International Journal of Aquatic Research and Education

Volume 7 | Number 3 Article 8

8-1-2013

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Cara E. Hammerton
Surf Educators International, cara@surfeducatorsinternational.com.au

Robert W. Brander
The University of New South Wales

Nicholas Dawe
Surf Educators International

Craig Riddington
Surf Educators International

Roger Engel
Macquarie University

International Journal of Aquatic Research and Education, 2013, 7, 254-265

International Journal of
Aquatic Research and Education
www.IJARE-Journal.com
RESEARCH

Approaches for Beach Safety and Education in Ghana: A Case Study for Developing Countries With a Surf Coast

Cara E. Hammerton, Robert W. Brander, Nicholas Dawe, Craig Riddington, and Roger Engel

Beach drowning in low- and middle-income countries (LMICs) such as the western African nation of Ghana, is a poorly understood problem. A physical site assessment of the Ghana coast was undertaken to determine beach types, hazards, and the potential for implementing community surf education and lifeguarding services. A questionnaire survey was administered to 346 participants in coastal regions providing information related to beach drowning. Results demonstrated that a significant number of drownings occur on this wave-dominated coastline, particularly on public holidays, with 82% of participants knowing someone who had drowned. Ignorance of the rip current hazard was evident with 37% of participants, particularly students, indicating they would swim in a hazardous rip current location. The majority of participants (57%) indicated they would seek help when they saw someone in a dangerous situation. These results indicate a strong need for community beach safety education and lifeguard services in Ghana.

Keywords: fatal and nonfatal drowning, lifeguards, swimming beaches, water safety, lifesaving

According to the World Health Organization (2010), drowning is the third leading cause of unintentional injury death with a conservative estimate of 388,000 annual drowning deaths worldwide. Unintentional drowning is particularly common in developing nations with 96% of all unintentional drowning deaths occurring in low- and middle-income countries (LMICs; WHO, 2010). Many LMICs are situated in tropical and subtropical geographic regions with long stretches of coastline often exposed to high energy open ocean wave conditions. While much of the existing

Cara E. Hammerton, Nicholas Dawe, and Craig Riddington are with Surf Educators International in Sydney, Australia. Robert W. Brander is with the School of Biological, Earth, and Environmental Science at The University of New South Wales in Sydney, Australia. Roger Engel is with the Department of Chiropractic at Macquarie University in Sydney, Australia.

literature on drowning in LMICs has focused on inland and child drowning (e.g., Peden & McGee, 2003; Hyder et al., 2008; Rahman et al. 2009; 2012; Brenner & Taneja, 2010), less attention has been given to the extent and nature of beach drowning in these regions (Suresh Kumar Shetty & Shetty, 2007). Little is known about the nature and cause of beach drowning in LMICs and data on the number of drowning incidents are largely nonexistent. Furthermore, the perceptions and understanding by beach users of potential drowning hazards are not well understood.

Fatal drownings at beaches still occur in high-income countries (HICs) with almost 100 reported in the United States (United States Lifesaving Association, 2011) and 29 in Australia (Surf Life Saving Australia, 2011) in 2011. These numbers likely would be much higher if not for mitigation measures such as lifeguarding services, warning signage, and community education programs. These mitigation measures simply do not exist or are in their infancy in LMICs. Introduction of these interventions would almost certainly help reduce the rate of beach drowning in these countries.

The African region is reported to have the highest rates of drowning in the world (Peden and McGee, 2003; WHO, 2010). The International Life Saving Federation (ILSF, 2007) reported 65,196 (50,006 male and 15,190 female) deaths by drowning in the African region in 2002. African data are known to be unreliable (ILSF, 2007; WHO, 2010), partly due to the lack of death registration data in the sub-Saharan region. Of the 47 sub-Saharan African countries, only 4 had mortality and cause of death data available (ILSF, 2007). Many African countries have a large coastal population with easy access to beaches that feature significant wave activity and inherent hazards such as deep water, waves, tidal inlets, and near-shore currents. While beach drowning is an important component of the overall drowning problem in these regions, existing information is largely anecdotal.

