

NSU: A Safe Water Campaign for an Urban Community in Western Ghana

Morton J^{1*} and Vanotoo L²

¹Department of Nursing, University of New England, US

²Ghana Health Service, Ghana

Abstract

Contaminated water and subsequent hygiene practices remain a concern for most low resource countries worldwide. Morbidity and mortality from health conditions associated with unsafe water practices remain at an all-time high and a global public health priority. "NSU": A safe water campaign for an urban community in Western Ghana, is a research translation project designed to assess/educate community members regarding knowledge, attitudes, and practices surrounding hygiene practices in an urban community in sub-Saharan Africa. "NSU", means translated as "water" in the language of Fante, utilizes a two-group pre-test, post-test design with a delayed intervention to be administered to the control group. Methods of education delivery include three-pile sorting and didactic lessons/discussions of no more than 15 participants per group. Participants completed a survey modified for cultural appropriateness to the area in an effort to measure the knowledge they gained. Research translation projects such as "NSU" that draw from best practices and are culturally attuned can serve as an impetus for effective and measurable community health education program development for global populations.

Keywords: Hygiene practices; Cultural attunement; Global health; Community health education

Background

Improvements in wastewater disposal, protections of water sources, and treatment of water supplies have greatly reduced health conditions that are commonly associated with contaminated water in many parts of the world. However, these health conditions that result from waterborne vectors remain a concern for underdeveloped and developing countries worldwide [1]. As described in the United Nations Sustainable Development Goals (2014), specifically #6; Clean Water and Sanitation.

"Clean, accessible water for all is an essential part of the world we want to live in and there is sufficient fresh water on the planet to achieve this. However, due to bad economics or poor infrastructure, millions of people including children die every year from diseases associated with inadequate water supply, sanitation and hygiene" [2].

Diarrheal disease affects millions annually, and is the second leading cause of death in children, worldwide [3,4]. Diarrheal disease generally results from the impacts of unstructured urbanization, rapid population growth, and the lack of community health education, which are pervasive variables in various parts of the world [5,6,3].

The twin cities of Sekondi and Takoradi in the western region of Ghana, Africa are characterized by the Central Intelligence Agency's World Factbook (2018) as urban, low resource [7]. The majority of the residents live in housing without a flush toilet or piped water, requiring them to transport water for ingestion purposes and visit public latrines for elimination [8]. According to the Sekondi Takoradi Metropolitan Assembly (March, 2018) [9], some progress has been made in the community with the use of bore holes and through urban liquid waste management principles including the implementation of subcommittees (advisory, communication, finance), partnerships with the private sector, training of 40 additional local inspectors, and school based educational campaigns. However, the biggest challenge remains to be centered around the knowledge, skills and attitudes of the community toward issues of sanitation.

Health records from the International Mission in Sekondi, Ghana that holds a primary health clinic runs biannually, are reflective of a high incidence of gastrointestinal health illness, most likely related to

unsafe water and hygiene practices consistent in low and even middle resourced countries. In an annual health care collaboration between the Ghana Health Service and the University of New England, clinical care is provided to members of the local community. An average of 500 patients are seen for primary and related health services. Over 15 years, roughly 57% of those patients seen received diagnoses or present with symptoms that included gastroenteritis, intestinal parasites, and/or diarrheal disease [8]. Anecdotally, patient education that occurs in the clinic during individual patient encounters is meritorious; however, it is impossible to determine whether they are consistent or reliable without a formal evaluation program. This includes evaluations of providers, nurses, and community health workers' teaching practices and suggests a need for a formalized education plan with a detailed, evidence-based curriculum and evaluation strategy of the effect of the teaching that addresses knowledge, attitudes, and practices. The program must also contain a plan for sustainability and self-efficacy over time.

In countries where a high incidence of gastrointestinal illness exists, primary prevention measures such as community health education are revered as the most important strategy for control [10]. Furthermore, when key players share health-related information, it empowers one to adopt health behavior actions. This is a key strategy for health promotion in low resource countries [11]. It is critical when developing programs specifically designed to address various health conditions must include features that are unique to the culture. This includes incorporating cultural and spiritual factors that have an emphasis on community [11-13]. These community-focused spiritual and cultural factors, when well researched and embraced by the research team, offer heightened credibility and build trust from the perspective of those who

*Corresponding author: Morton JL, Associate Professor and Director, Department of Nursing, University of New England, US, Tel: 207-221-4476; E-mail: jmorton@une.edu

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make up the community. When members of the community believe the research team has authentically employed these principles, they will begin to trust the research. For example, the educational program can be held in a local church in the native language of the participants in order to instill a sense of cultural assimilation.

Problem statement

Various health conditions among the community of Sekondi, Ghana are related to unsafe water practices that result from inadequate community health education surrounding clean water practices as indicated by health records of the International Health Mission.

Review of the literature

“NSU” refers to “water” in the Ashanti language of Fante that is spoken by the community of Sekondi, Ghana. Water or “nsu” represents life for the people because clean water practices are directly correlated to behavioral practices and subsequently, health. “Nsu!” A clean water campaign for an urban community in Ghana will employ established evidence-based guidelines that are currently utilized in other educational programs that can shape and reform health behavior practices in lower resource parts of the world in an effort to improve health.

“NSU!” utilizes the PEN 3 model [12] as a guiding theoretical framework. The PEN 3 model represents a conceptual approach to health behavior programming that combines components of affirmation and cultural expression in the contexts of three domains: 1) Health Education (Person, Extended Family, Neighborhood); 2) Educational Diagnosis of Health Behavior (Perceptions, Enablers, Nurturers); & 3) Cultural Appropriateness of Health Behavior (Positive, Existential, Negative). The cultural appropriateness of PEN 3 is especially useful in parts of the world that differ culturally from areas where other health behavior models have been developed and tested based on a Western paradigm (Figure 1).

