

<p>Institution: University of Strathclyde</p>
<p>Unit of Assessment: 14</p>
<p>Title of case study: Reducing morbidity and mortality in Malawi through an integrated Environmental Health approach to improving water quality and health</p>
<p>1. Summary of the impact Strathclyde research underpinned formation of the Scottish Chikhwawa Health Initiative (SCHI) in 2006, to deliver tangible health benefits by reducing major causes of disease and death in Chikhwawa, Malawi. Health impact occurred through training of government personnel and community volunteers, combined with increased infrastructure capacity, at health facilities and in the community, producing improvements in water quality, sanitation and communicable disease control. Within the first 2 years of implementation among a population of 5700 people, a 30% reduction in diarrhoeal disease was achieved, and access to safe water improved through increased water points and improved water storage [1]. Initial success saw expansion of the initiative to 150 communities covering a population of 110,000.</p>
<p>2. Underpinning research Context: Diarrhoea is responsible for high levels of morbidity and mortality across sub-Saharan Africa; in the Malawian population of just over 15 million, national diarrhoeal prevalence is estimated at 17%, while the figure for the under-fives, with a population of 2.8 million, ranges from 18-22% annually [2]. It is critical for countries like Malawi to address the issue of diarrhoeal disease if they are to achieve Millennium Development Goal (MDG) 4, which commits to reducing child mortality by two thirds before 2015. Understanding disease prevalence and source is essential to allow identification of appropriate controls and interventions aimed at reducing morbidity and mortality, and thus reducing reliance on curative health measures which are often not available or are accessed too late. Effective community health workers, health access and health education are key to the control and treatment of diarrhoeal disease. However, Malawi suffers from a weak disease surveillance system, poorly trained community health workers and limited health access which compound the effects of preventable diseases such as diarrhoea. Key findings: Research undertaken at the University of Strathclyde investigated the Environmental Health approach to diarrhoeal disease control in Malawi using <i>Cryptosporidium</i>, an extremely environmentally robust protozoan parasite, as a case study. Infection, manifesting as severe gastroenteritis, is particularly devastating to those with weakened immune systems, e.g. under 5s, and those immuno-compromised through malnutrition or HIV/AIDS. In Malawi, <i>Cryptosporidium</i> is thought to be responsible for around 10% of diarrhoea cases in children under 5, rising to 21% in the immuno-compromised population [3]. Morse and colleagues set out to identify risk factors associated with childhood cryptosporidiosis and environmental sources of infection in both rural and urban environments, hospital and community settings [3,4]. In addition to demonstrating wider species diversity in rural settings (possibly due to increased malnutrition and exposure to infected animals), the authors clearly demonstrated through qualitative, quantitative and observational data a picture of faecal-oral transmission of diarrhoeal disease, not only for <i>Cryptosporidium</i>, but also for other diarrhoea causing agents. For example, in surveying around 100 homes in Chikhwawa, despite 84% of respondents indicating that they washed their hands after defecation, 75% had bacteria indicative of faecal contamination isolated from their hands [4]. Immersion of hands and utensils in household stored drinking water is a known risk factor for contamination. Therefore it was not surprising that 76% of household stored water, utilised for all domestic aspects, such as drinking and washing, contained faecally derived micro-organisms[4]. The authors established the need for improvements in water, sanitation, household hygiene and animal control to reduce the incidence of infection in this population. Confirmation of Cryptosporidiosis is only possible through laboratory investigation, and as there is no effective, specific treatment or immunisation, an Environmental Health approach, targeting all diarrhoeal diseases, is essential to reducing prevalence and mortality. Therefore subsequent research, based in the rural district of Chikhwawa, aimed at reducing the diarrhoeal disease burden, had a wider remit to encompass all sources of infection [2, 5]. Factors identified by the research, affecting</p>

Impact case study (REF3b)

prevalence, included low-quality water sources, water hygiene particularly after collection, poor sanitation, poor personal hygiene practices, unsustainably high population density, and poor hygiene practices associated with food handling [3,5,6]. Grimason et al, and Masangwi et al also demonstrated that despite both rural and urban populations showing knowledge of the links between hygiene and disease prevention, discrepancies exist between knowledge and actual practice [2,6]. As such, the research determined that addressing diarrhoeal disease control and treatment required an integrated and multidisciplinary approach to health education and support to affect sustainable change.