This paper used the African nation of Ghana as a case study for approaching the issue of beach drowning in LMICs with coastlines characterized by strong wave and energetic surf conditions. In 2010–2011, the first author lived in the coastal region of Ghana between the towns of Accra and Busua (Figure 1). During this time, it became apparent through conversations with the locals that beach drowning was a regular and widespread occurrence and that little was being done to address the problem. This experience led to subsequent contact and collaboration with an Australian-based organization, Surf Educators International (SEI) who initiated a follow-up study in 2012.

The aim of this paper is to describe the potential of a multifaceted approach to address the beach drowning problem in Ghana. Our approach combines physical and social science research. The preliminary results of a pilot study are presented here as a template which we propose could be applied to other developing nations. While a plethora of attempts exist at addressing beach drowning in developed countries (HICs), few of these approaches have been formally described in the literature (Brander and MacMahan, 2011). We hope that application of the approach described in this study may help to reduce the incidence of future beach drowning in Ghana and in other LMICs.

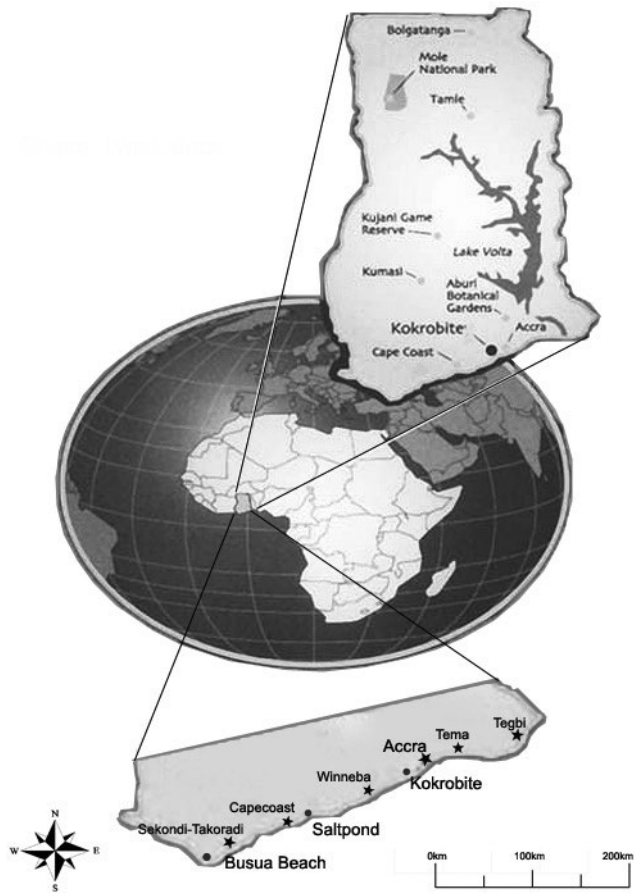

Figure 1— Location of the western African nation of Ghana showing coastal regions of relevance to this study.

The Ghana Population, Coast, and Drowning Problem

Ghana is a situated on the west coast of sub-Saharan Africa, bordered between Cote D'Ivoire to the west and Togo to the east (Figure 1). It has a population of 23 million with 94.7% under the age of 64 (Ghana Statistical Service, 2009). With a coastline of 539 km in length, 43.1% of the population is considered to live in regions by the coast (Ghana Statistical Service, 2009). Ghana is divided into ten regions, with the Western, Central, Greater Accra, and Volta Regions bordering the coastline. The coast is also home to two major cities, the capital Accra (pop. 1,848,614), and Sekondi Takoradi (pop. 559,548). The climate in Ghana is tropical

with annual average temperature ranging from 26°C – 28°C with coastal regions having two wet seasons, March to July and September to November (McSweeney et al., 2012). Sea temperatures vary between 27°C –29°C year round (Allersma & Tilmans, 1993).

