

Development of a Framework for Hand Hygiene Assessment

Report to the
WATER RESEARCH COMMISSION

by

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EXECUTIVE SUMMARY

Human hands are one of the chief vehicles of transmission of faecal-related disease, especially the hands of mothers and other caregivers. The 2000 Global Water Supply and Sanitation Assessment Report listed handwashing with soap (or ash or other aid) as one of the three most important hygiene behaviour which could significantly benefit human health. Good hand hygiene thus, plays a significant role in preventing and minimising sanitation-related diseases.

The microbial population of the human hands are divided into two categories: transient flora and resident flora. Resident flora is found in the deeper layers of the skin and is relatively difficult to remove. Transient flora colonizes the surface layers of skin and if the skin is healthy, approximately 10% of the skin which is shed will contain viable bacteria. Hand hygiene, a general term for the correct action of hand cleansing, is a process of removing transient flora from human hand to reduce an individual's exposure to faecal-hand transmitted diseases.

Internationally and nationally, there were a number of interventions that focussed on improving hand hygiene behaviours, including:

1. Implementation of hygiene education, awareness and promotion programmes to target improvements in hygiene knowledge, specifically improving hand hygiene knowledge, i.e. washing hand at critical times;
2. Provision of hygiene technologies includes provision of handwashing devices, soap and a water supply;
3. Hygiene education, awareness and promotion programmes that target improved hand hygiene technique such as the correct way to wash hands.

However, information related to the impacts of the different approaches to hygiene improvement interventions in South Africa was limited. Scientific information of the impacts of hand hygiene interventions on changing hand hygiene behaviours were even more limited. As a result, little was known regarding the most appropriate hygiene promotion interventions for different contexts in South Africa and the effectiveness of the health and hygiene (h&h) promotion initiatives were not well understood. Research was therefore required to better inform present and future investments in hand hygiene interventions in the country.

This report emanated from the WRC project called *The Effectiveness of Handwashing*, which had the aim to assess, through developing a scientifically suitable method, the handwashing and hand hygiene behaviours in South Africa. This report describes the literature and information which was used to develop a Framework for hand hygiene assessment. A framework was defined as the *theoretical models used to explain, predict and change human hand hygiene behaviour*. Literature had shown that theoretical frameworks used in this manner have evolved from those which determined behaviour using the environment and events, to those which used cognitive factors and reasoning as determining variable of hygiene behaviour, to more recent frameworks which took a broader approach of combining environment, trigger, barriers, emotions and other factors as determining variables of hygiene behaviours. Determining variables, as referred to in this report, were those variables which determine hand hygiene behaviours. The theory underlying the hand hygiene assessment Framework was that to change hand hygiene behaviours, a change one or more determining variables of hand hygiene were necessary.

The Framework was thus designed to capture data from a suite of hand hygiene determining variables which international literature in this report showed measured the effectiveness of hand hygiene and hand hygiene interventions. The Framework thus assumed that a change in one or more of the variables would show a resultant change in an individual's hand hygiene. The three component of the hand hygiene assessment Framework were developed to address one of the research hypotheses' of the assessment. These were:

1. That the manner in which individuals washed their hands (Hand Hygiene Technique) during a hand hygiene demonstration would be influenced by 6 indices, namely: Cultural Influence, Media Exposure, Household Socio-economic Status, Service Environment, Hygiene Knowledge and Social Profile of the Individual. Each index in-turn would be determined by one or more indicators of hand hygiene behaviours.
2. The 'cleanliness' of an individual's hands (i.e. the bacterial counts on a individuals hands) would be determined by the manner in which the individuals washed their hands and the bacterial counts in the water which was used to practice hand hygiene during the hand hygiene demonstration.
3. From international literature, there would be a number of indicators which would determine hand hygiene and thus hand 'cleanliness' of individuals.

The Framework was focused exclusively on hand hygiene and provided a structure for the capturing and analysis of data collected during the assessment. Two 'benchmarks' of hand hygiene were used in the Framework, against which the hand hygiene variables (indicators, indices and determinants) were assessed

- the microbiological assessed **levels of bacterial counts on interviewee hands** (referred to in the report as Hand Bacterial Counts or hand 'cleanliness'), measured as colony-forming units (cfu/hand). It was that an acceptable bacterial count on a 'cleaned' post-washed human hand was below log 5.7 cfu/hand
- the **observed Hand Hygiene Technique of an individual** (referred to in this report as Hand Hygiene Technique), measured as an average score for an individual out of 10. This score was determined by scoring, out of 10, whether an individual washed their hands with water, soap, both hands, rub hands together at least 3 times and dried their hands on disposal paper towel during a hand hygiene demonstration. Incorrect or other hand hygiene options used during the demonstration were provided with a zero or lesser score.

Data collected to populate the variables in the Framework was collected using a triangulation approach, combining qualitative, quantitative and microbiological information to determine these variables of hand hygiene. Triangulation allowed for the collection of information through a multitude of methods to ensure a comprehensive picture of the reality and at the same time, validation of the information being collected. In-field data to populate the variables in the Framework were collected using two data collection tools, namely a hand hygiene *observation* and a hand hygiene *interview*. Each question or observation on these two tools was a **measure** of an individual's hand hygiene behaviour. The Framework was applied in-field from the bottom up, with data collection tools (questionnaire and observations) designed to collect data for specific measures, measured scores were combined and averaged to give a score for each indicator in the Framework. Similarly indicator scores were combined and averaged for their related index. Various statistical methods were used to analyse the data for the variables within the Framework.

The Framework was tested using data from three study sites in the Tshwane metro, namely an urban, peri-urban and rural study setting. The sites were selected based on the perceived economic status and service levels to reflect a diversity of individuals. This would ensure that the Framework was not limited to capturing hand hygiene behaviours of a single sector and group in the country.

The testing of the Framework clearly demonstrated that the Framework and underlying process and tools provide details of which hand hygiene variable determine hand hygiene in the sample sites. The testing of the Framework also showed that measuring the effectiveness of hand hygiene interventions in South Africa may be more difficult than initially anticipated and may rely on a number of variables, which were not yet clear at this point in time. What was clear was that hand hygiene in South Africa showed significant difference with what had been found in international literature, with many gaps in the local and international understanding of hand hygiene.

The hand hygiene assessment Framework has the potential to:

- Provide information which could guide future hand hygiene intervention to ensure the most effective and efficient issues, technologies and messages to ensure sustainable behaviour change, i.e. which issues, technologies and messages;
- Provide a structured manner of collecting hand hygiene baseline data against which the effectiveness of hand hygiene interventions can be assessed;
- Provide a scientific manner of assessing hand hygiene behaviours and interventions using standardized methods, tools and data analysis processes.
- Provide information which can inform future sanitation-related and development policy and strategic intervention.
- Standardize hand hygiene assessment; if practitioners continue to use and refine the Framework, it has the potential to become the standard hygiene assessment Framework in the country.

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LIST OF ABBREVIATIONS

DoH	Department of Health
DWAF	Department of Water Affairs and Forestry (now DWA)
EHP	Environmental Health Project (USAID)
StatsSA	Statistics South Africa
UNICEF/WES	UNICEF Water, Environment and Sanitation (WES) Program
USAID,	U.S. Agency for International Development
World Bank/WSP	World Banks Water and Sanitation Program
WSSCC	Water Supply and Sanitation Collaborative Council

GLOSSARY OF TERMS

Awareness:	Imparts elementary understanding or sensitization, with short-term impact (DoH and DWAF, 2006)
Basic education:	Nine years of schooling from grade 1 to grade 9 (StatsSA, 2009).
Basic sanitation facility:	The infrastructure necessary to provide a <i>sanitation facility</i> which is safe, reliable, private, protected from the weather and ventilated, keeps smells to the minimum, is easy to keep clean, <i>minimizes the risk of the spread of sanitation-related diseases by facilitating the appropriate control of disease carrying flies and pests</i> , and enables safe and appropriate treatment and/or removal of human waste and wastewater in an environmentally sound manner (DWAF, 2003).
Basic sanitation service:	The provision of a basic sanitation facility which is easily accessible to a household, the sustainable operation of the facility, including the safe removal of human waste and wastewater from the premises where this is appropriate and necessary, and the <i>communication of good sanitation, hygiene and related practices</i> (DWAF, 2003).
Care dependency grant:	A monthly grant from government to parent/guardian/foster parent of a child with disability and in need of full-time special care (StatsSA, 2009).
Child support grant:	Government grant received on behalf of a child of a specific age as determined by legislation, in underprivileged families (StatsSA, 2009).
Disability:	A physical or mental <i>handicap</i> which has lasted for six months or more, or is expected to last at least six months, which prevents the person from carrying out daily activities independently, or from participating fully in educational, economic or social activities (StatsSA, 2009).
Disability grant:	Government grant received by adults, who are certified to have mental or physical disability, which lasts six months or longer and renders them unfit to work.
District Health System	A health district is the area of a district or metropolitan municipality National Health Act 61 (2003) (DoH and DWAF, 2006).
District Health Service	District health services include all health services in that district, up to and including the services provided at a level 1 or district hospital (DoH and DWAF, 2006).
df	df showed the degrees of freedom. The number of observation that are allowed to vary if the sample is to estimate precisely the population characteristic.
Dwelling:	Any structure intended or used for human habitation (StatsSA, 2009).
Education:	Imparts knowledge and /or skill, with long-term impacts relating to attitude and behaviour short-term impact (DoH and DWAF, 2006).
Educational level:	Educational level is aggregated into no formal education, primary school (grade 1 to grade 7), secondary school (grade 8 to grade 12) diploma or certificate without grade 12 (from lower to grade 11), diploma or certificate with grade 12, degree and other post-graduate degree (StatsSA, 2009).
F	F showed the Anova statistical value.
Grant:	Financial assistance provided by government, a public fund or private institution to a person or organisation for a specific purpose (StatsSA, 2009).
Grant in aid:	An additional grant awarded to persons who are already in receipt of an old-age grant, disability grant or war veteran's grant, and who need full-time care from someone else (StatsSA, 2009).
Hand hygiene:	The Jumaa (2005) definition of hand hygiene is used. Hand hygiene thus includes handwashing with non-antibacterial soap or soap-substitute and antiseptic handwashing which includes washing hands with soap or another detergent containing an antiseptic agent. Hand hygiene is therefore, handwashing with soap, detergent or a soap-substitute.
Handwashing:	Handwashing for hand hygiene is the act of cleansing the hands with water for the purpose of removing soil, dirt and/or microorganisms.
Head-of-Household:	The main decision-maker, or the person who owns or rents the dwelling, or the person who is the main breadwinner (StatsSA, 2009).