Key Researchers at University of Strathclyde: Dr Tracy Morse, Research Fellow, SCHI Project Manager 2006-present, Dept. of Civil and Environmental Engineering; Dr Anthony Grimason, Senior Lecturer Dept. of Civil and Environmental Engineering 1994-2009, now Professor in Environmental Health, University of Malawi 2010-2013.

3. References to the research

References 3, 5 & 6 best indicate the quality of the underpinning research.

- [1] Morse TD, Lungu K, Masangwi S, Makumbi A, Grimason AM, Womersley J, West P. Scotland Chikwawa Health Initiative – improving health from community to hospital. *Environment and Health International*, May 2008; Congress Edition. ISSN 1683-3805
- [2] Masangwi SJ, Ferguson NS, Grimason AM, Morse TD, Zawdie G, Kazembe LN. Household and community variations and nested risk factors for diarrhoea prevalence in southern Malawi. *Int. J Environ Health Res* 2010;20 (2):141-158. doi: 10.1080/09603120903403143
- [3] Morse TD, Nichols RAB, Grimason AM, Campbell BM, Tembo KC, Smith HV. Incidence of cryptosporidiosis species in paediatric patients in Malawi. *Epidemiol. Infect.* 2007; 135 (8):1307-1315. doi: 10.1017/S0950268806007758
- [4] Morse TD, Grimason AM, Smith HV. Epidemiology of diarrhoeal disease in rural Malawi – a case study of cryptosporidiosis. *Proceedings of the 33rd WEDC International Conference*, Accra, Ghana, April 2008.
- [5] Masangwi SJ, Morse TD, Ferguson NS, Zawdie G, Grimason AM, Namangale JJ. Behavioural and environmental determinants of childhood diarrhoea in Chikwawa, Malawi. *Desalination* 2009; 248 (1–3): 684–691. doi.org/10.1016/j.desal.2008.05.120
- [6] Grimason AM, Davison K, Tembo KC, Jabu GC, Jackson MH. Problems associated with the use of pit latrines in Blantyre, Republic of Malawi. *J Royal Soc. Promot. Health* 2000; 120 (3):175-182.

Other evidence for quality of research: The research has been funded by

- 3 grants (>£0.5M), awarded by Scottish Government International Development Fund to Scotland Chikwawa Health Initiative, covering 2006-2013. PI T Morse & A Grimason
- PATH funding, US\$20,000, to develop a National Road Map for Diarrhoeal Disease Control in Malawi - PI T Morse
- Association of African Universities Mobilising Regional Capacity Initiative, £93,740, 2010/11, PI T Morse
- National Commission of Science and Technology funding, US\$10,000, 2010, to undertake a Gap Analysis for Environmental Health Research in Malawi which has been integrated into the National Health Research Agenda - funded by DfID, Wellcome Trust and IRC
- British Council/DfID Developing Partnerships in Higher Education, £135,000, 2009-11, PI A Grimason, and T Morse for development of Africa Academy for Environmental Health.
- Publication strategy for the underpinning research and programme documentation has focused on professional practice journals, e.g. *Environment and Health International*, published by International Federation for Environmental Health, to ensure maximum dissemination among professionals working on an Environmental Health approach to health improvement.

