five mortality rates at 74/1000 live births, compared to the rate of 8/1000 in the United States. The NFHS-3 for Jammu and Kashmir, which includes the Zanskar Valley, shows a remarkable in infant mortality since NFHS-2, from 67 to 46 deaths per 1000 births among rural surveyed households; however the cause of this improvement is unclear. These statistics also may not be representative of the rural Kargil District population (which includes Zanskar Valley) population, which represents less than 1% of the Jammu and Kashmir population (India Census website). Additionally, in the surveyed rural households 42.7% used piped drinking water, and 90.4% have electricity. None of the targeted villages in the Zanskar Valley have either of these public health assets. While this data and these improvements show the state and national prioritization of these issues, Zanskar Valley is neglected. A 1994 (4 years before the NFHS-2) study conducted in the city of Leh estimated infant mortality at between 117 and 182 infants/1000 live births. The reason for this large discrepancy between the 1994 study and the NFHS survey is not clear, but only strengthens the case for targeting this region where reliable data is scarce. Depending on the season, in the Zanskar Valley, infant mortality is primarily caused by acute respiratory infections (winter) or diarrheal disease (summer). Improved hand hygiene would reduce both of these disease burdens, based on the above described studies.

Although hand hygiene and sanitation are clearly national and international priorities, local priorities are harder to identify because of the remote location and few previous studies on the population. The community assessment with interviewing and village mapping seeks to address this gap in knowledge in order to guide further program development.
Knowing the importance of prioritizing hand hygiene medically and politically, the most realistic and effective program must then be identified. Our program targets school-aged children with a once annual education and behavior focused intervention on hand hygiene. A huge number of evidence-based hand hygiene programs exist. That said, after extensive searching, I have not found programs in settings which mimic the Zanskar Valley during the HHE trips. The combination of extreme weather conditions, isolation, very limited water supply, a necessarily short annual duration of the intervention, and limited data on current community practices creates a relatively unique setting for this type of intervention.

Programs for hand washing have focused on children in a great variety of settings. The consistent components of these programs, including the Nali Kali (Joy of Learning) and Life Skills lesson plans, combine education on the need for hand hygiene and the situations in which it is most important, interactive demonstrations of proper hand washing techniques, and empowerment of the children to help their friends and families have better hand hygiene. For example, a randomized controlled trial in China demonstrated that a hand washing promotion program in rural schools with knowledgeable teachers, an encouraging environment, and an interactive demonstration session resulted in a 40% decrease in absenteeism from school, thought to be due to decreased infectious disease transmission. Another child-to-child approach program in Madagascar focused on increasing knowledge about poor hygiene and disease occurrence. The program saw some influences in the health behaviors of both adults and children. Additional successful studies include extensive work in Pakistan by Luby and colleagues. Their work notes decreased diarrheal disease in infants due to the protection from family members improving hand hygiene.
While all of the described studies present a strong case for prioritizing hand hygiene in individuals and a community, the program priorities must keep an eye towards available resources. Most studies are done with soap and water as cleaning materials, but soap is unavailable in the villages of Zanskar Valley. However, other studies have shown that rubbing ash in place of soap does not significantly decrease the efficacy of hand washing. This strategy will also be essential to the success of our intervention.

Program Theory

This program seeks to change community-wide behavior, starting with children, using a health belief model approach. The health belief model targets individuals and addresses the topic, hand hygiene in this case, in a manner built to build readiness to act before asking for actual behavior change. Through interactive education, this framework identifies an individual’s perception of the risk of not washing hands and the health behavior (hand washing) being encouraged. This includes how susceptible the child believes she is to the adverse effects of not hand washing, how severe she believes those effects are, what benefits may come from better hand hygiene, and what barriers exist for her to prevent this change. Using these constructs to communicate with the children also helps the program teacher understand their readiness for change, and thus guides the program presentation, allowing it to evolve with the setting and the population. This model also involves cues to action (ie. after defecation, or before eating) and self-efficacy constructs which engage the children in planning specific strategies that will encourage the behavior change, and reinforce their confidence in their ability to take action. In this case, that action is both changing their own hand hygiene behavior, and helping their family to learn better hygiene.
Child-to-child is a type of peer education, and as such follows a variety of theories building on the social interaction piece of education and behavior change. Initially explore by Bandura, the social learning theory states that as a part of each other’s environment and as models of behavior, people cause behavioral change in each other. In recognizing this general relationship and the individual values and behaviors in a group, this influence can be used as a resource to elicit behavioral changes.\textsuperscript{65, 66} Using this idea, if a group of children begin to regularly wash their hands, other children are likely to follow. Additionally family members at home may also follow. The Theory of Reasoned Action reinforces the social learning theory, noting that an individual’s perception of social norms and priorities influences behavioral decisions.\textsuperscript{66} So as more individuals begin to wash their hands, the perception of hand washing may change from something novel or entertaining, to a social norm, thus making not doing it a frowned upon behavior.