Researchers who have conducted descriptive research have substantiated the need for program planning in the area of health behaviour practices associated with hygiene and sanitation in low resource countries. For those attempting to create and/or sustain programs with measurable outcomes, understanding behaviour through the critical lens of theory, specifically health behaviour models, is a critical foundation. Qualitative inquiry is a valuable methodological approach in relationship building with other community-based participatory research methods [14]. Research translation projects, often referred to as quality improvement that utilizes a quasi-experimental research design provides a foundation whereby other community health education programs with measurable outcomes can be replicated and/or modified in public health practice. Such programs that emphasize characteristics unique to the culture provide fosters the necessary cultural sensitivity unique within the plan.

Not unlike Western culture, gathering spots where health education is shared serve as a vehicle for information dissemination in lower resource countries; such gathering spots include schools, churches, and markets. Schools have longed been revered as a conduit to deliver valuable community health education in western culture. Hadera et al. [15] utilized components of the theory of planned behaviour [16] to understand the motivation of adolescents to learn about HIV/AIDS prevention in Tigray, the northernmost region of Ethiopia. The authors posit that for effective prevention education, the participant must be motivated to learn. Moreover, attitude, subjected social norms, and self-efficacy are the determinants of a learner’s motivation to learn.

Waggie et al. [5] examined primary and secondary schools in sub Saharan Africa as viable education sites for interdisciplinary health promotion. A self-administered, structured questionnaire was given to teachers and principals that included demographic information, knowledge and attitudes of teaching staff of health promotion, current health promotion activities at the school, and barriers and opportunities for administering health promotion activities. Teachers (n=80) and principals (n=4) combined for an overall response rate of 68.75%.

Waggie et al. [5] found that most of the respondents (87%) felt that health promotion had a place within the school curriculum. This included concepts of healthy lifestyle and mind, awareness of emergent issues, and addressing such issues. Health promotion initiatives were an area where teachers were inconsistent. For example, only 51% reported that health promotion activities were actually implemented. Many of these activities were noted to have been attempted sporadically, often with little follow up. The teachers and principals identified numerous barriers and limitations, including: lack of finances, lack of time, no incentive, lack of resources and support, insufficient staff training, and overcrowding of classrooms.

Other topics of health education within health promotion models have been utilized in low resource countries with varying degrees of success. Karnell et al. [17] explored the efficacy of an American alcohol and HIV prevention curriculum adapted for use in South African schools. In this study (a two-group, randomized, pre-test, post-test design, utilizing a comparison group), five schools (three intervention, two control) participated, (n=661) with students who were at a ninth-grade level. All schools had similar characteristics demographically and had a primary spoken language of Zulu-African. A revised educational intervention based on the American model was modified for the study that consisted of pre-recorded monologues that told a story of fictional teenage township characters. The stories revealed dilemmas regarding alcohol and sex. They served as a basis for beginning discussions around safe practice that were facilitated by trained peer mentors. Following the monologue, an adapted curriculum was then delivered over a period of two months (30 minutes, once per week). The program was divided between alcohol-related content and HIV/AIDS content.

The survey instrument utilized by Karnell et al. [17] consisted of 106 items in a four-point Likert scale. Revisions that were culturally- and language-based underwent extensive pilot testing that included reliability coefficients of Cronbach’s alpha. Of the eight instruments modified, five had coefficients >.70. Pre-testing occurred two weeks prior to the implementation of the program and post-testing occurred eight weeks after the completion. The findings revealed significant differences in behavior and intent related to alcohol and safe sex practices utilizing logistical regression. The authors identified that due to the eight-week post-test, intervention decay could be a limitation. This warrants the necessity of future phases that include booster education with follow up post-tests. The strengths of this study are

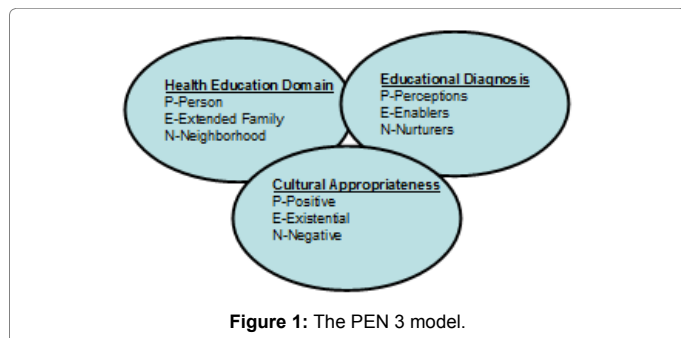


Figure 1: The PEN 3 model.

apparent through use of intervention and comparison groups with a pre-test/post-test design. The advantage of this design is that it provides a strong basis for comparison. If there are differences, and the between groups, there is reasonable confidence that education outreach has had some effect [18]. Additionally, utilizing approaches to education that incorporate culturally appropriate performance-based, arts/humanities are a unique way to engage a community.

The studies of Waggie et al., Karnell et al. [5,17] substantiate the site and population as viable and important characteristics for sampling, however logistics are predicated on a school schedule and extensive permissions are needed for access. Hedera's (2007) [19] work offers further strength in that the design embraces Airhihenbuwa's [12] constructs of perceptions, enabler and nurturer that are imperative to culturally attuned programs. Additionally, the work of Karnell et al. [17] adds strength and efficacy to programming that embeds sustainability over the long term, as identified by the booster educational methods utilized.