Health:	A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (World Health Organisation in DoH and DWAF, 2006).
Health Promotion:	The process of enabling people to increase control over, and to improve their <i>health</i> . Usually <i>short-term</i> and <i>project</i> based (DoH and DWAF, 2006)
Household:	A group of persons who live together and provide themselves jointly with food and/or other essentials for living, or a <i>single</i> person who lives alone (StatsSA, 2009).
Household income	All receipts by all members of a household, in cash and in kind, in exchange for employment, or in return for capital investment, or receipts obtained from other sources such as pension, etc. (StatsSA, 2009).
Hygiene education:	Water Supply and Sanitation Health and Hygiene Education relates to all activities that aim to increase an individual's knowledge about issues relating to personal habits and practices that affect one's health, particularly in relation to water and sanitation services. Increased knowledge must be presented in such a way that it will lead to a change in an individual's attitudes and practices. Changes in hygiene behaviour will only be achieved through ongoing long-term health and hygiene education activities (DoH and DoH, 2006).
Hygiene:	The practice or principles of cleanliness.
Income (individual):	All money received from salary, wages or own business; plus money benefits from employer, such as contributions to medical aid and pension funds; plus all money from other sources, such as additional work activities, remittances from family members living elsewhere, state pension or grant, other pensions or grants, income from investments, etc (StatsSA, 2009).
Informal dwelling:	A makeshift structure not erected according to approved architectural plans, for example <i>shacks</i> or <i>shanties</i> in <i>informal settlements</i> or in backyards (StatsSA, 2009).
Literacy:	Ability to read and write with understanding in any language. A person is literate who can, with understanding, both read and write a short simple statement on his everyday life (StatsSA, 2009).
Living together as a married couple:	Two persons who live together in the same <i>household</i> as a <i>married</i> couple but who are not <i>married</i> to each other; a cohabiting couple (StatsSA, 2009).
Marital status:	Personal status of each individual in relation to the <i>marriage</i> laws or customs of a country. Customary unions are now recognised as a legal <i>marital status</i> categories under <i>marital status</i> include <i>single</i> , <i>married</i> , <i>living together as a married couple</i> , <i>divorced</i> , <i>separated</i> and <i>widowed</i> (StatsSA, 2009).
P	<i>P</i> showed the significant level. If $p \leq 0.05$ then the results are statistically significant.
Pearson chi-square analysis	Pearson's chi-square is a statistical test to assess two types of comparison: tests of goodness of fit and tests of independence. The chi-square analysis in this report test for independence namely it is used to assess whether paired observations on two variables are independent of each other—for example, whether individuals in the three sample sites (urban, peri-urban or rural) differ in their demographic profile, access to services or hand hygiene behaviours.
Pension:	A steady income received by a person, usually after retirement, from a former employer, pension fund or other retirement provider (StatsSA, 2009).
Relationship to the head or acting head of the household:	Relationship through blood, <i>marriage</i> , adoption or other circumstance (StatsSA, 2009).
Separated:	Situation where a <i>married</i> couple have parted without divorcing, thus allowing for reuniting if they wish at some time in the future. This is not a legal <i>marital status</i> under South African law, and is therefore self-defined (StatsSA, 2009).
Rural area:	Any area that is not classified <i>urban</i> . Rural areas may comprise one or more of the following: tribal areas, commercial farms and informal settlements.
Single (common usage):	Person who is not <i>married</i> or cohabiting (StatsSA, 2009).
Widowed:	<i>Marital status</i> of a person whose spouse has died and who has not <i>married</i> again.
Youth:	Young person typically between the ages of 14 and 25 or 35. The exact <i>age</i> range must be specified in any analysis. In this study it is 18-35 (StatsSA, 2009).

Urban area:	A continuously built-up area with characteristics such as type of economic activity and land use. Cities, towns, townships, suburbs, etc. are typical urban areas. An urban area is one which was proclaimed as such (i.e. in an urban municipality under the old demarcation) or classified as such during census demarcation by the Geography department of Stats SA based on their observation of the aerial photographs or on other information (StatsSA, 2009).
War veterans' grant:	A grant received by persons 60 years or older; who served the country in one of the officially listed wars, and who are unable to maintain themselves due to physical/mental disability (StatsSA, 2009).
Work:	Any activity carried out by an individual, and whose product contributes to the national <i>output</i> , irrespective of whether the person doing it is paid (cash or in kind) or not paid (StatsSA, 2009).

1 INTRODUCTION

A significant amount of research has recently been conducted to identify strategies to change poor hygiene behaviours, the most popular of these being to highlight the relationship between good hygiene and a reduction in disease morbidity and mortality (Aiello and Larson, 2002; Bloomfield et al., 2007). Managers of hygiene improvements initiatives often choose to promote hygiene by highlighting the links between hygiene and health.

Health, according to the World Health Organization, is *a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity* (World Health Organization, 1948). Promotion of health, according to Metwally et al. (2008) is the ability of an individual to control their health to reach a state of complete comfort, welfare and security. To achieve health, an individual or group must have the capacity to change or cope with their environment by for example improving their hygiene practices and sanitation provision which will increase their capacity to deal with sanitation-related health risks.

Hygiene, a term derived from the Greek mythology goddess of health, cleanliness and sanitation, is defined as a *condition or practice* which has the intent of safeguarding health and healthy living. Hygiene promotion is a specific and targeted process that focuses on the reduction through prevention of disease that origination from unhygienic conditions and practices (Metwally et al., 2008). Good hygiene therefore, was a necessity for good health.

It has been widely shown that improvements in hygiene, including hand hygiene, and water service infrastructure can reduce sanitation-related infections (Aiello and Larson, 2002). Many countries, including South Africa, were thus focussed on addressing the Millennium Development Goal of providing universal access to basic water supply and sanitation services. However, having a sanitation facility is not sufficient to prevent faecal contamination of individuals and households (Almedom et al., 1997). A sanitation facility is only one of the barriers in the various routes of transmission of sanitation-related diseases. Other transmission routes, shown by the 5-F diagram in Figure 1, include fingers, flies, fields (soil), and fluid (water).

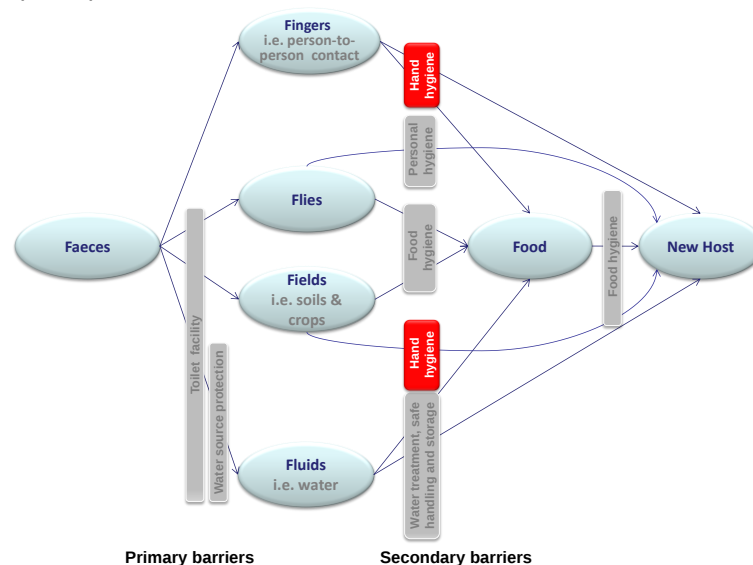


Figure 1: the 5-F diagram showing the most common routes of transmission of sanitation-related diseases (Adapted from Wagner and Laniox)

Figure 1 also indicates the effective primary (usually a toilet) and secondary (usually behavioural) barriers to prevent transmission of sanitation-related disease via these routes. The primary and secondary barriers shown in the figure affect an individual's health primarily by reducing the pathogen load in the environment to which an individual is exposed and thus, reduce the exposure of an individual to these pathogens. This in-turn reduces the individual's infection by these pathogens, reducing the morbidity and mortality (Billig et al., 1999).

The Global Water Supply and Sanitation Assessment 2000 Report listed handwashing with soap (or ash or other aid) as one of the three most important hygiene behaviours (secondary barriers) that were likely to have the most significant health benefit (World Health Organization and the United Nations Children's Fund, 2000). The other two were safe disposal of children's faeces and safe storage and handling of water.

Hand hygiene, a general term referring to any action of hand cleansing, is a process which focuses on reduction, through prevention, of transmission of disease which originate through hand contact with faecal matter. Improving hand hygiene is perhaps the most financially and fundamentally effective means of maintaining and improving human health.

Internationally and nationally, there were a number of interventions that have a focus on improving hand hygiene behaviours. These interventions include:

4. implementation of hygiene education, awareness and promotion programmes to target improvements in hygiene knowledge, specifically improving hand hygiene knowledge, i.e. washing hand at critical times;
5. provision of hygiene infrastructure which includes provision of handwashing devices, soap and a water supply;
6. hygiene education, awareness and promotion programmes that target improved hand hygiene processes and procedures such as the correct way to wash hands.

However, studies on the effectiveness of specific hand hygiene intervention on illness were limited in the international literature and in South Africa (Aiello et al., 2008). It was therefore, difficult to provide recommendations to funders and consumers as to which hand hygiene interventions were most effective in reducing infectious illnesses, when compared to other interventions (Aiello et al., 2008). Assessment of the effectiveness of a specific hand hygiene intervention in a community was important as it could provide scientifically-sound evidence for recommendations as to which hand hygiene awareness and promotion message and tools were the most effective in changing hand hygiene behaviours; could guide technologies choice based on the most effective hand hygiene technology for a community; and could provide evidence on the merits of a particular hand-hygiene procedure for the prevention of common infectious diseases.

Curtis et al. (2001) suggested that based on the very limited evidence of behaviour changes or improved health as a result of hygiene interventions in developing countries it was unsurprising that it was difficult to recommend to policy-makers to spend scarce resources on hygiene initiatives. To be able to strongly motivate for using scarce service delivery resources on hygiene promotion in South Africa would require comprehensive and extensive evidence that these interventions would actually result in effective changes in hygiene behaviours or evidence that these interventions would actually have an impact on health.

This report emanated from the WRC funded initiative called *The Effectiveness of Handwashing*. This research initiative aimed to survey handwashing and hygiene behaviours in South Africa to provide a scientific basis for determining the most effective hand hygiene messages, procedures and materials which would minimize the levels of pathogens on an individual's hands and thus, reduce the transmission of these pathogens during food preparation and through contact with other individuals. The study had the purpose of developing a methodology for the assessment of the impacts of hand hygiene programmes, to guide future implementation process of these initiatives. By providing an understanding of the impacts of the hand hygiene programmes, and the most effective and efficient means of implementation these, the research methodology developed in this research could inform future initiatives, ensuring effective use of resource to maximize the health benefits of these programmes, especially in the poorer sectors of the population.

1.1 What is Hand Hygiene

Skin hygiene, particularly of hands, is considered to be one of the primary barriers to reduce diseases transmitted via (Larson, 1999; Ejemot et al., 2008):

- Faeces – hand – mouth
- Faeces – hand – hand – mouth
- Faeces – fly – food – hand – mouth
- Faeces – fly – utensils – hand – mouth
- Faeces – fly – water – hand – mouth
- Faeces – animal – water – hand – mouth

Diseases primarily transmitted through this faecal-oral route include infectious diarrhoea, typhoid, cholera and infectious hepatitis (Howard and Bartram, 2003).

The microbial population of the human skin, and thus hands, are divided into two categories: **transient** flora and **resident** flora. Resident flora is associated with the deeper underlying layers of the skin, while transient flora colonizes the surface layers of the (Jumaa, 2005). Transient flora is the organisms most frequently associated with hand hygiene-related infections as they are more easily transferred by direct hand contact between individuals and between an individual and their surrounding environment (Jumaa, 2005). These transient floras are also the easiest to remove by routine hand hygiene.