Both of the previously stated theories, must start with empowerment of the individuals within a group as described in the Theory of Participatory Education.\textsuperscript{66} This theory is particularly relevant in health-oriented peer education due to its assertion that participatory education engenders horizontal discussion about community problems and solutions, negating the powerlessness that created previous barriers to change.\textsuperscript{66} This hygiene program works with the students, encouraging them to understand the risks of poor hygiene and come up with their own ideas of how to improve hygiene at their school and their own homes, thus empowering them to take ownership and share their thoughts.

While this project has an apparently narrow focus, with a largely individually targeted behavior change, taken within the larger context of HHE and Singh’s current activities and planned future activities, an ecological model applies. Ecological models approach public health issues from multiple levels. While the hand hygiene intervention works on an individual or
subpopulation level, it is built to be integrated into the larger efforts to improve health for the
Zanskar Valley inhabitants. Singh's efforts at education, improved acute care access, and
improved general health care access through new permanent facilities achieves a multiple-level
approach addressing the individual, community and healthcare system. The community
assessment seeks to continue to identify areas that will complement the existing public health
efforts and future plans, filling in weaker links in the ecological framework.67

Goals and Objectives

Goal 1: Improve hand hygiene and sanitation conditions in the communities of the Zanskar Valley
of the Indian Himalayas over the course of 3 day HHE visits.

Objectives:

1. Within 3 days, at least 50% of children in the village grade school will express improved
knowledge of the benefits of improved individual and home sanitation and hygiene.

2. Within 3 days, at least 75% of children in the village grade school will exhibit improved
understanding of appropriate hand washing techniques and key times to practice hand
washing.

3. Within 3 days, at least 25% of children will feel empowered to use their new knowledge
and skills to improve hygiene in their homes, as exhibited by reported behavior changes in
their home, including hand washing and discussion with family members.

4. Within 3 days, 10% of community assessment participants involved will report ideas of
how they can improve hygiene and sanitation in the community.

5. Within 2 months after completion of the expedition, a sustainability plan will be developed
for maintaining program goals and objectives through future HHE work.

6. 1 year after program implementation, school hand washing knowledge, attitudes, and
behaviors maintain improvement above baseline levels for 25% of students participating in
the previous year's program.

These goals and objectives are intended to work in concert to create an overall long term
impact of decreased morbidity and mortality due to infectious disease, specifically diarrhea.
Logic Model

**Goal:** Improve hygiene knowledge attitudes and behaviors (KAB) of students villages of the Zanskar Valley

<table>
<thead>
<tr>
<th>Program Action – Logic Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inputs</strong></td>
</tr>
<tr>
<td>HHE Staff: Directors, Translators</td>
</tr>
<tr>
<td>Volunteers: Medical &amp; Public Health Students</td>
</tr>
<tr>
<td>Funding from HHE</td>
</tr>
<tr>
<td>Research: Surveys, Literature Reviews</td>
</tr>
<tr>
<td>Lesson Materials: Nali Kali and Life Skills Lesson Plans</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Program Implementation**

This program plan includes interactive classroom-based educational activities that incorporate elements of the community assessment described above. These activities will be targeted at the available student population at each village, with an expected age range of 6-15 years old. First priority will be hand washing activities described in the International Water and Sanitation Centre (IRC) curriculums. Additional activities will depend on the community priorities as found in the concurrent community assessment. Implementation of this school hygiene
program will be shaped by the itinerary of the HHE expedition, the characteristics and resources of the population in the villages visited, and the teaching strategies presented in the IRC's Life Skills and Nali Kali curricula. The plan intends to reduce improve knowledge, attitudes, and behaviors related to hand hygiene and overall individual and community sanitation in order to decrease related infectious disease morbidity and mortality long term.