The Norwegian Refugee Council [20] in collaboration with Save the Children and World Vision conducted a program evaluation in 2015 with displaced refugees from Iraq. While access to clean water during a time of conflict is unique, the underlying concerns translate internationally across all demographics and include the following: 1) existing knowledge of hand washing practices-referring to the most common times handwashing takes place, 2) hygiene messaging-refers to dissemination of practice through flyers, posters, etc., and 3) disease prevention and treatment-referring to self-reports of family morbidity and mortality related contaminated water supply. The researchers concluded that KAP surveys provide a basis for understanding coverage, access, and usage of water and sanitation facilities (latrines) and how to best address untoward hygiene practices.

Metwally et al. [21] explored the roles of rural women in health care. An educational intervention to upgrade levels of awareness, attitudes, and practice of rural villagers toward environmental sanitation, sanitary housing, personal hygiene, safe water, food safety, and sanitary sewage was conducted. The authors provide an extensive review of the literature that suggests that children of mothers who lived in households with no toilets had higher morbidity and mortality rates than those who lived in a household with a flush toilet and piped water. Others have demonstrated that simple hygienic measures are capable of arresting the transmission of most infectious agents that cause diarrhea, suggesting that sanitation facilities are not sole predictors of improved health [22,23].

Metwally et al. [21] used a quasi-experimental design for their work, enrolling a convenience sample of 375 rural women who received environmental health training courses as an educational intervention. Prior to the intervention of the environmental training courses, individual training needs of the women were assessed and the knowledge attitudes and practices were ascertained through the KAP tool [24]. The KAP tool is an instrument that measures knowledge, attitudes, and practices surrounding hygiene practices. The environmental health training courses included: 1) social assessment of community and communication skills; 2) methods of data collection; 3) environmental pollution and its impact on personal hygiene and housing; 4) water and food sanitation; and 5) sewage and waste disposal. Pre- and post-testing surrounding the intervention and theoretical evaluation of the training courses were conducted.

Of the six major topics addressed in Metwally et al. [21] intervention, pre- and post-testing of the domains of awareness,

knowledge, and practices utilizing the KAP tool, followed by an outcome evaluation of the training were conducted. All areas revealed statistically significant improvements in all domains as evidenced by positive ranks and $p < 0.001$. This study concludes that an intervention that educates safe and hygienic health promotion practices shows significant improvement with respect to the environmental training topics identified. The findings also reinforced the concept that community members are culturally bound to disseminating valuable health messages to their own household families and communities.

There was no mention of reliability and validity of the KAP tool used in Metwally et al. [21] work. The study did not utilize a comparison group; however, pre- and post-testing provides some basis for comparison. The sample is highly representative of a project that recruits participants from a local market and church. This study also supports the importance and utility of theory-based evaluation as an outcome measure. Furthermore, when I accessed the original document [24], there was no mention of reliability or validity data despite this tool being endorsed by the World Health Organization.

In the study by Metwally et al. [21], 24 villages with randomly selected households comprised a total sample of 173 people. This study utilized a baseline survey that consisted of demographic information by asking heads of households' basic demographic information as well as their knowledge of causes and prevention of diarrhea, water handling, and sanitation practices. Additionally, focus groups were conducted to empower and mobilize the community toward ownership of the health-related program through social marketing which included creating the name of the project. Adoption rates of the behaviors and treatment techniques by the community increased 33.5% following the focus groups and educational intervention.

The limitations of Metwally et al. [21] work were related to statistical analysis. For example, only measures of central tendency were used to analyze the data. Without a strong statistical test, significance of the measures is weak and cannot effectively be ascertained. However, the study methodology was designed and delivered in a manner that was culturally attuned to the community. Involving the community in the planning of the program through community-based participation through the use of focus groups and social marketing is a strategy the embraces the cultural construct of the PEN 3 model.

In a study conducted by Makutsa et al. [21] challenges in implementing a point-of-use water quality intervention were explored. This resulted from a Water, Sanitation, and Education for Health (WASEH) Project originally implemented in 72 farming and fishing communities in Kenya in 1998. Although meritorious in its original intent, when water quality testing continued to be poor, Care [25] became involved in 2001. CARE represents one of the world's leading humanitarian agencies serving women and children, and has been involved in diarrheal disease prevention in Africa for more than a decade. The Safe Water System consists of point-of-use water treatment with sodium hypochlorite along with education regarding safe storage and behavior change that utilize strategies initially implemented by WASEH.

Almedom [14] described the use of participatory tools in a study that looked closely at rapid assessments with respect to hygiene behavior in low resource countries. "Three-pile sorting" is a tool that was used as an "ice breaker" for sensitive teaching material. A set of pictures that depicted site-specific topics such as water supply, sanitation, health, and hygiene were discussed with focus groups of up to 15 people. Pictures were discussed with a facilitator and then sorted

into one of three piles: good, bad, or unclear, hence the name “three-pile sorting.” For example, an illustration of a mother disposing of her child’s feces and then preparing food for the family represents a picture that participants should recognize as one that belongs in the “bad” pile. This also stimulated a brief discussion that lent itself to thoughtful, culturally-based dialog, aligning with Airhihenbuwa’s [12] positive, existential and negative support of health behaviours associated with the PEN 3 model. This community-based dialog builds trust with the education team and camaraderie with peers. Three-pile sorting can set the stage for a thoughtful, educationally-based programmatic intervention. Although this method was not identified in any of the studies in the literature review, it is well described in the theoretical literature [14] specifically looking at evaluation criteria used in hygiene practices.

Aim

The aim of this study is to provide culturally attuned health education focusing on clean water practices for community members of Sekondi increasing their knowledge and leading to self-efficacy.