4. Details of the impact

Process/Events from Research to Impact: The underpinning research identified specific areas, e.g. water, sanitation, hygiene practices, and community health activity, where implementation of controls and interventions could have direct impact on disease prevalence and mortality in the communities of Chikwawa. The research produced a body of evidence strong enough to elicit funding from the Scottish Government through their International Development Fund, which

Impact case study (REF3b)

allowed Drs Morse and Grimason to set up the Scottish Chikhwawa Health Initiative (SCHI) in 2006 [Source A]. Dr Morse has been the programme manager since inception, with funding now amounting to over £0.5M (2006-2013). Working with Ministry of Health, Chikhwawa District Health Office and the University of Malawi, SCHI implemented a programme of interventions designed to reduce mortality and morbidity in the target communities. This included provision of clean water at source and household level, supporting the construction of improved latrines, improving health facilities and access to such facilities, training of Health Surveillance Assistants (HSAs) and voluntary community members who form village health committees, and water point committees to build capacity for sustainable change at community level. Subsequent funding (2009 – 2013) has been used to implement maternal health programmes using the same principles and interventions, and has enabled expansion from the original 4 communities to over 150.

The SCHI programme approached the issue of diarrhoeal disease in a holistic manner addressing community health education, health access, capital investment, capacity building in government health workers and community based volunteers, and access to effective interventions, e.g. dose chlorination of water at household level. This combined approach aimed to achieve sustained behaviour change. The pilot communities were also developed as model populations, which were the basis for peer education and dissemination for their surrounding area.

Improvement in monitoring of health and reduction in disease: An overall reduction in diarrhoeal disease of 30% was achieved across the target communities (ranging from 20-35% from baseline data) during the first funding cycle (2006-09). This was due to a combination of improvements including a 20% increase in latrine coverage, 25% increase in improved latrine coverage, 100% increase in access to integrated management of childhood illness (including diarrhoeal disease prevention and treatment) at community level, 75% increase in access to growth monitoring and immunisation programmes at community level. These interventions were supported through capacity building of health workers and community volunteers, as well as specific infrastructural improvements [Sources A,B,H]. SCHI has also worked with a sister programme in Chikhwawa on renewable energy (Community Renewable Energy Development) which has allowed the provision of solar refrigerator units within health posts and therefore continuous access to vaccinations integral to diarrhoeal disease control [Source F].

Provision of training to health staff: One of the key investments of SCHI has been capacity building among government health staff (Health Surveillance Assistants, medical assistants, Environmental Health Officers and nurses). Health Surveillance Assistants (HSAs) are resident within communities and are responsible for community health access at health posts and clinics, health surveillance, water and sanitation development, and health education. Their positive impact can be utilised through increasing numbers of and empowering HSAs with knowledge to effectively disseminate information about disease and mechanisms of spread, and the ability to provide basic health services at community level. SCHI provided training on integrated management of childhood illnesses including diarrhoeal disease, HIV testing and counselling, and growth monitoring to all HSAs in the catchment area, 23 in total. To allow HSAs to conduct their activities effectively requires them to be resident within their catchment area and have access to affordable transport. SCHI has provided 20 bicycles, and 3 houses to support HSA activities, and this led to an increase in the satisfaction level of communities in their health access and support [Source F]; communities without an HSA have been shown to be less knowledgeable about causes, symptoms and prevention of diarrhoeal disease [Source C]. This training was supported by the construction and refurbishment of 4 health posts to provide a basis for services and were provided with solar refrigeration units and lighting. 23 bicycle ambulances have also been provided at strategic points within the catchment villages to enhance emergency transportation cover. Turnover of health staff in Chikhwawa is high due to the remote location in one of the hottest parts of the country and therefore staff retention is a key objective; capacity building is only beneficial where staff knowledge can be retained. To aid retention at health centre and hospital level, the SCHI has improved infrastructure through construction of further housing and facilities, e.g. a senior staff house, 3 nurses houses and an 18 bed nutrition rehabilitation unit with associated offices and teaching area [Source F].