The most superficial layer of the epidermis of hands, call the stratum corneum, is approximately 15 layers thick with a new layer formed approximately every day and completely replaced every 2 weeks (Larson, 1999). If the skin is healthy, approximately 10% of the skin which is shed will contain viable bacteria. Although the loss of the first few layers of stratum corneum reduces numbers of bacterial colonies shed from hands, counts remain stable with removal of subsequent layers (Larson, 1999). Literature has shown that the total bacterial counts on the hands of medical personnel ranged from 3.9×10^4 to 4.6×10^6 . The number of microorganisms on intact areas of skin in the same person can vary from $100-10^6$ per cm^2 (Jumaa, 2005). A number of physiological factors determine the bacterial skin flora including humidity, water content, skin lipids, temperature, and rates of desquamation (meaning the shedding of the outer layers of the skin). Hand hygiene results in changes in all of these factors. Larson (1999) concluded that *the goal should be to identify skin hygiene practices that provide adequate protection from transmission of infecting agents while*

minimizing the risk of changing the ecology and health of the skin and increasing resistance in the skin flora.

Handwashing was described by Reybrouck (1986), as “removing superficial desquamated skin scales, sweat and sebaceous secretions by the action of a detergent (e.g. soap) and water, and with them a variable proportion of the transient bacteria are also removed”. Every stage in hand hygiene is important and has an additive effect on transient microbial reduction.

Handwashing in this report was the washing of hands with water. Since the development of this hand hygiene assessment framework was not limited to rural or poor individuals, Jumaa’s (2005) definition of hand hygiene was included. Hand hygiene included *handwashing* which was washing hands with **non-antibacterial soap** and *antiseptic handwashing* which was washing hands with soap or another detergent containing an **antiseptic agent**. The practices of good hand hygiene also required knowledge of the correct times of handwashing, the correct handwashing technique (wash both hands, rub hand together at least 3 times) and the use of the correct handwashing technologies (water, soap and hygiene drying). In other words, handwashing was defined as washing hand with water, while hand hygiene was the using the correct handwashing technique and technologies at the correct times.

1.2 The importance of Hand Hygiene

Although there were studies before 1861 that recognise the importance of the hand hygiene of healthcare professionals in spreading disease, it was Ignaz Semmelweis’s study of the higher rate of deaths of women from puerperal fever (childbed fever) when delivered by a physicians and medical students when compare to women delivered by midwives. Semmelweis hypnotized that the higher mortality in women whose delivery was attended by a physician or medical student was due the lack of antiseptic hand disinfection (using chlorinated lime) between handling of corpses during autopsies and attending to a delivery (Larson, 1999; Best and Nauhauser, 2004). Midwives did not conduct autopsies and thus resulted in lower mortality of women post-delivery. Semmelweis had difficulty convincing the ‘old guard’ health professionals of the necessity of hand disinfection to prevent infection. Although he was recognised as the first healthcare professional to demonstrate experimentally that hand disinfection could prevent infection it still took another two decades for his work to be credited (Best and Nauhauser, 2004). There was little hand hygiene research published after the Semmelweis study, with further hand hygiene research only emerging in the mid-20 centenary (Larson, 1999).

When compared with other preventive measures (barriers), hand hygiene has been shown to have a significant impact on decreasing the incidence of diarrhoea (Curtis and Cairncross, 2003; PRISMA, 2004; Ejemot et al., 2008). Research related to hand hygiene showed various levels of reducing diarrhoeal disease including:

- Handwashing with water and soap reducing diarrhoeal disease by 35% (Aldemon et al., 1997).
- A systematic review conducted by Curtis and Cairncross (2003) showed that interventions to promote handwashing with soap displayed a 44% decrease in risk of diarrhoeal disease, based on high quality studies only.

- Fewtrell et al. (2005) showed a 43% reduction in diarrhoeal illness associated with hand hygiene.
- Aillo et al. (2008), in a meta-analysis of hand hygiene interventions and disease, found that improvements in hand hygiene resulted in reductions in gastrointestinal illness of 31% and reductions in respiratory illness of 21%.
- Approximately 30% reduction in diarrhoea morbidity was observed by Ejemot et al. (2008) in a review of randomized controlled trials which compared handwashing and hygiene promotion interventions vs. no intervention.

Figure 2 shows the health benefits of handwashing with soap was higher those of both water supply and sanitation service, or a combination of these, and demonstrates why it was important to prioritize investment in this hygiene practice (Curtis, 2005).

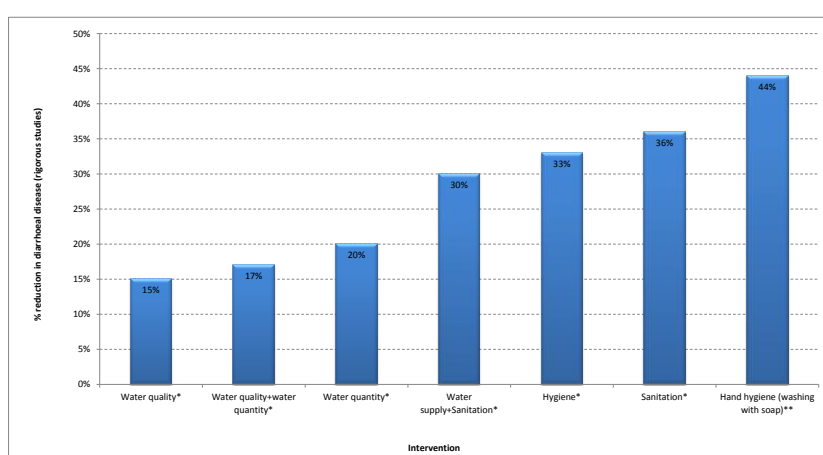


Figure 2: Effectiveness of water supply, sanitation and hygiene intervention on diarrhoea (* Esrey et al., 1991; **Curtis and Cairncross, 2003).

Interventions to address diarrheal diseases in high mortality environments were extremely cost-effective (Jamieson et al., 2006). When comparing interventions to address pre-transitional conditions relating to poverty and under-development such as TB, malaria, diarrhoeal disease and HIV/AIDS interventions, Laxminarayan et al. (2006) found that hygiene promotion was the most cost effective intervention in low and middle income countries (approximately \$5 per DALY averted), with provision of improved water and sanitation interventions ranging from US\$1,118 to US\$14,901 per DALY averted from diarrheal disease.

Despite the clear indication of the benefits of hand hygiene, it is not widely practiced by individuals. Biran et al. (2008) estimate that around the world, handwashing rates remain very low, typically at 2-10% of individuals.

1.3 Purpose and Structure of the Report

This report is a review of hand hygiene local and international literature which underpins the development of the hand hygiene assessment Framework. The report also documents the approach, framework, variables, sampling and data analysis process recommended from the South African hand hygiene assessment.

This report consists of the following sections:

1. Section 1: Introduction where covers the key definitions of hand hygiene and highlights which hand hygiene was so critical to an individual's health;
2. Section 2: Review of Hand Hygiene in South Africa which addresses key policies related to hand hygiene, highlights some of the hand hygiene initiatives in the country and reviews hand hygiene technologies in use in South Africa.
3. Section 3: Review of Hand Hygiene Approaches which review the approaches to behaviour studies and hygiene studies from international literature
4. Section 4: Review of Hand Hygiene Assessment Frameworks which documents frameworks applied in the international literature to hygiene assessments and highlights the framework recommended for the South African hand hygiene assessment.
5. Section 5: Assessing the Effectiveness of hand hygiene in South Africa documents the variable (determinants, indices, indicators, sub-indicators and measures) which were used in the South African hand hygiene assessment.
6. Section 6: Sample selection briefly highlights sample issues related to hand hygiene assessment
7. Section 7: Tool for the South African hand hygiene assessment discussed the tools which were used in this study.
8. Section 8: Review of methods applied in data analysis of hygiene research
9. Section 9: A summary of the testing of the hand hygiene assessment framework
10. Section 10 and 11: Conclusions and references.

2 REVIEW OF HAND HYGIENE IN SOUTH AFRICA

2.1 Hand Hygiene-related Policy in South Africa

2.1.1 *Municipal Structures Act (1998)*

According to the Municipal Structures Act 117 of 1998 (DPLG, 1998), municipal health services, and thus health and hygiene education, awareness and promotion, were a function of metro and district municipalities. This function has historically been executed by local municipalities and provinces, with minimal services outside the cities and main towns.

2.1.2 *Sanitation Policy (2001)*

The 2001 South African White Paper on Basic Household Sanitation (DWAF, 2001) underpins hand hygiene awareness, promotion and education in South Africa. The White Paper had the purpose of addressing the negative effects of poor sanitation on rural and informal settlement-based individuals and on the environment. According to the White Paper, the aim of provision of sanitation service was to reduce the burden of sanitation-related disease such as diarrhoea, cholera and typhoid. One of the key policy principle of the white paper was *sanitation improvement...supported by an intensive health and hygiene programme*.

The white paper highlights that despite significant investments being made in the provision of safe water supplies for all, the health benefit of this investment was limited in areas where inadequate attention was paid to sanitation and to health and hygiene promotion. It argues that the weak public awareness of the strong links between sanitation and health could be addressed through an information dissemination programme aimed at promoting awareness which target *personal hygiene, including the importance of washing hands after going to the toilet or changing the nappies of babies, before the preparation of food or the handling of drinking water* (DWAF, 2001).

Although hand hygiene was not a key discussion point of the White Paper, it was by default a critical component of the health and hygiene requirements of the paper.

2.1.3 *Framework for National Sanitation Strategy (2002)*

The purpose of the Framework for the National Sanitation Strategy was to define a means to accelerated sanitation delivery, with the focus on rural households, peri-urban areas, informal settlements, and institutions. According to the Framework, good sanitation includes appropriate health and hygiene awareness and behaviour as well as acceptable, affordable and sustainable sanitation services.

To address sanitation backlogs in South Africa, the Framework proposes a guide subsidy of R1 200.00 per household for free basic sanitation. This subsidy should cover the hygiene promotion costs and the operating costs of providing a basic sanitation service to households. However, the Framework indicates that existing environmental health resources at all levels of government were inadequate to support a major national health and hygiene programme, and that the free basic sanitation subsidy (health promotion) be achieved through various other sources, i.e. Municipal Infrastructure Grant, Low-cost Housing. Implementation of health and hygiene programmes therefore, was the responsibility of local government. This required close collaboration between the district municipality responsible for environmental health, the water services authority and the water services provider.

2.1.4 Strategic Framework for Water Services (2003)

The 2003 Strategic Framework for Water Services (DWAF, 2003) re-enforced the role of health and hygiene in water service provision. Two health and hygiene (h&h) fundamentals were included in the definition of water services, i.e. provision of a basic sanitation facility (primary barrier) and the communication of good sanitation, hygiene and related practices (secondary barriers). A basic sanitation service in South Africa was therefore, not just the delivery of technical services, but also a h&h communication component (DoH and DWAF, 2006).

2.1.5 Health Act (2003)

In terms of the National Health Act (2003) environmental health services, and thus health and hygiene education, awareness and promotion, were the responsibility of local government. This shifted the responsibility for rendering environmental health services to metropolitan and district councils (DoH, 2003).

According to the Act, municipal health services included, but were not limited to:

- (a) water quality monitoring;
- (b) food control;
- (c) waste management;
- (d) surveillance and prevention of communicable diseases;
- (j) vector control; and
- (g) environmental pollution control.

Hand hygiene played a role in a number of these activities, i.e. good hand hygiene was necessary for food control and was required in the prevention of communicable diseases.