With a narrow continental shelf and absence of offshore islands, the Ghana coastline is exposed to persistent swell waves generated from storms in the south Atlantic Ocean. Deep water wave heights average 1–1.5 m, although waves of 2–3 m are common. Wave periods are in the order of 12–13 s on average (Allersma and Tilmans, 1993). During monsoonal conditions, locally-generated wind waves in the Gulf of Guinea from the southwest tend to be smaller, rarely exceeding 1.25 m with shorter wave periods of 3–4 s (Allersma and Tilmans, 1993). Tides along the coast are semidiurnal and microtidal with an average tidal range of approximately 1 m.

Beaches in Ghana are frequented mainly by those living adjacent to the coast and by tourists (both domestic and international). Primary beach activities include bathing/cooling off and fishing, the main source of food for coastal Ghanaians. Fishing is dominated by males utilizing handmade wooden fishing vessels. Navigating boats out and back into shore through heavy surf is hazardous, particularly as many fishermen cannot swim. While official drowning data are not available for Ghana, frequent news reports refer to drowning, mainly in conjunction with public holidays. For example, it has been reported that an average of four people drown at La Pleasure Beach (also known as Labadi Beach) in the Greater Accra region every public holiday (Tuffour, 2010). While exact numbers are not known, our preliminary research indicates that up to 15 people per week could be caught in life-threatening situations while swimming at beaches outside the capital city, with at least two of these resulting in fatalities.

Outside of privately-owned areas, there are no formal lifeguard services provided on Ghana's beaches and no signage informing the locals of dangerous surf conditions and hazards. Rip currents, which are strong, narrow seaward flows of water, are the most common hazard to beach swimmers worldwide (e.g., Brander and MacMahan, 2011; Brander, Bradstreet, & Sherker, 2011) and are prevalent along the Ghana coast where there are many anecdotal reports of people being 'carried out to sea.' Unfortunately, adequate swimming and surf education is lacking in Ghana. There are no trained swim teachers nor are there any adequate swimming or beach/surf safety training programs in place. Based on the first author's experience, concern about beach drowning among the coastal villagers and the need for improved awareness and education is high.

Method

The proposed multifaceted approach to tackling the coastal drowning problem in Ghana is largely based on observations made during the first author's visit to Ghana in 2010–2011 and a subsequent preliminary pilot study carried out by the SEI team in August 2012. The approach consists of four components: (1) assessing the physical character of the beaches and associated hazards in a region; (2) surveying the local inhabitants and beach users regarding their knowledge of drowning, beach hazards, and safety; (3) establishing a community education program in drowning prevention; and (4) developing a plan for creating and sustaining an appropriate and

practical lifeguarding service. It should be noted that this study is ongoing and is still being refined. We have gained valuable insights in developing this approach; insights we believe could be relevant in other LMICs and should be shared.

Research Instruments

Coastal risk assessment. To understand the nature of beach drowning in a particular region, it is essential first to assess and describe the physical character of the coast to ascertain the types of beach and surf hazards present. Beach morphology is described by Abraldes and Perez-Gomez (2009) as one of the main risk factors to consider for beach injury prevention. This is not surprising given that the types of hazards that can lead to drowning or injury are strongly dependent on the morphology and wave climate of the beach. Numerous physical classifications of beach types exist in the literature (e.g., Wright & Short, 1984) and attempts have been made to relate these types to a beach hazard rating system (e.g., Short & Hogan, 1994; Scott, Russell, Masselink, & Wooler, 2009). In most LMICs, formal documentation of the physical characteristics of beaches and coastline does not exist.