The resources provided as a standard part of the HHE expedition provide for basic infrastructure necessary in program implementation. The HHE staff includes drivers, cooks, and interpreters, who will provide the basic living needs for volunteers who drive and trek to the different clinic sites. Singh offered the staffed interpreters for assistance in the programs as necessary. Additionally, the medical student volunteers attending HHE from around the United States will have the option of participating. The clinics at the villages are run in the afternoon, allowing mornings for the hygiene program and community assessment activities. The triage set-up for the clinics also provides a format for qualitative survey recruitment as discussed in the community assessment section (Section 3).

The HHE trip itinerary will be set before leaving by Singh and his staff and will most likely include 4 clinics in the Zanskar Valley (See Figure 5), with 2-3 days spent in each clinic site (see Table 1 below for approximate timeline followed at each village). Some of the staff will go ahead of the team to set up camp and prepare our meals. These staff will alert the village leader and school teachers of the team’s coming and desire to work with their classes. Some flexibility will be calculated as the number of students and what age range is not determined until team arrives. Historically, there are 12 clinic days with 1600-1800 patients seen total, distributed over 4-5 village sites in the Valley (website citation). However this includes patients outside the villages, and
patients of all age ranges, so is of limited use in estimating student numbers. Some students may be away at school in Manali if their families can afford it.

Below, in table 2 are some of the activities included in the plan over a 3 day village visit (the average visit length on a given HHE expedition).

<table>
<thead>
<tr>
<th>Activity (see table of contents below for Lesson Plan topics)</th>
<th>Participants Involved</th>
<th>Day of visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request permission to work with school children of any age and meet with village leader</td>
<td>HHE staff</td>
<td>½ day before team arrival</td>
</tr>
<tr>
<td>School activity 1 – hand hygiene lesson and seasonal diagramming</td>
<td>Project coordinator, teachers, students, +/- medical student volunteers, interpreters</td>
<td>Morning 1</td>
</tr>
<tr>
<td>School activity 2 – environmental sanitation with mapping activity</td>
<td>Project coordinator, teachers, students, +/- medical student volunteers, interpreters</td>
<td>Morning 2</td>
</tr>
<tr>
<td>Transect walk and repeat of village map (described in Community Assessment Section XXX)</td>
<td>PC, village representatives, interpreters</td>
<td>Morning 3</td>
</tr>
</tbody>
</table>

Table 1. Program Timeline – outline for each village visit.

As mentioned previously, the project will use the philosophy and lesson plans drawn from the Life Skills and Nali Kali (Joy of Learning) IRC manuals. Relevant sections of these manuals are found in Appendices 2a and 2b. Assuming we have time for 2 lessons, one lesson will focus on hand hygiene (see appendix for copy of 2 hand hygiene lesson plans), and the other will be on another hygiene or sanitation topic determined at the time. The manuals include a variety of activities for various ages on hygiene, school sanitation, water and sanitation-related diseases: diarrhea and food storage. These activities vary from mapping to acting to and others. The decision of which lesson plans to use will be based in part on alignment of resources needed in the lesson plan with resources available in the villages, in addition to age-appropriateness for the classroom of children we find on site. If the concurrent community assessment (and in part
integrated into the program plan) provides information requiring further adjustment of the lesson topic, additional adjustments to the final lesson plan will be made. The lesson plans in the manuals also include activities that are part of the community assessment, including village or social mapping and seasonal diagramming, facilitating the parallel program implementation and community assessment.

The table of contents for the Life Skills-based and Nali Kali (Joy of Learning) hygiene curriculum lesson plans and the plans in their entirety are included in the appendices.19,20

Figure 5. Scheduled HHE Kargiakh/Zanskar Valley Trip Route
Section 5: Program Evaluation

The core principles and methods planned in this program are well-established: improvement of hand hygiene through school-based education interventions. However the details of the setting and infrastructure reflect an uncharted territory. While any project benefits from evaluation to improve process and assess whether objectives have been met, the novel circumstances of this program make the evaluation all the more important. Additionally, this project seeks to be a demonstration project, with logical expansion to the villages reached by other similar HHE expeditions. In order to most effectively expand, the question of whether objectives and intended outcomes are being reached must be answered, and the implementation must be evaluated and improved.