2.1.6 The National Health and Hygiene Strategy Related to Water Supply and Sanitation Services (2006)

The most recent hand hygiene related policy document was the 2006 National Health and Hygiene Education Strategy (NHHS) related to water supply and sanitation services (DoH and DWAF, 2006). The strategy aimed to support the provision of sanitation h&h communication required by the White Paper and Strategic Framework. The strategy set out a comprehensive approach to the delivery of health and hygiene education in South Africa, in terms of water and sanitation related health and hygiene practices, particularly at the domestic level. It also provided a clear vision of ensuring *a healthy South African population, free from the burden of disease linked to inadequate water supply and sanitation services* (DoH and DWAF, 2006).

Although many government structures played a role in Health and Hygiene, the strategy identified the Department of Health as *the custodian* of Health and Hygiene Education in South Africa. This implied that the Department of Health was responsible for providing South African with the knowledge and/or skills to affect a long-term impact on their poor or incorrect health and hygiene attitudes and behaviours.

Since local government was responsible for *delivery* of basic sanitation services, with health and hygiene education as part of this service, local government was responsible for the implementation of health and hygiene education at a community level. The Municipal Health Service (MHS) of a municipality had the primary role of providing health and hygiene

education on an on-going bases as part of local health care programmes and as part of water supply and sanitation projects. The MHS were also responsible for keeping records of all health education initiatives, as part of their h&h monitoring responsibility (DoH and DWAF, 2006).

The Health and Hygiene Strategy provided minimum standards for messages related to Health and Hygiene programmes, including hand hygiene. In these standards were included:

- in the theme related to *breaking the cycle of disease*, messages of hand hygiene at critical times; and
- under theme related to *Improving your sanitation*, how to attach a handwashing facility.

Thus, the Strategy did provide minimum standards for improving knowledge (i.e. washing at critical times) and minimal standards for handwashing technology (i.e. device) but did not provide comprehensive hand hygiene standards which would also include minimum standards for all handwashing technology (i.e. devices), hand hygiene materials (i.e. soap, dry material) and the hand hygiene technique (i.e. how to wash hands correctly).

2.1.7 Environmental Health Professions Act

The responsibilities for environmental health services, which fall under municipal health services, were determined by the Health Professions Act of 1974 (ACT No. 56 OF 1974). This Act was amended and expanded in 2008 to include in the scope of practices of EHPs including, amongst others, the Water Act and the Waste Management Act.

Although hand hygiene or handwashing were not explicitly mentioned in any of these Acts, the focus of many of the Acts included aspects of hygiene, and thus hand hygiene. The Environmental Health Professionals Act included in the responsibilities of Environmental Health Practitioners, health and hygiene promotion aimed at prevention of environmentally induced diseases and related communicable diseases and the use of Participatory Hygiene and Sanitation Training (PHAST) approaches for effective control measures at Community Level.

2.2 Review of Hand Hygiene Initiatives and Imperatives in South Africa

This section of the report provided an overview of hand hygiene initiatives which were being conducted in South Africa. The report captured as many of these initiatives as possible; however, it could not cover an exhaustive list of interventions. Details of these hand hygiene initiatives were shown in Table 1 below. The table showed the following information for each initiative:

Primary Audience:	the targeted audience of the campaign
Secondary Audience:	the indirect audience of the campaign
Champion:	the organization driving the campaign
Focus:	the key focus of the campaign, i.e. water, sanitation, hygiene or handwashing
Motivation:	the motivation for conducting the campaign
Key Message:	the key message or messages of the campaign
Tools used:	the communication/promotional tools used in the campaign, i.e. TV, radio, posters, workshops, visits

A short description of each initiative was provided below to provide more details of each.

2.2.1 Water, Sanitation and Hygiene (wash) in South Africa:

Minister Kasrils launched the WASH programme in South Africa during Water Week in March 2002 in Ladysmith, KwaZulu-Natal. In the first year of WASH there was an intensive national campaign promoting hand washing, market research was conducted into how to “sell” hygiene messages and youth education and best practice activities were also run. Since the 2002 launch, the South African WASH programme campaigns have taken the form of national/regional radio advertisements, taxi branding, radio, billboards and at railway stations. Dance road shows were also launched at our annual “Youth in Water” awards. A WASH song and advert was compiled by Joe Nina, a popular South African musician.

Former South African President, Nelson Mandela endorsed WASH by featuring in a Television advertisement in 2002, in which he was shown washing his hands with soap and water (Department of Human Settlements, 2010). Recent WASH interventions in South Africa include:

21. Training health and hygiene provincial co-ordinations
22. The tell-a-friend card (Appendix 1) which was launched at schools in 2010. The purpose of the campaign is based on a ‘learn-teach’ approach where the name each person who had been taught hand hygiene was entered onto the card. Approximately 500 cards were sent to each school and the children were asked to teach other individuals hand hygiene and enter their names on the card. Once complete the cards were sent to the national office. A school submits a minimum of 450 cards to be entered into a draw for a cellphone. More than 50 thousand individuals were estimated to have been reached by the campaign.
23. End-user education which is linked to the Rural Infrastructure Programme (RIP). The department assists with training of health promoters involved in the RIP initiatives. Standards sanitation toolkits were provided, i.e. SIT packs.

Linked to the South African WASH initiative was the Global Handwashing Day which was held every year. The Global Handwashing Day focused on one key hand hygiene message every year and made use of various and varied tools to communicate handwashing messages. The campaign promoted handwashing with soap as an effective means of saving lives. The Department publishes and distributes various materials related to cholera and hygiene education as part of the initiative (Appendix 2). Various activities, media and materials were used for this campaign. For example Global Handwashing Day in 2009 was celebrated by more than 13,000 schools and 2000 medical centres. These schools and medical centres were equipped with handwashing promotion materials, including posters, and leaflets. Other activities included:

- drawing competition,
- games and songs,
- glo-germ testing
- advertorials on how to wash hands properly were placed in key publications.

Bryan Habana and 1,802 Gauteng schoolchildren, from Edenglen and Eastleigh set an official new Guinness World Record for the most number of people washing hands at one location. More recently Global Handwashing Day has made use of radio advertising of hand hygiene distributed a thematic diary for learners and hand out hygiene flyers. Global Handwashing Day is a partnership between various government departments, soap and hand cleansing material suppliers, NGOs and communities.

2.2.2 Gimme 5 for Germ-free Hands:

Bryan Habana was part of the Gimme 5 for Germ-free Hands campaign led by Protex, an anti-bacterial soap brand, owned by Colgate Palmolive. The campaign has visited more than 1,200 primary schools throughout the country. On Global Handwashing Day about 1-million children from schools around South Africa washed their hands under the auspices of the Protex brand (Sanitation Updates, 2009). The Gimme 5 campaign also includes a TV advertisement which promotes handwashing with Protex to prevent disease.

2.2.3 2020 Vision for Water and sanitation education programme

In 1996, the Department of Water Affairs and Forestry (DWAF) launched the 2020 Vision for Water and Sanitation Education Programme (2020 VfwSEP), aimed at creating awareness amongst the citizens of South Africa around the efficient use of water. The 2020 VfwSEP was a broad education programme with the purpose of education society about; amongst others, health and hygiene. One of the aims was to empower learners, schools and communities with knowledge and water management skills that will enable them to practice good hygiene. Two of the 2020 VfwSEP projects were of note to hand hygiene, namely the *Baswa Le Meetse* and the Curriculum Support project. The *Baswa Le Meetse project* of 2020 VfwSEP focused specifically on handwashing and sanitation, with Grade Six Learners entering a competition to convey health and hygiene messages through the arts, i.e. drama, traditional music, poetry, praise singing and posters. The award started with competitions from district, province and national levels. The provincial and national winners were eligible for grand prizes, which benefit both the learners and the school. The Curriculum Support component of 2020 VfwSEP aligned educational resource materials related to water and sanitation for grades R to 9. These materials were the tools which enable educators to implement water and sanitation activities within the school curriculum. Early Curriculum Support activities included interaction with the Takalani Sesame education programme, where a handwashing poster was developed for the programme (see example of poster below in Appendix 3).

2.2.4 Healthy Hands Campaign

The 'Healthy Hands' initiative raised funds to upgrade or build ablution facilities at 14 schools countrywide. Four schools in particular were selected for an official handover of new ablution facilities, as well as education on sanitation from the 'Healthy Hands' project. These schools were Phakamani Senior School in the Eastern Cape, Zwelihle Secondary School and Mtuba High School in Kwazulu-Natal and Mopholusi Secondary School in Sebokeng (bizcommunity.com, 2009).

2.2.5 Gauteng Handwashing Championships

This was a campaign initiated by Kimberly-Clark in 2007. The Hand washing Championships was launched in October 2007, with more than 170 representatives from Gauteng Hospitals and clinics attending. The competition consisted of 4 levels of play-offs by a team, viz. local, district, regional and then the FINAL. The competition followed extensive training conducted by Handwashingforlife, with hospitals equipped to do their rallies and evaluations viz. glow hand gel, ultra violet machine for testing hand washing competence, training DVDs and CDs (Gauteng Department of Health, 2010).

The hand hygiene-related campaigns in South Africa were summaries in Table 1 below.

Table 1: Summary of hand hygiene initiative in South Africa.

Project/ Programme	Primary Audience	Champion	Focus	Motivation	Key Message	Tools used
Water, Sanitation and Hygiene (WASH)	Primary school children	Dept of Human Settlement (Sanitation)	Water, sanitation and hygiene hardware and software. WASH focuses on broad water, sanitation and hygiene issues	Handwashing with soap as an effective means of saving lives	Various including <i>handwashing with soap as an effective means of saving lives.</i>	printed advocacy materials, newsletters mass media including newspapers, radio and TV
Global Handwashing Day in South Africa	Primary school children	Dept of Human Settlement (Sanitation)	A handwashing initiative linked to WASH	"Clean hands saves lives": Handwashing with soap was the most effective and inexpensive way to prevent diarrheal and acute respiratory infections	Handwashing with soap before eating and after using the toilet should be an ingrained habit	printed advocacy materials, newsletters mass media including newspapers, radio and TV roadshow
Gimme 5 for Germ-free Hands	Primary school children	Protex (Colgate Palmolive)	Handwashing with anti-bacteria soap	Handwashing using anti-bacteria soap prevents infection and saves lives	Using anti-bacterial soap to wash your hands was critical	School visits and various promotional and education materials
2020 Vision for Water and sanitation education programme	General Public	Dept of Water Affairs	Creating awareness amongst the citizens of South Africa around the efficient use of water	"educate a child to educate the nation" - young people play a crucial role in changing the mind-set of the communities	Practice good hygiene for a healthy life	2020 VWSEP currently runs three projects, namely <i>Curriculum Support</i> , the <i>Baswa Le Meetse Awards</i> , <i>Working for Wetlands</i> , <i>Aqua Enduro</i> and the <i>South African Youth Water Prize</i>
Baswa le Meetse Awards Project	Grade Six Learners	Dept of Water Affairs with Avis, Absa, MTN and Roundabout Playpump as sponsors	A handwashing initiative linked to 2020 Vision	To promote health and hygiene	"Washing of Hands, Use and Care of Sanitation Facilities for Health Life"	Recognize the achievements of Grade 6 learners in their efforts of educating our society about integrated water resource management, promoting water use efficiency as well as health and hygiene. The award proceeds with competitions from district, province and national levels