A preliminary coastal risk assessment of the Ghana coastline was undertaken over a 10-day period in August 2012 with site assessments of beaches along a 350 km stretch of the coast (65% of total coastline) from Axim in the Western region to Accra in the Greater Accra region (Figure 1). Most beaches were accessible by foot with some isolated beaches requiring 4WD access. Site assessments involved noting geological, morphologic, wave and tidal characteristics, and the presence/absence of rip currents at each beach. Because the Ghana beaches were found to be similar to those in southeastern Australia, the broad beach type was recorded based on the classification system described by Short (2006). Also noted were the presence of anthropogenic influences, such as seawalls and other structures, and the type(s) of beach usage by locals. Each beach was assessed in terms of suitability for implementing community education programs and/or lifeguard presence. This was largely based on proximity to schools and major transport hubs/junctions, local populations, frequency and type of beach usage, and the physical conditions and hazards of the beaches themselves.

Survey questionnaires. We conducted social science research using a pilot survey questionnaire in the Western, Central, and Greater Accra regions of Ghana (Figure 1) during August 2012. The purpose was to establish an initial profile of the demographics of local beach users, existing knowledge about beach safety and/or drowning prevention and how a beach and surf safety education program might be received. The survey questionnaire (Appendix A) was divided into four sections and consisted of 11 quantitative and 2 qualitative questions. The sections were (1) personal details; (2) drowning; (3) existing abilities and knowledge; and (4) future education programs. The questionnaire and subsequent study analysis received human research ethics approval from Macquarie University in Sydney, Australia (Ref. # 5201200521) and was trialed before the pilot study. Participants had to be over the age of 18 and written and/or verbal informed prior consent was obtained from all participants with the aid of a translator, where applicable. A local language translation of the questionnaire was available for non-English speaking

participants. As a pilot study, one of our intentions was to test the validity and reliability of the questionnaire to improve future iterations.

Three research team members from SEI undertook the role of administering the questionnaires and providing assistance in respect to any competency and comprehension issues that arose. The research team members were stationed on the main beaches of each region dressed in SEI uniforms. Potential participants voluntarily approached a member of the research team out of curiosity invoked by the SEI uniform. As such the participants were self-selecting, and no coercion was involved. Many coastal residents and tourists were willing to participate in a study that would benefit the local population.

Quantitative questions were demographic in nature (e.g., age, sex, location, occupation) and closed-ended (e.g., Q. B1 '*Do you know anyone who has drowned in your area?'*; Appendix A). Qualitative questions were open-ended and designed to ascertain the participant's level of knowledge about drowning prevention. A visual aid was used (Q. C5) to identify choice of swim location on a beach with a rip current visible. The picture depicted a beach with four locations (A, B, C, D) with location B being in the middle of a rip current. Participants were asked to identify the safest place to swim by choosing one of the four locations (Appendix A).

Challenges faced in conducting the questionnaire mainly related to communication issues. Although English is the official language of Ghana, a translator was needed when conducting the questionnaires in more remote and rural areas. Some English terms in the questionnaire were not understood even by those who spoke English fluently; these words included *drowning* and *prevention*. This was overcome by substituting the word *drowning* for *death in the sea* and by explaining the term *prevention* until the question was understood. One of the most significant communication issues was the use of the word *surf.* When the term *surf education* was used, most participants were confused and asked if the researchers were teaching people how to surf. Simply changing the term *surf education* to *ocean education* was enough in most cases.

Results

The pilot coastal risk assessment indicated that the majority of beaches along the Ghana coast were wave-dominated and characterized by varying configurations of surf zone sand bars and channels. The main physical hazards were the presence of breaking waves across wide surf zones, longshore currents, and rip currents, which occur along the beach and adjacent to many headlands. Beaches west of Cape Coast tended to be characterized by short stretches of embayed sandy beaches with headlands and rocky outcrops offering some protection from the prevailing winds and waves in their eastern corners. East of Cape Coast, the beaches were characterized more by long, exposed sandy beaches ranging from flat and wide high-energy dissipative beaches to intermediate beaches with longshore, rhythmic, and transverse bar and rip morphology (Short, 2006). Only minimal protection is offered from occasional headlands and rocky outcrops along this section of the coast. Of note, the beaches in the vicinity of Cape Coast, a major domestic and international tourist destination with large local populations, were different, being

steep, with prominent low tide terrace morphology resulting in changing wave conditions and hazards between high and low tides. Although a more detailed assessment of physical conditions taken over larger spatial and temporal scales is needed, this basic information is useful as it provided a foundation for developing initial community education and lifeguarding programs.