Methods

The above review of the literature provides a solid programmatic foundation for the “Nsu!” project. The empirical works utilized important methodological strategies that can serve as an evidence base for a research translation project. For example, utilizing three sites that include schools, churches, and a local market incorporate components of the previous studies, yet strengthen the program plan due to its generalizability to the greater population. The authors of the cited works were careful to employ methodologies that were culturally congruent to the population. This is essential and consistent with the theoretical underpinnings suggested by Airhihenbuwa [12] in the PEN 3 model. Additionally, a theory-based instrument, an innovative educational intervention that utilizes components of the PEN 3 model, and timely post-testing with a comparison group provided strength in sampling that offered further sensitivity for statistical analysis. These methodological approaches utilize various aspects cited in the critical appraisal that are meritorious to any evidence-based approach to community health education in a framework that focuses on knowledge, attitudes, and practices of community participants.

Following the appropriate approvals, the program took place at the site of a local church, home to a primary care clinic provided by Ghana Health Mission during the month of August. Additionally, two other recruitment sites that included a local high school and the local market fostered viable educational sampling that enabled the project to reach a generalizable public. However, due to unforeseen circumstances, the school site was not available for sampling.

The program theory explored the benefits of an educational program related to clean water practices and hygiene guided by the PEN 3 model. There were two phases to the project. The effect theory included evidence-based educational interventions to be delivered to participants at the three individual sites. Two experienced community health workers were hired as support educators for the program. Community health workers (CHW), mainly college students who were identified, selected, and trained by the church as future leaders, have historically assisted mission health professionals with Fante-to-English translation and community health education. The assistance of the CHWs was integral due to the need for translation between Fante and English that was required in disseminating the educational information in a manner that fostered health literacy for the participants.

A convenience sample of 60 participants was recruited from the three sites on a first come, first served basis. Half were placed into an intervention group (n=16) and the other half into a comparison group (n=15), despite a targeted total sample of 60. The intervention group participated in a focus group activity of “three-pile sorting” with respect to hygiene practices. This served as an ice breaker exercise designed to build trust with the primary educator and community health workers, while also providing a social assessment and assessment of prior knowledge that are consistent with community participatory programs [26]. The three-pile sorting cards were illustrated by an artist to depict the culture and hygiene practices that were unique to Sekondi, Ghana. Following the three-pile sorting exercise that lasted 30 minutes, participants received clean water practices education that utilized components of the Hesperian Foundation’s “Water for Life” and “Sanitation and Cleanliness of a Healthy Environment” [27] publications. This was also tailored to the unique needs of community of Sekondi, based on the clinic’s needs assessment data, including the educational components of the following: 1) water contamination and its effects on health, 2) water and food sanitation, and 3) sewage and waste disposal. The education itself included no more than 15 participants in each session and lasted for 90 minutes. The group received a coupon to return to the education site two weeks later at a specific time for a post-test evaluation and small gift in appreciation for their participation that consisted of a water bottle and oral hydration packs.

The comparison group received the intervention (three-pile sorting and education session) in a delayed format after post-testing of all consented participants in both groups had occurred. This delayed intervention for the comparison group provided a basis for which comparable outcomes could be measured. Outcomes were measured utilizing a post-test outreach format with the control group. The benefits of utilizing only post-tests are unique to this program because it is a short-term health mission immersion, therefore a pre-test may have offered sensitivity to the post-test. Differences in outcomes can be appreciated through the use of a comparison group, suggesting that at some level the outreach has had the desired effect. Offering a delayed intervention provides a moral foundation to deliver the important health information that participants need and is therefore equitable for all participants.

The moderating and mediating variables involved in this study include a demographic questionnaire combined with a valid, theory-based quantitative instrument. This demographic questionnaire is embedded into the instrument developed by Duncker [24]. The Knowledge, Attitudes and Practices Tool (KAP) for Hygiene Awareness utilizes subscales that measure 1) expenditure, 2) income, 3) water source, 4) water storage, 5) water treatment, 6) waste water disposal/reuse, 7) solid waste disposal/reuse, 8) sanitation, 9) nutrition, 10) hygiene, 11) perception of health, 12) diseases/treatment, and 13) community capacity (see Appendix A). Inter-rater reliability was ascertained between the two workers with respect to the education and the oral reading of the KAP tool to ensure that they were presenting the material consistently to participants. Additionally, internal consistency was also measured to ascertain the reliability of the instrument between participants, thus demonstrating that the rigor of instrument delivery could be maintained. Cronbach’s alpha was needed to lend further credibility to this project due to the lack of reported reliability of this instrument in the literature and was 0.81 respectively.

The CHWs received “train the trainer” education prior to the intervention to reinforce concepts and to learn new methodologies of

hygiene education. For their services, they received pay commensurate with that of a secondary school teacher for the two weeks (approximately 75 U.S. dollars) the research translation project took place. In addition, a research translation assistant was hired to help coordinate and organize groups, obtain consent from participants, and enter data.

The KAP tool for hygiene-modified utilizes mutually exclusive categorical data. Measurements were ascertained between two groups (intervention, comparison). Therefore, a nonparametric test, a Chi square analysis, was the statistical method of choice [28]. Descriptive statistics and frequencies were also utilized to analyze data. The process, program, and effect theories described in the methodology of this project were systematically combined to provide a salient approach to community health education with measurable outcomes. This serves to educate, empower, and change health behaviors in a culturally congruent manner with respect to clean water practices in the city of Sekondi, Ghana.