Project/ Programme	Primary Audience	Champion	Focus	Motivation	Key Message	Tools used
Curriculum Support Project	grades R to 9	Dept of Water Affairs and Department of Education	A project linked to 2020 Vision			The DWAF provided ongoing support through workshops conducted jointly with the Department of Education (DOE).
Healthy Hands Campaign	Children in rural schools	Specialist sponsorship and brand activation agency Exp South Africa, working with Lifebuoy, Spar and Build It	aimed to raise funds for schools in need throughout South Africa	Often deadly diseases can circulate through a community due to a lack of sanitation. In rural and developing communities this can be a real danger due to the fact that there was often a lack of clean water and adequate healthcare	Healthy Hands campaign : the importance of keeping clean	Health officials educated the learners as to the benefits and importance of personal sanitation, after which each pupil was treated to a healthy and wholesome lunch. In addition, Lifebuoy, Spar and Build It will maintain an on- going relationship with each school to assist with health education and general sanitation procedure
Gauteng Handwashing Championships	Health Care Profession als	Dept of Health, Kimberley- Clark and Handwashin gforlife	handwashing at health care centres and hospitals	Lowering the rate of infection with handwashing	'Washing was caring' – 'Everyone wins when you wash your hands'	Team rally training campaigns to train staff on handwashing

2.2.6 Comparison of Hand Hygiene Audiences and Messages

In assessing the hand hygiene audiences which were the focus of these campaigns, it was clear that hand hygiene initiatives in South Africa focused on very similar audience, leading to opportunities being missed to ensure that the entire South Africa population was targeted with hand hygiene messages at some stage in their lives. Table 2 clearly shows the overlap in the audiences of hand hygiene campaigns, with many of the campaigned being focused on learners.

Very few of these campaigns address other important hand hygiene audiences such as adults, caregivers and health professions. There were a few other campaigns in the country which focus on health professionals; however information related to these was not readily available.

None of the campaigns included in this report focused on very young children (under 5 years) which was concerning as this is the age at which basic hand hygiene can become entrenched as spontaneous behaviours.

There were also gaps in campaign which target the mothers of these young children. Research has shown that these were perhaps the most responsive audience to hand hygiene promotion as these individuals were open to improving hand hygiene behaviours as a 'protective' mechanism to safeguard their children from diseases and could be responsive to messages of teaching their children to wash hands as good manners. In their assessment of motivators of hygiene behaviours Curtis et al. (2009) suggest that *persuading mothers that a child that washes hands with soap was demonstrating good manners could be an effective means of getting habits established early.*

Table 2: Summary of groups targeted by South African hand hygiene initiatives

TARGET GROUP	CAMPAIGN
<5 years	No specific campaign
Primary school children (6-12)	• WASH • Gimme5 • Healthy Hands Campaign • P&P School Club • Reckitt Benckiser, Unilever and Colgate Palmolive schools campaigns • Keep it Clean Project
Secondary school children/teenagers (13-18)	• Gimme5 • Healthy Hands Campaign • P&P School Club • Keep it Clean Project
Adults (>18 years)	• Keep it Clean Project
Mothers with children <5	No specific campaign
Caregivers	• Keep it Clean Project
Health professions	• Gauteng Handwashing Championships

Table 3 shows the key messages of these hand hygiene initiatives in South Africa. Similar to the audience of these initiative, hand hygiene message were relatively similar across the campaigns, which has led to some gaps. Many of the initiatives focused on practicing hand hygiene to prevent disease. Research has shown that despite many international hygiene initiatives focusing on the links between hygiene and disease as a motivator of behaviour change, these initiatives have been ineffective in resulting in sustained behaviour changes (Scott et al., 2007). Curtis (2001) suggests that expecting behaviour change based on an individual's aversion to germs was ineffective and provided insufficient motivation to 'trigger' hygiene behaviour change. Hygiene behaviours seems to be driven by a multiple of factors, a combination of instinctive behaviours, behaviours that were influence by the environment to which an individual was exposed and behaviours which were learnt. Thus to focus on changing behaviours based on the germ theory expects individuals to based behaviour change only

on 'learnt' factors without address those poor hygiene behaviours which were instinctive or influence by the environment of an individual. There were few initiatives in South Africa which focus on the manner and critical times of hand hygiene and no campaigns which focus on using 'disgust' messages as a motivator for had hygiene behaviour change.

Table 3: Summary of key messages of South African hand hygiene initiatives

KEY MESSAGE	CAMPAIGN
Wash hands with soap to prevent disease or to save lives	WASH P&P School Club Reckitt Benckiser, Unilever and Colgate Palmolive schools campaigns
Handwashing with antibacterial soap save lives	Gimme5
Practice good hygiene	WASH 2020 Vision
Wash hands	WASH Baswa le Meetse Awards Project Healthy Hands Campaign Gauteng Handwashing Championships
Behaviour change	Keep it Clean Project
'Gross' or disgust messaging	
Wash hands at critical times	P&P School Club
Wash hand thus:	National Handwashing Day 2010

2.3 Hand Hygiene and Health Imperatives in South Africa

The increasing prevalence of diseases that compromise immune function means that patients were at higher risk for infections. Medical advances allow individual which were highly susceptible to these diseases (e.g. very-low birthweight infants, persons with malignancy or HIV infection, recipients of organ transplantation) to live longer. However, these individuals were in a state of heightened vulnerability to infection (Larson, 1999).

Diarrhoea was one of the most frequent illnesses occurring amongst patients which have compromised immune function. Reducing the risk of diarrhoea, through good hand hygiene, was therefore particularly important in the care of these individuals. A randomized controlled study of the hand hygiene practices of 148 patients with AIDs by Huang and Zhou (2007) found that intensive hand hygiene among patients with AIDS reduced the number of new episodes of diarrhoea illness.

South Africa, with the significant number of individuals living with HIV, needs to take special note of the importance of hand hygiene in assisting individuals living with this and other immune compromised diseases and the contribution of this hygiene behaviour in controlling diseases associated with compromised immune systems.

2.4 Review of national hand hygiene technologies

A number of handwashing technologies were available in South Africa. As Table 4 showed, these vary in sophistication, operation, capacity and cost. Handwashing technologies for the rural areas of the country were limited to a bucket or basin until the end of the 90s. However, the last 11 years has seen an increase in the availability and options of handwashing technologies for these areas. Individuals in the formal urban settlements usually had access to a household tap or yard tap for hand hygiene. Those that live in informal urban settlements however, could have had access to these

sophisticated hand hygiene technology but could also be limited to the basic sanitation technologies found in rural areas, such as the tippytap, the pipe and tap system, the CSIR handwashing dispenser or a bucket for handwashing.

Table 4: Examples of Hand Hygiene Technologies being used in South Africa.

TECHNOLOGY	PRODUCER, DISTRIBUTOR OR MAIN PROVIDER	DESCRIPTION	NUMBERS	CAPACITY	EXAMPLE
CSIR Handwashing Dispenser	CSIR	Plunger cap attached to a 2 liter bottle	> 100 thousand	2 liters	
Handwashing Facility	Amalooloo	Reservoir with a washbasin over a toilet cistern. Water poured into the reservoir	40-50 thousand	9-11 litres	
Pipe and tap	Thermoplastics	Tap attached to a pipe with brackets that attached through the wall of the toilet with a stud outside	30 thousand	5-6 litres	
Bucket and tap	Mvula	Wine tap attached to a 5 litre bucket	15 thousand	5 litres	
Tap or tap&basin	Various	On-site yard tap connected to a municipal water system or in-house tap with sink or basin	Assuming all householder with on-site or in-house connect have one of these.	Limitless	
Tippytap	Household	Usually a bottle or container attached to the toilet, a stick or on its own. Water was poured from the container onto the hands	Unknown	Dependent on size of container	
Handwashing basin	Household	Usually a bucket or basin of water next to the toilet	Unknown	Dependent on size of container	

TECHNOLOGY	PRODUCER, DISTRIBUTOR OR MAIN PROVIDER	DESCRIPTION	NUMBERS	CAPACITY	EXAMPLE
Ethekwini yard tank	Municipality	A yard tank which was fed from a municipal supply (limited)	>80 000	200 litres	

3 REVIEW OF APPROACHES APPLIED IN INTERNATIONAL HAND HYGIENE ASSESSMENTS

Hygiene studies have made use of a number of approaches to conduct these assessments. A review was provided of the approaches which were applied in similar hygiene studies in other countries, with these guiding the approach used in the development of hand hygiene framework for South Africa.

A review of sanitation-related hygiene and hand hygiene studies showed that assessment of behaviour change should ideally take a multi-disciplinary approach with a combination of methods used to assess these behaviours. Curtis et al. (2009) reviewed 13 studies of large-scale and national handwashing promotion programmes to capture the root-causes of handwashing behaviours. These studies used a variety of approaches for data collection including:

- **structured observations** which measured current handwashing practice through direct observation of handwashing of individuals for a 3-hour period in the morning, and recording these practices in a structured format.
- **behaviour trials** which involved volunteers being given soap and being asked to carry out hand hygiene for a period of 7 or 10 days, followed by an in-depth debriefing interview.
- **Focus Group Discussions (FGDs)** where targeted individuals using a variety of tools, such as ranking, motivational images, storytelling and word elicitation, to elicit active participation in describing hand hygiene behaviours.
- **key informants interviews** which included village elders, health workers and teachers.

Table 5 shows some of the methods that have been applied in assessment of hygiene and hand hygiene in other hygiene assessments.

Behavioural assessments make use of quantitative and qualitative research, which differ in that:

1. qualitative research was used to achieve an in-depth understanding of human behaviour and the reasons that govern such behaviour. Qualitative research investigate the why and how of decision making, not just what, where or when. Smaller but focused samples were thus usually needed. These types of assessments were need to ensure that hand hygiene interventions were spatially and temporally suited to the local environment (Bergqvist, 2008).
2. quantitative research develops and employs mathematical models, theories and/or hypotheses. The process of measurement was central to quantitative research as it provided the connection between empirical observation and mathematical expression of quantitative relationships.

Documenting hand hygiene behaviours and motivators of these behaviours is extremely complex. Although a number of approaches or combinations of methods have been used to asses behaviours and motivators of hygiene these often rely on an individual's memory (recall) of previous behaviours; rationalizing of these behaviours; and individuals having to behave 'normally' while being observed and documented. Despite these approaches to assessment of hygiene behaviours Curtis et al. (2002) suggest that many of the hand hygiene behaviours were automatic, habitual or 'triggered' by external stimuli and that individuals do not necessary register these habitual behaviours and cannot rationalise why they behave in a particular manner.

Table 5: Methods applied in various approaches to hygiene behaviour assessments.