Environmental Impacts: In relation to areas such as water and sanitation, the SCHI has provided two new wells, repaired non-functioning wells and upgraded 17 others. A key issue in water quality is post collection contamination. To reduce the risk of disease transmission via this route, chlorine can be added to household storage containers. The programme has been involved in distributing

Impact case study (REF3b)

8748 bottles of chlorine tablets per year which treats 8.7 million litres of water. To ensure sustainability of water sources, community committees received training on maintenance, health education, revolving fund management and community participation [Source F]. Through community engagement and voluntary committees, the programme has introduced simple ecological sanitation technologies and increased pit latrine ownership from 39% to 59%; this was supported by health education on the need for effective hand washing.

Public Policy Impacts: Due to in-country expertise and underpinning research, Dr Morse was invited by PATH (Program for Appropriate Technology in Health), an International NGO, and funded through Gates Foundation Funding, to assess current programmes and challenges for diarrhoeal control in Malawi [Source D]. The final report "Towards an Integrated Approach to Diarrhoeal Disease Control in Malawi" [Source E] put forward recommendations on reducing diarrhoeal disease burden in Malawi, and is now being used as the basis for the development of a national diarrhoeal disease control policy by the Malawian Government. Acknowledging the challenge a high burden of preventable/treatable disease and limited health service brings to Malawi, the Government instigated a 5 year Health Research Capacity Strengthening Initiative (HRCSI), co-ordinated by the National Commission for Science and Technology (NCST), with the aim of promoting multidisciplinary health research; one of the milestones of the HRCSI was the development of National Health Research Agenda, a policy document setting national research priorities for 2011-2016 [Source B]. To address national limitations in Environmental Health provision, the NCST approached Dr Morse to undertake a gap analysis of Environmental Health research needs, with the goal of recommending research priorities and an effective action plan to address the gaps; research priority areas highlighted include water and sanitation, disease surveillance and response, health promotion and education. The Gap Analysis (2012) has been incorporated into the National Health Research Agenda [Source G].

Reach and Significance: The SCHI was initially designed for implementation in 4 villages, covering a population of about 5700. Continuation of the initial programme through subsequent funding (2009-2010, 2010-2013) resulted in implementation in over 150 communities, covering a population of over 110,000. The SCHI has been highlighted during review of the Scottish Government International Development Funding as representing a good example of best practice *"in terms of partnership working, applying technical knowledge in a practical manner at community level and in terms of working with communities and listening to beneficiaries at community level to ensure that planned activities are meeting local needs and with regard to ongoing feedback for planning future activities"* [Source A] The health impact resulting for the SCHI is significant; the work is life saving through implementation of health interventions designed to reduce morbidity and mortality, and improve the standard of living and quality of life of communities in rural Malawi.

5. Sources to corroborate the impact

- A. Scotland Chikhwawa Health Initiative, <https://www.strath.ac.uk/malawi/projects/chikwawaproject/reviewofscottishgovernmentidproject/>
- B. Statement from Director of Sector Wide Approach, Malawi Ministry of Health, Malawi Health Strand Lead for Scottish Government International Development Fund, confirming that the SCHI provides the basis for national policies.
- C. Masangwi SJ et al. 'Pattern of maternal knowledge and its implications for diarrhoea control in Southern Malawi'. Int. J. Environ. Res. Public Health 2012; 9: 955-969.
- D. Statement from Senior Programme Officer, PATH.
- E. Towards an Integrated Approach to Diarrhoeal Disease Control in Malawi. PATH Report 2011 www.path.org/publications/files/VAC_malawi_policy_fs.pdf
- F. Morse TD. Scottish Government Malawi Development Programme Final Report for project MA17 Scotland Chikhwawa Health Initiative (2010 – 2013).
- G. Gap Analysis of Research Needs in Environmental Health, Malawi, report to National Commission for Science and Technology 2010. www.ncst.mw/pdf/Environmental%20Health.pdf
- H. Environment and Health International 2008; 10 (2) Congress Edition. ISSN 1683-3805 www.ifeh.org/magazine/ifeh-magazine-2008_v10_n2_Congress_Edition_2008.pdf