A total of 346 participants completed the pilot survey questionnaire with 113 in the Central region, 113 in the Greater Accra region, and 120 in the Western region. While a detailed analysis of questionnaire results has not yet been completed at the time of writing this manuscript, preliminary findings provided useful information. When asked if they knew someone who had drowned (i.e., "who died in the sea"), 82% of all respondents answered yes. This result was consistent across regions. In contrast, responses to the question about swimming skill varied significantly between regions with 87% of respondents in the Western region claiming they knew how to swim compared with 51% and 62% in the Central and Greater Accra regions, respectively. The difference can likely be attributed to the Western region having many more small coastal communities reliant upon ocean resources and thus perhaps these respondents were more familiar with ocean conditions than the other regions.

In terms of choice of safe swimming locations in the presence of a rip current, 37% of all respondents indicated that they would swim in the rip current—the incorrect choice. In general, fishermen seem to make safer swimming choices with around 60% indicating they would swim in the areas of breaking waves away from the rip current which was the safest place to swim. In contrast, students and women fishers were more likely to swim in the rip current location. These findings have implications toward developing community ocean (surf) education programs among target groups in terms of rip current awareness.

When respondents were asked what they would do if they found themselves in a dangerous situation while swimming, the majority of participants (45%) indicated they would call or raise their hand for help, followed by relaxing and floating with the current (21%) or trying to swim to the beach (20%). When asked what they would do if they saw someone in a dangerous situation while swimming in the ocean, the majority of respondents (57%) indicated they would call out for someone who could swim to save the person with only 12% saying they would help the person themselves. This finding indicates the need for trained lifeguards with appropriate skills and resources to assist swimmers in difficulty.

Discussion

Community Ocean Education

The need for ocean water safety education in Ghana is supported by the fact that 100% of questionnaire participants indicated they would welcome ocean education lessons for themselves and their communities. The question then became how to implement an ocean education program where none previously exists. The following describes our proposed 5-stage program that is being planned for trial implementation in Ghana.

Stage 1: Location selection of a pilot program. Identify small communities with 2–3 schools to test a pilot education program for children. The program delivery should be monitored and evaluated for effectiveness using techniques such as those described by Solomon et al. (2012) before expanding to larger population centers. Based on the physical site assessments, two locations were identified as suitable for a pilot education program: Busua Beach in the Western region and Saltpond in the Central region (Figure 1).

Stage 2: Development of appropriate pilot curriculum. Develop the content of the initial education program based on results of the physical site assessments, data gathered from the questionnaires, and findings from the literature relating to open water and surf swimming safety and hazards (e.g., McCool, Ameratunga, Moran, & Robinson, 2009; Moran, Quan, Franklin, & Bennett, 2011; Hatfield, Williamson, Sherker, Brander, & Hayen, 2012). This information should be combined with existing content from SEI surf education programs run in Australia.

Stage 3: Development of pedagogical content. Create the delivery of the education program using a combination of oral and visual presentations involving videos and workbooks. Tailored content should focus on topics such as the following:

- Basic ocean and surf knowledge
- Types of local beaches, beach morphology, and hazards
- Wave formation, wave breaking, and types of waves
- Interactions between waves and sand bars
- Rip currents—definition, formation, types, and identification
- Rip currents—appropriate responses if caught in one
- Recognition and understanding of safe/unsafe swimming areas
- How to react and respond to dangerous situations in the ocean

Because much of the content may be difficult to translate into Twi and Fanti (the two main local dialects of the coastal regions), the program will initially be pilot tested and taught exclusively in schools (both primary and high school level are applicable) where English comprehension is a requirement of all students. Meetings with school principals from one school in Busua and two schools in Saltpond found a significant level of interest for either training teachers to teach this program or having a representative from SEI deliver the program to the school.