Study Reference	Sample of the study	Sample Size	Country of assessment	Approach to sanitation-related hygiene or hand									
				Questionnaire surveys/interviews	Semi-structured Qualitative Interviews	Projective interviews	Structured or Spot check Observation	Focus Group Discussions	Key Informant interviews	Behavioural trials	Self-reporting	Electronic data loggers	Microbiology assessment
Curtis <i>et al.</i> , 1993	Mothers, from the town Bob-Dioulasso, with children who were hospitalised with diarrhoea between 1990-1991 and a control group of neighbouring mothers with children who were not hospitalised with diarrhoea during this period	2775 individuals	Burkina Faso	✓			✓						
Curtis <i>et al.</i> , 1995	Mothers with children 36 months and under who were hospitals with diarrhoea between 1990-1991 and a control group of neighbouring mothers with children who were not hospitalised with diarrhoea during this period	2793 individuals	Burkina Faso	✓			✓	✓					
Curtis <i>et al.</i> , 2001	Principle carers of young children (0-35 months) and their immediate social circle; primary school children	190 individuals	Burkina Faso	✓			✓						
Curtis <i>et al.</i> , 2002	Households with an infant below 3 months who had received a polo vaccine within the past 2 weeks and had a toddler below 3 years	10 households	England		✓	✓	✓	✓					✓
Edwards <i>et al.</i> , 2002	Restroom users at a university	184 individuals	USA				✓						
Scott <i>et al.</i> , 2003	Young mothers	144 individuals	India	✓				✓		✓			
Luby <i>et al.</i> , 2004	Households with at least two children under the age of 15 years and at leave 1 of these was under the age of 5 years	1050 households	Pakistan	✓									
Biran <i>et al.</i> , 2005	Volunteer households, preferably the poor households in 6 villages	65 households	Kyrgyzstan	✓			✓	✓		✓			
Webb <i>et al.</i> , 2006	Pregnant women and women with children younger than 36 months from four villages	613 households	Guatemala				✓						
Biran <i>et al.</i> , 2009	Head of households with at least one child registered at the primary school and 1 other child under the age of six	288 households	India	✓			✓				✓	✓	
Stevenson <i>et al.</i> , 2009	Undergraduate students; individuals from the local community; volunteers and paid participants of various ages	1363 individuals	Australia								✓		
Judah <i>et al.</i> , 2009a	Commuters from various cities	409 individuals	Uk	✓									✓
Judah <i>et al.</i> , 2009b	Travelling public who use highway restrooms	198000 restroom uses	Uk	✓								✓	
Schmidt <i>et al.</i> , 2009	Households in various provinces	800 households	Kenya	✓				✓					

To address some of the above mentioned problems with measuring hand hygiene behaviours and motivators, hygiene behavioural assessments very often applied a combination of quantitative and qualitative research methods to produce a general picture of behaviours using complementing data sets. A brief overview of some of these quantitative and qualitative research methods was provided below.

3.1 Quantitative Methods of Hand Hygiene Assessment

3.1.1 Questionnaire surveys or interviews

Most hygiene behaviour assessments relied on gathering information using behaviour questions. Questions were answered by an individual 'recalling' behaviour, during an interviews or surveys (EHP, 2004). Interviews and surveys were commonly used in behavioural assessment as they were faster to complete and less intrusive than some of the other behaviour study methods.

The disadvantage of surveys or interviews was that the "recall" of a behaviour by an individual often showed little alignment to their actually behaviours (Ruel and Arimond, 2002). Interviewees often over-reported good behaviours or tried to report the perceived 'correct' answers to interview questions. In an assessment of hygiene behaviours of mothers in a town in Burkina Faso, Curtis et al. (1993) found poor correlations between the questionnaire responses of interviewees and the actually observed behaviours. Curtis et al. (1993) suggested the reason for this discrepancy could have been due to the reporting of 'good' behaviours by mothers, despite not actually practicing these behaviours. Factors which influenced hand hygiene (such as status, attraction and disgust) were often 'irrational' and as a result, were under-reported in questionnaire studies where interviewees try to give the 'right' answer (Curtis et al., 2009).

3.1.2 Spot-check observation

Spot-check observation, a rapid and easily standardized alternative to structured observations, observes hygiene behaviours using a line-item checklist of behaviour proxies (Webb et al., 2006). For example, rather than observing whether an individual washes their hands with soap, a spot-check method used the observed cleanliness of the individual's hands and nails as an indicator of hand-washing behaviour (Webb et al., 2006).

The advantage of using spot-check observations was that it was unnecessary for an observer to remain in the home, watching the behaviours of an individual, until a specific hygiene activity was observed. The spot observation took less time, thus providing a 'timesaving and economic alternative' to structured observations, and it was less intrusive for the individual whose behaviours were being assessed (Webb et al., 2006).

Examples of hand hygiene spot observations questions included (EHP, 2004):

- Presence of soap (a necessary condition for washing hands with soap)
- Presence of a water supply (a necessary condition for hand hygiene)
- Presence of a hand hygiene designated place (a necessary condition for hand hygiene)
- Fingernails without dirt (as a result of handwashing and cleaning)

Despite their apparent benefits, little was known regarding the repeatability or predictability of the spot-check method. In addition, the association between behaviours assessed using a spot-check and the genuine handwashing behaviour was not completely defined.

3.1.3 Bacteriological Sampling

Hand hygiene assessment often used field and laboratory methods to determine faecal contamination of water, hands or food preparation surfaces. The methods used in the assessment was determined by the type of assessment, i.e. water could be collect in sampling bottles while hands were assessed using swabs or the bag-method.

Microbiological assessment of hands in communities with a high incidence of diarrhoea, included samples collected from hand swabs, from the water used to wash hands and from sterile solution that hands were rinsed in. Various methods have been used to quantitatively analyse these samples, using methods similar to assessing water quality. The advantage of this type of hand hygiene assessment was that it gave a quantitative measure of the levels of indicator species on hand and thus, some quantitative measure of how 'clean' an individual's hands were at that point in time.

The disadvantage of this method was that it can be expensive and complex. The rapid recontamination of hands in highly contaminated environment means that microbiological assessments of individual hands may not efficiently identify those persons who regularly washed their hands (Luby and Halder, 2008). Thus, microbiological assessment on its own was not sufficient to determine the effectiveness of hand hygiene. This method should be complemented with other quantitative and qualitative hand hygiene behaviour assessment methods.

3.2 Qualitative Assessment Methods of Hand Hygiene

3.2.1 Semi-structured (informal) interviews

Informal, semi-structured interviews were structured; open-ended interviews which use a predetermined set of questions related to hand hygiene. The interviewer captured the descriptive answers for each questions, i.e. there were no pre-determined answer 'options' to each questions.

3.2.2 Observations

Many of the most recent hygiene behavioural studies included direct observation of behaviours. Structured observation involved a fieldworker sitting in a study household, while the householders continued their normal activities (Biran et al. 2008). The fieldworker observed the householder, usually for a 3 hours period, and recorded their hand-washing practices. Observation of the actual behaviours practiced by an individual had the advantage of minimising the bias of recall from interviews and surveys (EHP, 2004).

The disadvantage of structured observations was that they were time consuming, costly and could be intrusive. They also required a higher level of skills to minimise the undesirable effect of individuals behaving out of the norm because they were being observed (EHP, 2004). In addition, since individuals changed behaviours to suit a situation or the time of day, observation of behaviours for a limited period would not capture all these behaviours, i.e. handwashing behaviours could vary throughout the day. Structured observations could thus not have accurately reflected the "normal" or "typical" hygiene practice. Structured observations also tended to be highly variable from visit to visit, thus reducing repeatability within subjects (Webb et al., 2006).

3.2.3 Focus group Discussions

Focus group discussions (FGDs) were facilitated discussions among groups of six to 10 people who share similar characteristics (e.g. rural mothers with children under 5).

FGDs were most useful for exploring social norms, broad concepts, and the range of behaviours in a community, rather than focusing on individual practices. In these sessions, pictures or other props could be used to help people talk about typical behaviours without feeling ashamed of revealing intimate details about their own lives (Favin et al., 2000).

3.2.4 Self-reporting

Self-reporting hand hygiene was an instrument where the subject was asked to record their hand hygiene behaviour over a specific period of time. Unfortunately, there were currently no validated standard measures for self-reporting, and those that were available tended to be group-specific (e.g. to medical personnel) (Stevenson et al., 2009).

The disadvantage of this method of assessment was that self-reporting of hygiene behaviour could be compromised by the 'impression' that the individual taking part in the assessment could want to present in the study (i.e. the desire to present a "clean" and "hygienic" image). This could result in self-reporting measures having little practical value (Stevenson et al., 2009).

3.2.5 Handwashing demonstration

Handwashing demonstration was where the fieldworker asks the interviewee/individual being observed to demonstrate how they usually washed their hands after defecation (Biran et al., 2008). Fieldworkers recorded the method of handwashing (both hands, one hand, neither hand), the cleansing material employed (soap, ash, mud, stone, water alone) and the presence or absence of soap at the hand-washing site.

The observation of handwashing technique had been promoted as one of the few structured observations in household surveys (Billig et al., 1999). This observation method captured 'how' a subject would typically wash their hands. However, the disadvantage of this method was that asking individuals to demonstrate hand hygiene did not mean that the individual used this handwashing technique at all times (EHP, 2004).

3.3 Approach Recommended in the Assessment of Hand Hygiene in South Africa

In the assessment of hand hygiene in South Africa a combination of qualitative and quantitative methods was recommended. Triangulation is the term used to describe an approach of combining qualitative and quantitative information in an assessment. It allowed for the collection of information through a multitude of methods to ensure a comprehensive picture of the reality and at the same time, validation of the information being collected.

Integrating several types of methods could provide a comprehensive picture of the what, when, how and why specific hand hygiene behaviours could occur. Qualitative data provided the cultural context which would vary spatially and temporally, while quantitative data could capture a private experience and allowed for comparisons with data from other studies (Kaltenthaler and Drašar, 1996). Thus the use of a variety of methods in the assessment of hand hygiene facilitated the construction of a picture of existing hygiene practices, generates baseline data for a subsequent evaluation and allowed for comparison of hand hygiene behaviour between various studies.

The review of the approaches taken to various hygiene behaviour assessments (Table 5) suggested that the approach that should be taken for the South African hand hygiene assessment should be

multi-dimensional, including individual structured and semi-structure interviews, spot observation, focus group discussion and microbiological assessment (Figure 3).

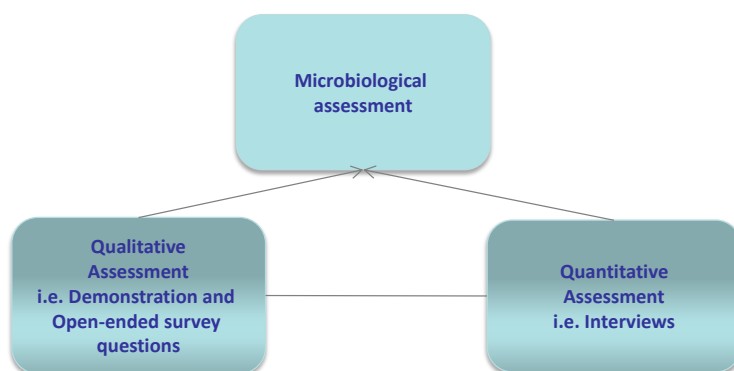


Figure 3: Triangulation approach recommended for hand hygiene assessments in South Africa

Despite observation of hand hygiene behaviours being used extensively in behaviour studies and becoming more popular in recent years, they were extremely time consuming and require skilled local observers. Since the method being developed in this hand hygiene assessment was expected to be applied in a 'project' situation where financial and human resources would be limited and timeframes for assessment would be short the use of this method was not recommended, rather spot observations were recommended.