The evaluation must begin looking at the context for the project, to see if the remote setting, the unique culture, and the brief intervention have any unexpected effects, or if the program planned appropriately for these influences and the scarcity of resources on site. The next logical piece of the implementation evaluation will assess whether the planned hygiene-oriented school activities, and community assessment encountered any major barriers, were carried out as planned, and had the expected participation levels. And as a last major area, the evaluation will assess whether the short or long term health outcomes are being reached. These evaluation components together will guide future improvement measures for the project in the Zanskar Valley, in addition to clues about how to approach expansion to other expeditions in the future.

As described below in the methods section, much of this evaluation will be integrated in with the existing community assessment strategies and future program plans. Because of this participatory evaluation style, an internal evaluator is most suited for the task. This also results in an evaluator who understands the unique organization of HHE, and can therefore search as a
better advocate for active improvement of the program plan, and have more effective communication with the HHE director.

**Short Term Objective 1:** Within 3 days, at least 50% of children in the village grade school will express improved knowledge of the benefits of improved individual and home sanitation and hygiene.

<table>
<thead>
<tr>
<th>Evaluation Questions</th>
<th>Participant</th>
<th>Evaluation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 3 days, did at least 50% of children in the village grade school express improved knowledge of the benefits of improved individual and home sanitation and hygiene?</td>
<td>Student Participant; Program Manager</td>
<td>Pre and post-program surveys</td>
</tr>
<tr>
<td>How many of the village students participated?</td>
<td>Teachers</td>
<td>Interview</td>
</tr>
<tr>
<td>How could the curriculum have been more effective?</td>
<td>Teachers; Program Manager; Participants</td>
<td>Open-ended Interview Questions</td>
</tr>
<tr>
<td>What were the barriers to student participation and learning?</td>
<td>Teachers; Program Manager; Participants</td>
<td>Open-ended Interview Questions</td>
</tr>
</tbody>
</table>

**Table 2. Evaluation Framework for Objective 1**

**Evaluation Methods**

Evaluation of the short term Objectives (1-4), combine qualitative and quantitative methods. A simple test or survey, given to the participants before and after their participation in the program, can test the short term outcomes of the program. This will quantitatively assess the short term outcomes of improved knowledge, attitudes, and behaviors (KAB). This survey could be written, but with resource constraints could also simply be done through hand-raising class participation. Qualitative methods will be used for process evaluation of the program implementation. Interviews will include a combination of open and closed-ended questions assessing the strengths and weaknesses of the program implementation, the barriers it
encountered, and ideas for improvement for future implementation in this community or expansion to others. These interviews will be conducted with the teachers at the participating schools, 1-2 students from each school (chosen with help from the teachers), and input from the Program Manager.

The objective of developing a sustainability plan and the evaluation of the long-term objectives are intricately tied, as are the evaluation methods for them. Development of the sustainability plan will establish that the hygiene program will return to the community during the same HHE expedition the following summer (in addition to adjusting and potentially expanding the program). This return visit would involve repeating the pre- and post-surveys for student KAB, establishing the long-term outcome measures. Additionally, the village mapping community assessment, which provides a combination of quantitative and qualitative data, will be repeated. Over years of completion of this map, any progressive change in the hygiene and hygiene-related health outcomes can be traced, and possibly even shown to be associated.

**Study Design and Methods**

The study design will be observational only. Evaluation of short-term objectives must be done during the same restricted three day time period as the program plan and community assessment. For this reason, the most basic evaluation methods will be incorporated into the program plan. In each village, a series of questions pertaining to level of knowledge on hygiene and the effects of poor hygiene on health will be asked of the students. The same questions will be reviewed at the end of the three day classroom sessions to assess for short-term improvement in knowledge and attitudes. Additionally, at the end of the stay in each village we will discuss with teachers and other available village leaders what proportion of village children were involved in
the program and how they felt the program proceeded, including ideas for improvement, and their perceived barriers. When possible we will include Singh, the HHE program director, in these interviews.