Stage 4: On-beach education. A visit to a local beach (within walking distance of the schools) will be conducted as part of the program. The educator(s) will identify and explain the safe and dangerous areas of the beach and conduct a rip current identification and escape demonstration.

Stage 5: Practical surf skills. As the program becomes more well developed, participants will experience valuable 'hands-on' knowledge of surf conditions at the beach with supervised water activities that include the following:

- Wading and basic surf negotiation
- Diving over/under waves and bodysurfing

- Catching gentle broken waves on foam boards
- Additional surf awareness and rip current identification
- Supervised rip current floating and escape on foam boards

Implementing this proposed 5-stage program has obvious challenges. It is anticipated that initially few of the participants will be able to swim and familiarity with English may be a problem. Therefore the SEI training educators will have to have lifeguard credentials and work with an interpreter at all stages of the program. The interpreter should be able to assist with translating concepts related to surf science and ocean education into a Ghanaian context. It is anticipated that the initial pilot program will require the services of two lifeguards, trained in delivering ocean water safety education for a period of one month. The lifeguards will divide their time between delivering education in class and on the beach as well as training teachers and other interested locals.

The primary goal of the 5-stage program is to establish the first community-based surf education program in Ghana. It is hoped that this will improve community knowledge about local beaches and the ability to identify and avoid life threatening hazards and situations such as rip currents. Following a period of intensive training, it is envisaged that the running of the program will be handed over to the local Ghanaians.

Development of Lifeguarding Services

As described by Abraldes and Pérez-Gómez (2009), one of the main categories essential for risk factor analysis of beaches is the presence of a lifeguard service. It is well established that the most effective means of reducing the incidence of drowning on beaches is the presence of lifeguards (Branche & Stewart, 2001). There are presently no public lifeguarding services at any of the beaches in Ghana except for 10 lifeguards operating at a privately-owned area on Labadi Beach in Accra. At present, rescues in the ocean outside Labadi Beach are done by members of the public, mostly fisherman or young male locals who happen to be using the beach for recreation at the time of the drowning. Methods used for ocean rescue vary between regions and ought to rely upon the type of beach usage and resources available on the beach.

Commonly observed local rescue techniques. Most rescues in the Western Region are carried out by flotation devices such as surfboards or body boards. The reason for this is that beaches in this area are surfing destinations for tourists and most accommodation venues have surfboards and body boards available. In the Central region, it is often a fisherman who swims out to the individual(s) in danger and ties a fishing rope around their waist so they may be pulled in to shore by other fishermen. In the Greater Accra region, a common rescue method observed was for the rescuer to swim behind the individual(s) in trouble and use a push-swim, push-swim technique to bring the individual(s) safely back to shore. In most cases, even a potential rescuer with adequate swimming skills will not have the skill set and knowledge required to properly conduct a successful rescue operation in the ocean, particularly if the victim has experienced a nonfatal drowning episode.

Proposed pilot lifeguard operations. As a result of the physical site assessments, two beaches have been identified as ideal for trial lifeguard operations: Busua beach

in the Western region and Kokrobite beach in the Greater Accra region (Figure 1). These were selected because of three factors: (1) easy accessibility to the beach; (2) high usage by the public; and (3) reports of a high drowning rate. Both beaches are also known for particularly high incidences of drowning on public holidays. The trial lifeguard operation would operate over a one month period and involve two Australian-trained SEI lifeguards who would also be involved in the surf education awareness program described previously. The lifeguard trial would involve two components: (1) on-beach lifeguarding during public holidays and (2) training locals to be lifeguards. The purpose of having trained lifeguards on beaches during public holidays, when most drownings occur, allows for examination of whether lifeguard presence has an immediate effect on reducing the incidence of drowning. If effective, this would expose locals to the importance of having lifeguard services and help justify the need to establish a permanent lifeguarding service.