4 REVIEW OF HYGIENE ASSESSMENT FRAMEWORKS

A framework, in this study, was defined as the *theoretical models used to explain, predict and change human hand hygiene behaviour*. Theoretical models (frameworks) used in this manner have ranged from those that determined behaviour based on the environment and events, to those that included cognitive factors and reasoning as determining variables, to more recent models (frameworks) which took a broader approach when determine behaviours, such as combining environment, trigger, barriers, emotions and other factors as determining variables of hygiene behaviours (Curtis et al., 1995). Determining variables, as referred to in this report, were those variables which determine hand hygiene behaviours. To change these behaviours, a change in the variables of hand hygiene would be necessary.

4.1 The Health Belief Model

Earlier research to understand the drivers of “behaviour” (compliance) of individuals to treatment regiments of illnesses relied heavily on the “Health Belief Model” (see Figure 4). This model was used to predict the likelihood of positive “preventive” health behaviours by an individual using a 5 attitude and behaviours predictors.

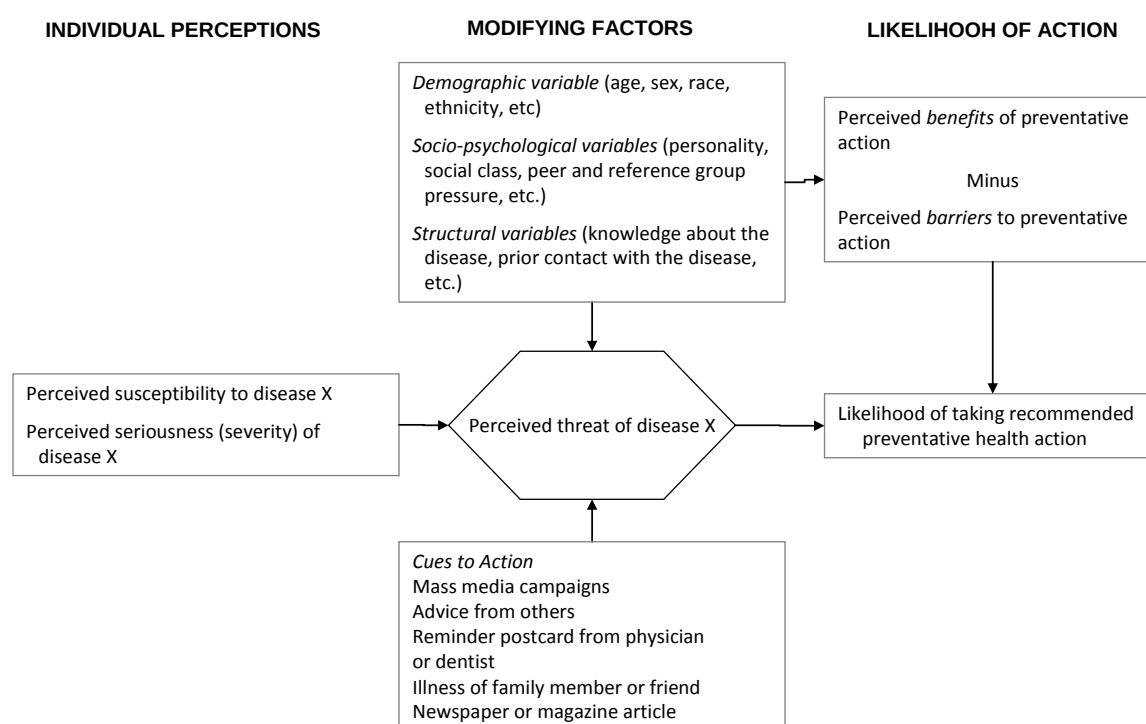


Figure 4: The ‘Health Belief Model’ as predictor of preventive health behaviour (Becker et al., 1974).

Figure 4 showed that one of the key predictors of an individual’s ‘likelihood of taking recommended health action’ were the individual’s *perception* of a threat from a disease (Becker et al., 1974). This perception was driven by a diversity of modifying factors including demographic, structural, and socio-psychological variables. In addition, according to the model, an individual’s perceived ‘threat’ from a disease was determined by their:

1. perception of how susceptible they were to the disease, i.e. their perception of the risk of contracting the illness, in the case of a hand hygiene study this would have related to an individual’s perception of their risk of contracting water-related disease such as diarrhoea or cholera;

2. perception of the seriousness of the disease, i.e. their perception of severity of contracting the illness, in the case of hand hygiene this would have related to the perceptions of an individual of how serious of contracting of diarrhoea or cholera would be; and
3. a behaviour modifier in the form of a "cue" or triggering mechanism that was necessary to trigger appropriate action, i.e. in the case of hand hygiene this could be something such as a hand hygiene media message or a disease threat such as the cholera outbreak experienced in South Africa in 2000 (Becker et al., 1974).

Once the disease was perceived as a 'threat', whether the individual would take preventative action was based on the outcome of a second behaviour predictor; namely an individuals *perceived* barrier/benefit assessment of preventative action, i.e. in the case of hand hygiene the predictor would have been the benefits of action weighed against the difficulties (lack of technologies; time limitations) in taking the hand hygiene preventative action to reduce the risk of contracting diarrhoea or cholera. Again the model suggested that this perception was also driven by a diversity of modifying factors including demographic, structural, and socio-psychological variables. Based on the model, changes in recommended preventative health action behaviours thus, required a change in the underlying perceptions, which in-turn necessitated changes to the underlying demographic variables and introduction of 'cues' to action.

The weakness of the Health Belief Model was that it was based on the premise that educating people about the threat of disease, the benefits of the preventative action and removing the barriers to the preventative action led to a reduction in risk behaviours. However, studies suggested that traditional health education such as this was unlikely to be an effective route to behaviour change (Scott et al., 2007).

Becker et al. (1974) adapted the 'Health Belief Model' for use as a predictor of behavioural compliance of mothers dealing with sick children (Figure 5).

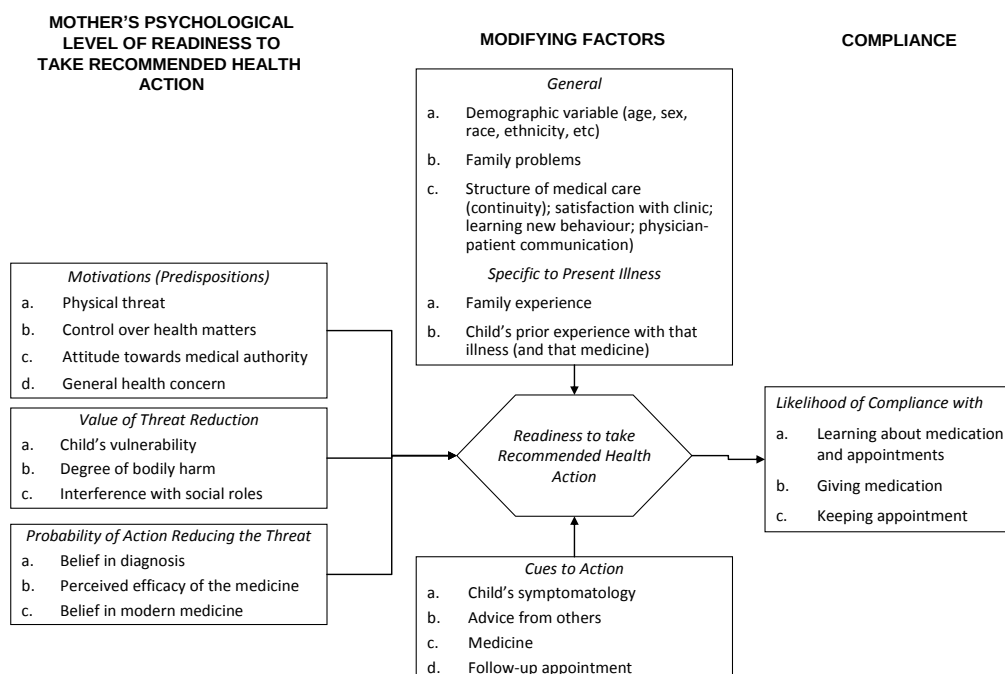


Figure 5: Adapted 'Health Belief Model' as predictor of compliance in pediatric situations (Becker et al., 1974).

The adapted model introduced predictors of an individual's psychological readiness to take recommend health action, based on:

- **motivations** from four dimensions, namely the perceived physical threat of the illness, the control over health matters, the attitude towards the medical authority and general health concern (Becker et al., 1974). The adapted model not only measured the negative (threat of disease or condition) motivators of health behaviours but introduced a positive dimension (general health concern) as a motivator.
- an "**incentive value**" of whether the threat could be reduced, determined by the perceived vulnerability to the threat, severity of the threat and difficulty in taking action;
- the perceived probability of whether the required action would reduce the threat.

Based on these psychological predictors, the readiness of an individual to take action was determined. However, this readiness was also determined by an additional predictor and a 'cue' to action; namely

- an individual's **estimate of the likelihood** of whether following the physician's instruction would reduce the threat, measured through the (1) the perception of the accuracy of the diagnosis; (2) the perception of the usefulness of medications which were previously obtained; and (3) the general confidence in the usefulness of modern medical practices; and
- some external 'cue' of action such as advice from others, medicines and general health (Becker et al., 1974).

Despite these motivators to behaviour, the model suggested that an individual's 'readiness to take the recommended health action' was still susceptible to the influence of positive and negative modifying factors such as demographics variable, family problems and experience, the structure of medical care and the perceived "costs" of the health action and could also often require 'cues to action'. Finally, the model components were combined to explain and predict the probable degree to which the individual would comply with the various cognitive and behavioural aspects of the medical regimen provided (Becker et al., 1974).

Becker et al. (1974) applied this framework to determine compliance of daily caregivers to a medical regimen provided to a sample of 125 cases of children being treated with otitis media. The framework was used to model variables which will be useful predictors of a mother's behaviour, to characterize the principle motivations of individuals and groups health behaviours and to provide clues to the nature of appeals that physicians, health educators, and other health workers might use in attempting to heighten the probability of compliance of individuals to medical regimes provided by the practitioners. The study found that most of the variables in the model were significantly associated with three compliance behaviours of daily caregivers; namely administer the medication to the child, keep follow-up appointments and appointment-keeping ratios (Becker et al., 1974).

4.2 The Precede-proceed Health Model

Health scientists have often made use of the precede-proceed model to promote healthy behaviour (Figure 6). The model was based on the theory that health behaviour was driven by more than knowledge, beliefs and attitudes (Green and Ottoson, 2006). The model showed that health was determined by the interaction of individual human factors such as hygiene behaviours, knowledge, beliefs, environmental and other enabling and predisposed factors such as policies, hygiene interventions, peer pressure, etc. These factors together drove an individual not just to improve their health, but rather toward improving the quality of life (Curtis, 2001).

A framework for the assessment of change in health, based on this model, required a number of methods of assessment:

- Before an intervention:
 - social assessment to determine both the baseline and thus, changes in quality of life;

- epidemiological assessment to determine baselines behaviours (i.e. hand hygiene) and lifestyles, immediate environment, human biology and health (i.e. diarrhoea, well-being) against which change can be measured;
- education and ecological assessment to understand, and measure change, in individual predisposition, habits and the enabling environment;
- assessment of implementation needs which inform the structure and nature of intervention required;
- during and after an intervention: assessment of the implementation and results (inputs, output, outcomes, impact) of the intervention.