For middle and long term objectives, the planned community assessment described in section 3 discusses Village Mapping. This strategy serves to create a base set of both quantitative and qualitative data. Pending the success of the sustainability plan, allowing for continuation of the program with potential expansion, the community assessment portion of the program would continue as a part of future program plans. This has the potential to provide longitudinal data on an annual basis for outcomes evaluation. This will facilitate evaluation of changes in behaviors, resources, and health outcomes in greater detail in some cases than a simple survey, due to geographical mapping portion of assessment.

Section 6: Discussion

The program and research model described in this paper work towards a combined aim of educating the populations of the Zanskar Valley about hygiene and health, in addition to educating the researchers and HHE participants about the practices and priorities of these village populations. The resulting model contains community assessments based on Community Based Participatory Research (CBPR) theory and Child-to-Child (CtC) focused education, integrated as one program throughout. With its emphasis on incorporating community members into research and program planning, CBPR validates any unique culture or experience found within the communities. Given the extreme geography and diverse cultural background of the populations in the Zanskar Valley, this integration of participants’ subjective experience is particularly important. The
community assessment tools described, including village mapping, transect walks, and seasonal diagramming, are well-suited for integration into an educational program plan because the dialogue they create around hygiene and sanitation resources and health effects.

CtC programs, including hygiene programs, have been implemented throughout the world in a wide variety of settings spanning socioeconomic conditions, geography, and cultures. Similarly, CBPR based research and program planning are widely accepted among public health practitioners in large part because of the flexibility it provides across variable cultures and settings. The drawback of the diversity in the practice of these theories and strategies is the resultant absence of studies translating well to the conditions in our target population in the Himalayas. On the other hand, a plethora of studies exist demonstrating the utility of hand washing and other sanitation interventions to improve long term health outcomes including multiple meta-analyses yielding strong data in favor of interventions.\textsuperscript{21,31,62}

This model has the potential to act as a demonstration program for larger expansion to villages throughout the Himalayas visited annually by existing HHE expeditions in addition to the Zanskar Valley expedition described here.\textsuperscript{2} With acute respiratory infection and diarrheal disease as the leading causes of infant and child mortality in the rural Himalayas, successful implementation of this program with subsequent expansion seeks a goal of widespread change in hygiene practices and an impact of lowered child morbidity and mortality due to infectious disease. Given the established sustainability of HHE expeditions over the past decade, continuing this project in concert with existing expeditions could strengthen the volunteer relationship with the villages visited and establish longitudinal data about an infrequently studied population.

Building this program on the existing infrastructure of HHE provides both strengths and limitations. HHE provides an abundance of resources in a remote region where material and
human resources would otherwise be extremely difficult to access. This includes local and state networks, experienced interpreters, transportation, and funding among other assets. However, the established schedule of the HHE expeditions necessitates program implementation over 3-4 days in a single village, allowing little advanced interaction with the community. CBPR theory provides assets within this setting by immediately incorporating villagers into the research and programming process. This will prevent the often resented image of westerners entering a village and imposing outside ideas of help on the community. The CtC approach also comes with strengths and limitations. Every village visited on HHE expeditions has either a school or a monastery (many children enter monasteries starting as young as age 4), many of which house the clinics run by HHE, providing simple and direct access to a defined population. The weakness of targeting a child population for hygiene education is our absent knowledge of the role of children in the local culture. The success of CtC depends on child empowerment to enact change in the community, which requires a certain existing role for children in the community culture. We will not know if this is a problem until implementation or longer.

While this paper focuses on the research and implementation project for a single HHE expedition, future studies and projects could continue this work in the Zanskar Valley in addition to adjusting and expanding for other HHE programs. As more data is gathered on the resources, needs, and priorities of the community, research and program plans can adjust or expand appropriately. Based on environmental risk and disease burdens in similar high altitude regions, particular areas of interest for future research and programs include indoor air pollution and improvement of seasonal clean water sources.68, 69

Throughout the world improved hygiene over the last century has positively affected morbidity and mortality measures. Despite strong evidence of the efficacy of improved hygiene in
disease prevention, many areas of the developing world lack the public health infrastructure and education to encourage these practices. The villages of the Zanskar Valley fall into this group, but through the structure provided by HHE and Ravi Singh’s personal resources, hygiene research and programming is feasible for these villages. CBPR theory provides a framework on which to build this program, and further, establishes practices ideal for sustained HHE involvement and eventual expansion.
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