There is great potential to train locals at both Busua and Kokrobite in lifeguard operations. During the site visits, a number of local surfers, fishermen, and laborers who already had strong swimming skills, knowledge about waves and rip currents, and experience with performing rescues showed an interest in receiving lifeguard training. Training lifeguards and implementing a self-sustaining lifeguard service at these locations, or anywhere in Ghana, is fraught with challenges involving differences in beach culture, language issues, and ongoing commitment.

Potential challenges to success. The most significant challenge is the application of a western style lifeguarding approach to beach and surf interactions in an entirely different socioeconomic and cultural environment. Any training program must consider these differences very carefully and extend beyond the provision of standard theoretical and practical lifeguard training techniques (e.g., first aid, ocean rescue, surveillance). For example, it was observed during the site visits that given the extremely high daytime temperatures, many men in coastal communities relax or sleep from midmorning to the middle or late afternoon. This is also the peak time for ocean swimming and future trained Ghanaian lifeguards would need to be present and alert during these times. Work is presently underway to design an appropriate and culturally relevant training course for potential lifeguard trainees that would be administered and assessed by SEI lifeguards. This is partially assisted by the results of the pilot survey questionnaire.

In terms of language, many locals who use the beach daily may be illiterate, which poses challenges for the potential use of signage relating to the lifeguard service or beach hazards, even in the local language. Finally, it is all well and good to train lifeguards in the hope that an established lifeguarding service will continue and thrive once the training staff leave, but the question remains if it actually will. There must be a designated official in each coastal region who can coordinate the lifeguarding service and, of course, there must be funding and monetary incentive for individuals to continue working as lifeguards. These are significant challenges to overcome.

Conclusions

The nature and extent of beach drowning in developing countries (LMICs) with surf coasts clearly represent an undocumented and under-reported problem that currently lack suitable interventions. This paper has proposed and described a

multifaceted approach to address the incidence of beach drowning using the African nation of Ghana as an exemplar. The approach uses preliminary physical and social assessments of Ghana's beaches and coastal population to highlight the need for the development of community beach safety education as well as lifeguard services. While similar endeavors have been implemented by other organizations in other countries, these initiatives often have not been formally documented in the literature. Our approach faces many challenges, but we hope that the ideas expressed here will motivate and assist others with similar goals to take steps to reduce the occurrence of drowning on beaches in LMICs.

Acknowledgments

This study was funded by Surf Educators International (SEI) and the funds raised during events held by SEI. Thanks to Sarah Knapman for assistance with the field surveys, filming and photography in Ghana. Mischa Moraza is thanked for assisting with the data analysis of the questionnaires.

References

Abraldes, J.A., & Pérez-Gómez, J. (2009). Assessment of risk factors for injuries on beaches. International Journal of Aquatic Research and Education, 3, 272–283.

Allersma, E., & Tilmans, W. (1993). Coastal conditions in West Africa – a review. Ocean and Coastal Management, 19(3), 199–240.

Branche, C.M., & Stewart, S. (Eds.). (2001). Lifeguard Effectiveness: A Report of the Working Group. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

Brander, R.W., & MacMahan, J.H. (2011). Future challenges for rip current research and community outreach. In S. Leatherman & J. Fletemeyer (Eds.), Rip Currents - Beach Safety, Physical Oceanography, and Wave Modeling (pp. 1–29). Boca Raton, FL: CRC Press.

Brander, R.W., Bradstreet, A., & Sherker, S. (2011). Responses of swimmers caught in rip currents: perspectives on mitigating the global rip current hazard. International Journal of Aquatic Research and Education, 5, 476–482.

Brenner, R.A., & Taneja, G. (2010). Injury prevention: Drowning. In R.E. Tremblay, M. Boivin, RDeV. Peters RDeV, Eds. Encyclopedia on Early Childhood Development [online]. Montreal, Quebec: Centre of Excellence for Early Childhood Development and Strategic Knowledge Cluster on Early Child Development; 1-6. http://www.child-encyclopedia.com/documents/BrennerTanejaANGxp.pdf accessed Oct 24, 2012.