Mnukwa et al. [29] developed benchmarks for hygiene evaluation in low resource countries. They include performance objectives consistent with those developed for “Nsu!” and key performance indicators that target an 80% increase in knowledge followed by changes in self-efficacy related to attitudes and practices. This target value was used to assess the impact objectives. An effect size of .80 would hold that 79% of the control group would score lower than the intervention group following the educational activity [30]. The target values included the post-test measure of the knowledge gained from the KAP for hygiene tool [24] that was administered during the outreach educational offering (Tables 1 and 2).

The International Mission is home to collaborative health care clinic between the Ghana Health Service and the University of New England (USA) for two weeks every summer. A local community spiritual leader, representation from the local health service, and the PI have carefully constructed a clinic that sensitively, through culturally attuned care, meets many of the health care needs of the people of the urban area. In collaboration with church elders, community leaders and local health officers, health care professionals offer services to any member of the community, regardless of religious affiliation and/or ability to pay. Clinic data has provided valuable input that assists

Characteristic	Intervention (M) N = 16	Control (M) N = 15
Gender		
Male	7 (16.7%)	7 (16.7%)
Female	9 (21.4%)	8 (19%)
Community		
Sekondi	13(31%)	12 (28.6%)
Takoradi	2 (4.8%)	2 (4.8%)
Other	1 (2.4%)	1 (2.8%)
Number in household		
3-2	7 (16.7%)	5 (11.9%)
> 7	9 (21.4%)	10 (23.8%)
Church		
Catholic	4 (9.5%)	5 (11.9%)
Pentecostal	8 (19%)	5 (11.9%)
Methodist	2 (4.8%)	4 (9.5%)
Number of school children in household		
1-2	3 (7.2%)	4 (9.4%)
3-4	5 (11.9%)	3 (7.2%)
>4	8 (18%)	10 (23.8%)

Table 1: Comparison of characteristics of intervention and control groups.

	Education n=16 %		Control n = 15 %		χ ²	p
1. Household potable source-rainy season?					9.74	0.021
river, stream	2	6.5	0	0		
yard taps	12	38.7	7	22.6		
street taps	1	3.2	8	25.8		
spring	1	3.2	0	0		
2. Household potable source-dry season?					8.1	0.044
river, stream	3	9.7	0	0		
yard taps	10	32.3	7	22.6		
street taps	2	6.5	8	25.8		
spring	1	3.2	0	0		
3. How often water collected?					7.25	0.123
once a day	4	12.9	1	3.2		
twice a day	1	3.2	1	3.2		
> twice/day	11	35.5	8	25.8		
every other day	0	0	1	3.2		
4. What container used for water collection?					3.45	0.48
plastic can with lid	10	32.3	12	38.7		
plastic can without lid	1	3.2	0	0		
open bucket	3	9.7	1	3.2		
bucket with lid	2	6.5	1	3.2		
5. How often containers washed/drinking water?					10.81	0.013
once a day	6	19.4	3	9.7		
twice a day	7	22.6	1	3.2		
every other day	3	9.7	11	35.5		
6. How does the household treat drinking water?					11.52	0.009
Boiling	8	26.7	2	6.7		
chemical	2	6.7	10	33.7		
other	1	3.2	1	3.2		
no treatment	5	16.7	1	3.2		
7. What does the household do with wastewater?					4.97	0.083
veld	10	32.3	14	45.2		
garden	4	12.9	0	0		
other	2	6.5	1	3.2		
8. How often members wash hands/body same water?					15.7	.000
once	9	29	1	3.2		
twice	1	3.2	11	35.5		
several times	6	19.4	3	9.7		
9. What does the household do with solid waste?					1.66	0.441
veld	5	16.1	2	6.5		
rubbish pit	10	32.2	11	35.5		
other	1	3.2	2	6.5		
10. If no toilet, where do members go?					3.67	0.16
veld	0	0	1	3.6		
stream/ocean	0	0	0	0		
others' toilets	3	10.7	0	0		
communal toilet	13	46.4	11	46.4		

Table 2: Demographic variables for KAP questions.

clinicians to create programs and refine community health education offerings. “Nsu!” is one such program that represents an innovative, well-researched intervention that can be sustained over the long term.

The investigator has served as the University program leader for over 15 years. In addition to participation in a clinical capacity, other collaborative research looking at the effect of short- term immersion on the perceived cultural competence of health professionals has also been conducted. These relationships, now sustained for ten years, will

continue to grow, with added efforts in the area of community-based participatory research translation, as we all work together to improve the health of the people of this urban community.

“NSU!” underwent ethical review and approval by all involved parties, international and domestic, for all necessary approvals to safeguard the cultural appropriateness and human subjects’ protection.

Cost effectiveness of programs designed to improve health, although very important, can be difficult to measure in lower resource countries such as Ghana. Community member’s access to health care is often compromised due to lack of money, lack of access, and lack of knowledge related to various health conditions. For many, this collaborative health care program represents an option they have access to. Cost, in this situation, is measured over time with decreases in morbidity and mortality. Innovative programs that target primary prevention can serve as an impetus whereby sustained population outcomes can impact population health. Providing community health education that empowers the residents of urban communities of likeness will, over time, decrease rates of environmentally associated health conditions related to unsafe water practices.

Recruitment of eligible participants took place at the International Mission and a local urban market. The school site was not accessible at the time of recruitment due to an unforeseen closing. A script (see Appendix B) describing the research translation project was read to potential participants in Fante or English depending on their preference. The script reading took two to three minutes and represented an annotated version of the project. If potential participants were interested, they were given a ticket to report to the International Mission on the following day.

Of the 43 potential participants approached, all 43 agreed to come back to the International Mission on the following day. Of the 43 who agreed to come back, 42 actually returned, and consented to participate in the project. They were divided into two groups (Group 1, Group 2) in a methodological counting off “1, 2, 1, 2” manner. Those in Group 1 represented the intervention group, and those in Group 2 represented the comparison group.

Participants in Group 2 were then asked to fill out the survey questionnaire, the KAP Tool for Hygiene-Modified (Appendix A). Two Ghanaian community health workers who had been trained in the project assisted non-English speaking participants with their surveys, while research assistant assisted the English speaking and non-English literate participants with their questionnaires. At the conclusion of the questionnaire, participants were given a ticket to return to the International Mission eight days later for an educational offering on safe water practices. They were also given the small gift of a water bottle filled with oral re-hydration solution packets at the completion of the educational lesson.

Group 1 participants were taken to an area non-adjacent to those in Group 2. They were instructed that, consistent with the information given to them in the consent form, we would need approximately 90 minutes of their time followed by a return to the clinic in eight days to fill out a questionnaire. The educational offering included the “break the ice” exercise, Three-Pile Sorting (TPS). As we will recall, TPS utilizes illustrations to depict “good,” “bad,” and “in between” practices with respect to the educational subject being explored. It is used in many parts of the developing world to team build and ascertain a frame for what participants know within the context of the subject of interest. In this case, TPS, re-illustrated for cultural appropriateness to sub-Saharan Africa, was used as a method of team building because the educational

offering had been built based on previous needs assessment data. A series of six pictures were shown to participants, one at a time (see Appendix C). Several participants engaged in dialog that had specific meaning in relationship to the pictures. It was clear from the pictures that participants had similar ideas as to what constituted a “bad” practice. However, “good” and “in between” practices were areas that were less discernable. For example, Pictures 1 and 4 depict food being prepared outside on the ground. It was very clear to most participants that food prepared in an area that birds are inhabiting represents a less than ideal hygiene situation. However, in Picture 1, although the food is on the ground, there do not appear to be animals nearby. Participants were less able to commit to an answer. They were assured that there was no correct or incorrect answer, but rather the exercise was designed to begin the conversation about hygiene practices.

Following TPS, hygiene education was delivered in a seminar based educational format in English, simultaneously translated into Fante by a community health worker, the education offered cultural assimilation consistent with an urban setting in West Africa. This is important because not all hygiene education worldwide is consistently executed. For example, urban areas are more apt to access their water from piped sources rather than a stream or river, as in a more rural area. This supports the theoretical construct by Airhehenbuwa [11] suggesting that the program developer must intimately know and have the trust of those who reside in the demographic they are working with. This requires a process whereby the programmer must immerse him-or herself in the culture and partner with the community to gain unique understanding of the community.

The curriculum for “Nsu!” was extrapolated from Hesperian Foundation’s “Water for Life” and “Sanitation and Cleanliness of a Healthy Environment” [27] publications. The specific content underwent critical cultural revision that was assimilated to the needs of those who reside in urban sub-Saharan Africa. Curriculum concepts included: 1) what do we need and use water for?; 2) what makes water unsafe?; 3) the chain of illness; 4) diarrheal disease (including germs and worms) and its signs, symptoms and treatment; 5) oral re-hydration solution (ORS); and 5) preventing the spread of germs and worms.

1) “What do we need and use water for?” Represented an open discussion among participants to include two important concepts related to hygiene: drinking and washing. The importance of clean water was highlighted as a key concept because contaminated water is where the disease triad begins. In addition, problems from not enough water that lead to dehydration were also discussed.

2) What makes water unsafe? This discussion focused on types of contaminants that cause water to be unsafe. In urban Africa, toxic chemicals add to the contamination of water along with the more common contaminants, germs and worms. Methods of disposal of and collection of water were discussed.

3) The chain of illness was presented in the form of a case study. Timothy’s story highlights a young child who ingests contaminated water after the family water pump breaks and there is no money for repair. Because Timothy is an infant, he is particularly vulnerable to dehydration as a result of dysentery. This case study led to powerful dialog that resonated with almost everyone in the group on a personal level. Although the case did not reflect the outcome of Timothy’s illness, several participants in the group thought Timothy had died, noting that this outcome is very common in Africa.

4) The educational concept of diarrheal disease (germs and worms) especially focused on the vulnerability of the very young and the very old. Feces that carry the germs and worms are transported by human hands, flies, fields, and fluids (rivers, streams). These were the concepts that drove this discussion. Simple transmission techniques were demonstrated with the use of flour on the fingertips as a visual educational concept. It was also reinforced that many types of diarrhea disease require the services of a doctor or health professional. Typhoid and bacterial dysentery such as *Shigella* require antibiotics, while roundworm and hookworm require de-worming medicines.

5) Oral re-hydration solution (ORS) as a mechanism to re-hydrate a person suffering from dehydration consists of a recipe of one liter of clean water mixed with eight teaspoons of sugar and one-half teaspoon of salt. Adults suffering from dehydration should drink one to three liters of ORS daily. Participants received one-liter water bottles and ORS packets.

6) Preventing the spread of germs and worms was presented to participants as handwashing being the single most effective mechanism of preventing the spread of germs and worms. Discussion focused on the “when” (after toilet, before eating, before handling food, after handling dirty things), and the “how” (washing vigorously with soap and water for 60 seconds).

Following the educational session that lasted approximately 90 minutes, participants were given a ticket to return eight days later. They were told that at that time they would be assisted in filling out a questionnaire having to do with the information that had been presented to them, as well as what they already knew related to safe water practices. All participants agreed to return for follow-up.

Meanwhile, Group 2 participants were filling out the KAP questionnaire with the assistance of a community health worker trained to the “Nsu!” project. The CHW assisted Group 2 participants with the questionnaire. They were given tickets to return to the International Mission eight days later to receive delayed “Nsu!” curriculum and the water bottle and ORS as a gift for their participation.