Ghana Statistical Service (GSS). (2009). Ghana Demographic and Health Survey 2008. Accra, Ghana.

Hatfield, J., Williamson, A., Sherker, S., Brander, R., & Hayen, A. (2012). Development and evaluation of an intervention to reduce rip current related beach drowning. Accident; Analysis and Prevention, 46, 45–51. PubMed

Hyder, A.A., Borse, N.N., Blum, L., Khan, R., El Arifeen, S., & Baqui, A.H. (2008). Childhood drowning in low- and middle-income countries: urgent need for intervention trials. Journal of Paediatrics and Child Health, 44(4), 221–227. PubMed

International Life Saving Federation (ILSF). (2007). The World Drowning Report (25 pp.). Belgium: Leuven.

McCool, J, Ameratunga, S., Moran, K., & Robinson, E. (2009). Taking a risk perceptions approach to improving beach swimming safety. International Journal of Behavioral Medicine, 16(4), 360–366. PubMed

McSweeney, C., New, M., & Lizcano, G. (2012). Ghana. UNDP Country Climate Change Profiles. Available at: http://country-profile.geog.ox.ac.uk accessed Oct 24, 2012.

Moran, K., Quan, L., Franklin, R., & Bennett, E. (2011). Where the evidence and expert opinion meet: A review of open-water recreational safety messages. International Journal of Aquatic Research and Education, 5, 251–270.

Peden, M.M., & McGee, K. (2003). The epidemiology of drowning worldwide. Injury Control and Safety Promotion, 10(4), 195–199. PubMed

Rahman, A., Mashreky, S.R., Chowdury, S.M., Giashuddin, M.S., Uhaa, J., Shafinaz, S., . . . Rahman, F. (2009). Analysis of childhood fatal drowning situation in Bangladesh: exploring prevention measures for low-income countries. Injury Prevention, 15, 75–79. PubMed

Rahman, F., Bose, S., Linnan, M., Rahman, A., Mashreky, S., Haaland, B., & Finkelstein, E. (2012). Cost-effectiveness of an injury and drowning prevention program in Bangladesh. Pediatrics, 130(6), e1621–e1628. PubMed

Scott, T.M., Russell, P.E., Masselink, G., & Wooler, A. (2009). Rip current variability and hazard along a macro-tidal coast. Journal of Coastal Research, SI, 50, 1–6.

Short, A.D. (2006). Australian beach systems – nature and distribution. Journal of Coastal Research, 22(1), 11–27.

Short, A.D., & Hogan, C.L. (1994). Rip currents and beach hazards: their impact on public safety and implications for coastal management. Journal of Coastal Research, SI, 12, 197–209.

Solomon, R., Giganti, M.J., Weiner, A., & Akpinar-Elci, M. (2012). Water safety education among primary school children in Grenada. International Journal of Injury Control and Safety Promotion, 10.1080/17457300.2012.717083. PubMed

Suresh Kumar Shetty, B., & Shetty, M. (2007). Epidemiology of drowning in Mangalore, a coastal Taluk of South India. Journal of Forensic and Legal Medicine, 14, 410–415. PubMed

Surf Life Saving Australia. (2011). National Coastal Safety Report 2011. Sydney, Australia.

Tuffour, F.A. (2010, April 7). 4 drown every year at La Beach. The Ghanaian Times. Retrieved from http://newtimes.com.gh/story/4-drown-every-year-at-la-beach

United States Lifesaving Association. (2011). 2011 National Lifesaving Statistics. Available at: http://arc.usla.org/Statistics/current.asp?Statistics=Current accessed Oct 10, 2012.

World Health Organization. (2010). Drowning. Fact Sheet 347. Available at: www.who.int/mediacentre/factsheets/fs347 accessed Oct 10, 2012.

Wright, L.D., & Short, A.D. (1984). Morphodynamic variability of beaches and surf zones: A synthesis. Marine Geology, 56, 92–118.