The administration of the instrument was met with unforeseen challenges with respect to health literacy. Both Group 1, education ($n=16$) and Group 2, delayed education/control ($n=15$), contained a mix of literacy levels. Some spoke English, some read English, and some only spoke Fante. Due to the variety of levels of understanding across two languages, six participants worked with a CHW and were read the instrument in Fante. Their responses were written sequentially. The remaining participants spoke English proficiently but had limited English reading literacy. A trained research assistant assisted this group by reading the questions and assisting them by writing down their answers sequentially. The degree of time and individual attention this questionnaire process entail exceeded the expectations of the investigator. Although the community health workers were trained to the instrument delivery with inter-rater reliability with 91% in the languages of English and Fante, the outcome with the participants most likely did not meet this 91% standard due to the mix of instrument delivery methods required.

Results

Data were entered into SPSS version 17.0. The KAP tool in both its original version and in the version modified for this project utilized demographic data and categorical survey responses. Neither form of the KAP tool defines psychometric properties, therefore a total score and subsequent comparison of mean scores is not obtainable. In

addition, there are no reliability statistics reported, and with the added confounders of alternative delivery required (oral English, oral Fante, written English, and written Fante), reliability statistics of such a small sample in this study were simply impossible. However, descriptive statistics and frequencies were run on both the intervention and control groups.

Demographics were obtained on specific variables considered important to an educational program with respect to West African culture. This included gender, number of members in household, number of children in household, number of children and adults who are students in the household, as well as community and church affiliation. Gender is important because women have very laborious roles within the household. Urban Ghanaian households tend to have larger family and /or extended family units compared to Western households. Also, this urban area is largely a Christian evangelical community where much education is received and disseminated through a spiritual conduit, even health-related education.

The results of the survey questionnaire were aggregated utilizing Chi square analysis between groups. The KAP tool-modified that consisted of 23 categorical questions was further modified to include questions that spoke directly to the theoretical components of the educational program, specifically 1) water contamination and its effects on health, 2) water and food sanitation, and 3) sewage and waste disposal as they related to the health education domain of the PEN 3 model [11]. I also considered themes embedded in the educational appropriateness domain, specifically the perceptions of the health constructs of Airhihenbuwa’s model when teasing out specific questions for statistical analysis. The synthesis of the aforementioned domains of the PEN 3 model in this study also embodies the third and final domain: cultural appropriateness as a guiding principle.

The majority of the community members who participated in this research translation project had underlying knowledge and appropriate practice behaviours with respect to hygiene practices. For example, in the areas of educational focus that included water storage, treatment, and disposal, most respondents in both groups (79.7%) agreed that water storage needed to occur with a lid and despite 97.9% of the respondents citing that they obtained their water from yard taps, 73.3% still treated their water through a chemical or boiling process suggesting a concentrated awareness that city piped water is not completely safe. This reinforces the fact that the educational needs in urban sub-Saharan Africa may be very different than those of rural sub-Saharan Africa requiring educational programs to be tailored very differently. However, there were several areas related to water storage and hygiene that yielded statistically significant results between groups. Household members in the control group were apt to wash containers less frequently than those who received the education ($X^2=10.81$, 3, $p=.013$). Perhaps one of the most telling results was related to this washing of drinking storage containers. The majority of members of the delayed intervention group wash drinking storage containers every other day ($n=11$) as compared to those who received the education first ($n=3$). Those who received the education prior to the survey were three times more likely to wash their container once or twice per day Also, household members who received the education used the same water less frequently than those who were in the control group and received the education in a delayed format ($X^2=15.71$, 2, $p=.000$), reinforcing the idea that hygiene practices are a learned concept.

Limitations

Long term impact and sustainability is important to any educational

program. For replication of such a project, a Phase 2 extension with booster education and repeat measures is important to measure sustained knowledge over time.

Due to the small sample size, it is difficult to generalize the findings to the greater population. Subjects were recruited from the clinic population as well as the urban market. It is possible that recruited participants have greater knowledge of hygiene practices because they have sought health care at the International Mission. The KAP tool, although modified to better suit the cultural constructs of an urban area of the western region of Ghana, had components that weren't particularly relevant to urban water knowledge. For example, 12 questions having to do with water sources did not appear relevant in a sample where 97.9% retrieved their water from a piped source such as yard or street taps. Anecdotally, the trained community health workers cite that many urban community members obtain their water from non-piped sources, reinforcing the concern that a small sample cannot generalize to the greater population. It also raises concern that convenience sampling in other cultures runs the risk of excluding potential subjects due to lack of trust. Conversely, those participating may exhibit a research phenomenon known as social desirability that explains trying to please the researcher.

Modifying the survey to better suit the community demographic can only be achieved through further immersion travel to this community. Further research translation work is needed to explore more in depth the knowledge, attitudes and practices surrounding health practices with actual diarrheal disease and prevention methods.

"Nsu!" was complicated by the logistics of a small window of time by which the community health education could be conducted. From the point that subjects were recruited, there was little time to assist participants with scheduling conflicts to ensure their participation or to reschedule subsequent groups. Additionally, with language and reading literacy realities, it might have been more beneficial to have smaller groups receive repeated information.

Conclusion

It is clear that conducting a research translation project in Ghana requires thoughtful and culturally-attuned planning. Ideally, this type of project would require a minimum of one month to carry out all aspects of the project with methodological rigor. Additionally, the attempts to multi-task this research translation project while operating a clinic and also mentoring/educating student nurses presented a real barrier, placing a burden on the rigor of methods delivery. For example, on the day that the education was being delivered in a delayed format to the control group, the two trained community health workers were 30 minutes late for the education. The participants were restless and becoming increasingly impatient, despite this being a cultural norm. Although data was not being collected on this group after their education session, the investigator was concerned regarding the quality of the product that was promised them. Hence, the ethical importance of offering the education in a delayed format may have seemed complacent given the tardiness of the educators.

The results gained from this research translation project and the lessons learned resulted in a critical needs assessment that suggests members of the community may have adequate underlying knowledge surrounding water sources and disposal practices. This can serve as an impetus to build a larger scale community health education project surrounding clean water practices that is refined and tailored to the unique cultural needs of the community.

"NSU!" as a research translation project served a limited population in its initial delivery. Future offerings should be reinforced through booster education and subsequently be disseminated by participants to family members and others in the community. This chain of educational communication has the possibility of reaching the greater population. The community health workers involved in the project will almost certainly provide ongoing hygiene education. Additionally, we will continue to provide other, critical forms of community health education during future collaborative clinics that occur annually in August. The project findings provide a basis for future hygiene education, as well as a framework dedicated to improving population outcomes in lower resource communities, globally.

References

1. Duncker L (1999) Hygiene awareness for rural areas in South Africa. 25th WEDC conference of integrated development for water supply and sanitation.
2. United Nations (2014) Water and sanitation-United Nations sustainable development.
3. <http://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease>
4. United Nations international children's emergency fund (2018) Diarrhoeal disease.
5. Waggie F, Gordon N, Brijal P (2004) The school, a viable educational site for interdisciplinary health promotion. *Education for Health* 17: 303-312.
6. <https://www.cdc.gov/healthywater/global/diarrhea-burden.html>
7. https://www.cia.gov/library/publications/the-world-factbook/geos/print_gh.html
8. Ghana health mission (2008) International mission clinic health data, August 2008 mission.
9. <https://www.sanitationchallenge4ghana.org/resources/>
10. Belkind-Valdovinos U, Belkind-Gerson J, Sanchez-Francia D, Espinoza-Ruiz MM, Lazcano-Ponce E (2004) Nitazoxnide vs albendazole against intestinal parasites in a single dose and for three days. *Salud Publica Mexico* 46: 333-340.
11. Nyamwaya D (2003) Health promotion in Africa: Strategies, players, challenges and prospects. *Health Promotion International* 18: 85-87.
12. Airhihenbuwa CO (1995) *Health and culture: Beyond the western paradigm*. SAGE Publications, Inc.
13. Ellis FSN (2015) *Cultural sensibility in healthcare: A personal and professional guidebook*. Sigma theta tau international honor society for nurses, Indianapolis IN.
14. Almedom AM (1996) Recent developments in hygiene behavior research: An emphasis on methods and meaning. *Tropical Medicine and International Health* 1: 171-182.
15. Hadera HG, Boer H, Kuiper WAJM (2007) Using the theory of planned behaviour to understand the motivation to learn about HIV/AIDS prevention among adolescents in Tigray, Ethiopia. *AIDS Care* 19: 895-900.
16. Azjen I (1991) The theory of planned behavior. *Organizational Behavior and human decision processes* 50: 179-211.
17. Karnell AP, Cupp PK, Zimmerman RS, Feist-Price S, Bennie T (2006) Efficacy of an American alcohol and HIV prevention curriculum adapted for use in South Africa: Results of a pilot study in five township schools. *AIDS Educ Prev* 18: 295-310.
18. Whitney W, Dutcher GA, Keselman A (2013) Evaluation of health information outreach: Theory, practice, and future. *J Med Libr Assoc* 101: 138-146.
19. Norwegian refugee council (2015) Knowledge, attitude and practice (KAP) Survey-Final report NRC, SC, WV Kirkuk - Iraq, September 2015.
20. Metwally AM, Saad A, Ibrham NA, Emam HM, El-Etreby LA (2007) Monitoring the progress of the role integration of environmental health education with water and sanitation services in changing community behaviors. *Int J Environ Health Res* 17: 61-74.
21. Makutsa P, Nzaku K, Ogutu P, Barasa P, Ombeki S, et al. (2001) Challenges of implementing a point of use water quality intervention in rural Kenya. *Am J Public Health* 91: 1571-1573.

22. Curtis V, Kanki B, Cousens S, Ddiallo I, Kkpozehouen A, et al. (2001) Evidence of a behavior change following a hygienic promotion programme in Burkina Faso. *Bull WHO* 79: 518-527.
23. Macassa G, Ghilagaber G, Bernhardt E, Burstrom B (2004) Contribution of household environment factors to urban childhood mortality in Mozambique. *East African Medical Journal* 81: 408-414.
24. Duncker L (2001) The KAP tool for hygiene: A manual on knowledge, and practices study for hygiene awareness in the rural areas of South Africa. WRC Report No TT 144/00.
25. Care (2008) Defending dignity, fighting poverty.
26. http://www.ehproject.org/PDF/Strategic_papers/SR-9%20Lit%20Rev.pdf
27. United nations development programme (2005) *Water for life: Community water security*. New York, NY: The Hesperian Foundation.
28. Salkind NJ (2016) *Statistics for people who think they hate statistics (6th)*. Thousand Oaks, CA: SAGE.
29. Mnukwa N, Sigwaza T, Ngubane N (2001) Framework for providing health and hygiene education: People and systems for water, sanitation and health. Paper presented at the 27th WEDC conference, Lusaka, Zambia.
30. Coe R (2002) It is the effect size, stupid. In: What effect size and why it is important. The British educational research association annual conference.