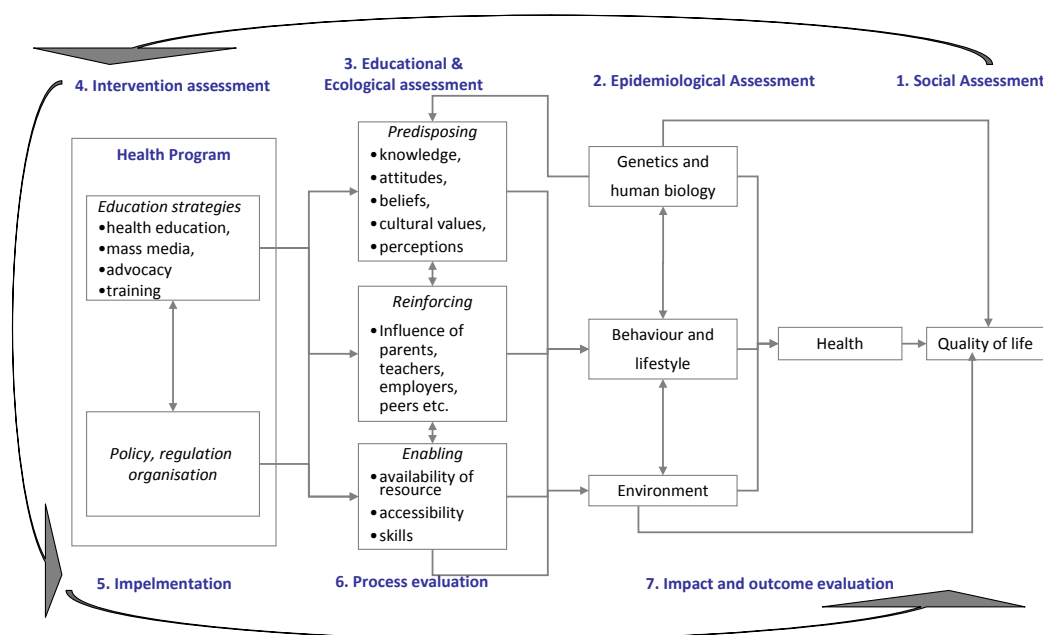


Figure 6: The Precede-proceed framework for planning and evaluation of health interventions (taken from Green and Ottoson, 2006)

4.3 Framework of Hygiene Determinants

Curtis et al. (1995) used these earlier health models to develop a conceptual framework for assessing sanitation-related hygiene behaviours, including hand hygiene behaviours (Figure 7). This framework located sanitation-related hygiene behaviours within two environments, namely; (1) the external environment, such as the social and physical environment in which an individual operates and (2) the immediate environment, such as an individual's socio-economic status, their access to basic water services and their level of hygiene knowledge. To change hygiene behaviour, both the external and internal environment in which an individual lives would need to change. Change in hand hygiene behaviours which could take time and substantial resource investment (Ejemot et al., 2008) would thus require:

- improvement in the social and physical environment of the individual;
- improvement in the socio-economic status and quality of life of the individual;
- improvement in infrastructure, i.e. water, sanitation and health service;

- improvement in hand hygiene knowledge usually through a hand hygiene awareness and promotion intervention as part of a health and hygiene education, awareness and promotion programme;
- changes in cultural particularly hand hygiene culture such as washing hands without soap;
- Change in routine, customary behaviours such as not washing hands at all the critical times.

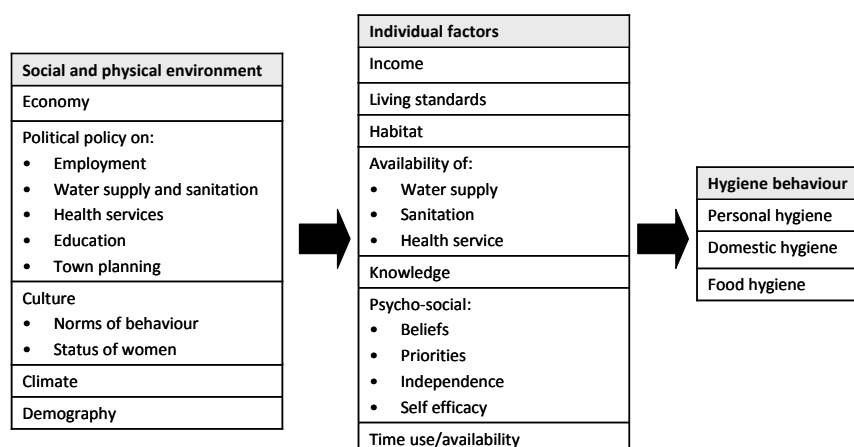


Figure 7: Determinants of hygiene behaviours (taken from Curtis et al., 1995)

The model suggested that it was only through an understanding of immediate and external environmental determinants of hand hygiene and implementing interventions to facilitate a change in these that hand hygiene behaviours could be changed. To ensure the most effective improvements in hand hygiene, assessment of all these determining variables was necessary.

4.4 Hygiene Improvement Framework (HIF)

The USAID Environmental Health Project (EHP), through lessons learned from interventions to reduce child diarrhoea, developed the Hygiene Improvement Framework (HIF). This framework was based on the three key components required for a successful hygiene intervention; namely access to hardware, hygiene promotion and an enabling environment (Figure 8) (EHP, 2004; EHP et al., 2004). These components were designed to focus on encouraging household behaviours that reduce the incidence of childhood diarrhoea.

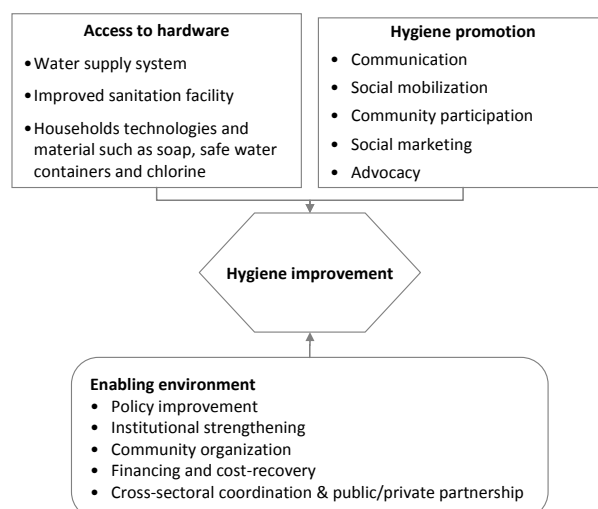


Figure 8: Components underpinning the Hygiene Improvement Framework of USAID's Environmental Hygiene Project.

The EHP developed a set of guidelines for assessing hygiene improvement at household and community level using the Hygiene Improvement Framework as its basis (EHP et al., 2004) (Figure 9). These guidelines made use of a hierarchical framework of indicators to measure the success of hygiene improvement interventions.

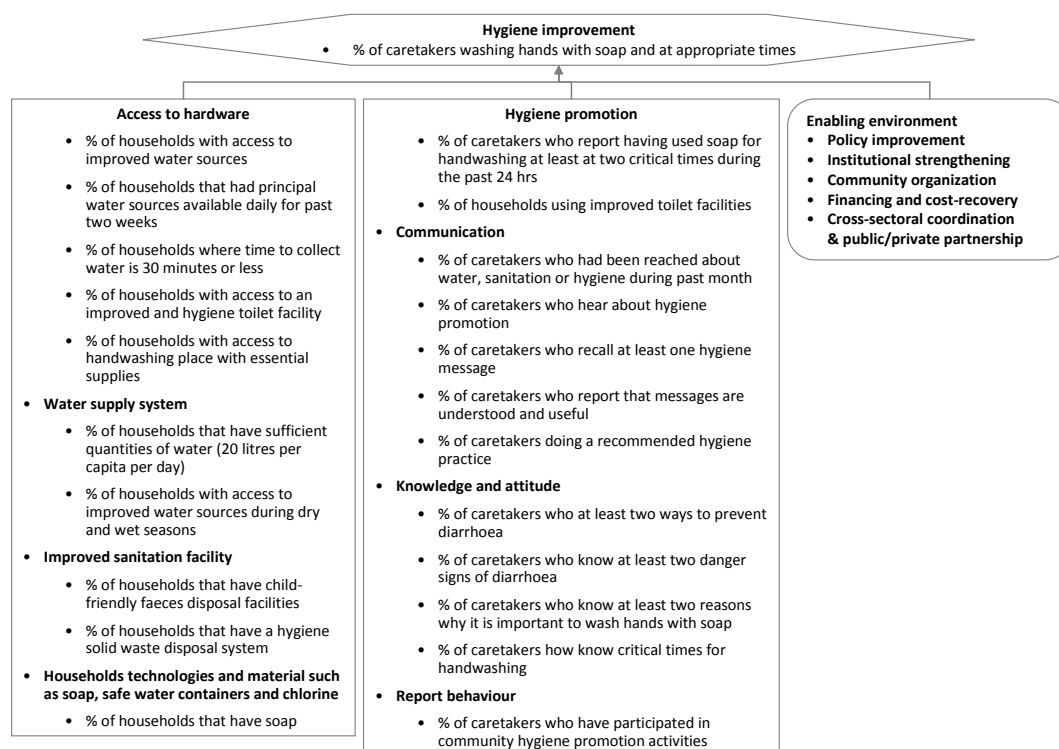


Figure 9: Hand hygiene-related indicators used to assess hygiene improvement based on the Hygiene Improvement Framework

Indicators, which fell into four groups, were organized hierarchically into the 3 components of the HIF (see Figure 8). The four groups of indicators were:

- Impact indicators which measured the long-term impacts of an intervention such as a decrease in the prevalence of diarrheal disease;
- Outcome indicators which measured the short-term impacts of an intervention such as changes in hygiene behaviours;
- Outcome indicators which measured the immediate, physical output of an interventions such as access to a water supply, sanitation facilities and hand hygiene technologies;
- Input indicators where measured the institutional requirements for a successful hygiene improvement programme.

Included in the indicators were those which relate to hand hygiene including those shown in Figure 9.

4.5 Framework to Assess the Root-cause of Hand Hygiene Behaviours

All of the health models and hygiene assessment frameworks discussed above assumed that, if all the environmental and hygiene components or elements were available to an individual, they would practice good hygiene behaviours. However, despite individuals having all the knowledge, techniques and tools necessary to practice good hand hygiene, this practice seldom occurred. While to the health scientist, hygiene was a rational concept based on the argument that 'the practice of keeping oneself

and one's surroundings clean, was especially important in order to prevent illness or the spread of infection', to ordinary people hygiene behaviours were rarely carried out for health-related reasons (Scott et al., 2007).

Recent assessment of hygiene behaviour have hypothesized that factors such as wishing to appear attractive, smell good, removing dirt or the need to protect children were the motivators for good hygiene behaviours and not the need to prevent disease. According to Curtis et al. (2009), in their review to capture the underlying causes of hand hygiene behaviours, a change in the 'brain' (thinking) was required to action a change in hand hygiene behaviours.

The Curtis et al. (2009) study tabulated data from the 13 hand hygiene using the conceptual framework shown in Figure 10. The framework showed the underlying cause of hand hygiene behaviours were the physical, social and biological environment in which an individual lived. This framework took the framework shown in Figure 7 above a step further and hypothesized that not only those social, physical and individual factors determined hygiene behaviours, but rather that a change in individual 'thinking' was needed before behaviour change will occur. The physical, social and biological environmental determinants discussed in this framework were the same as those suggested in the two previous hygiene models; namely the Curtis et al., (1995) model and the Hygiene Improvement Model (EHP et al., 2004).

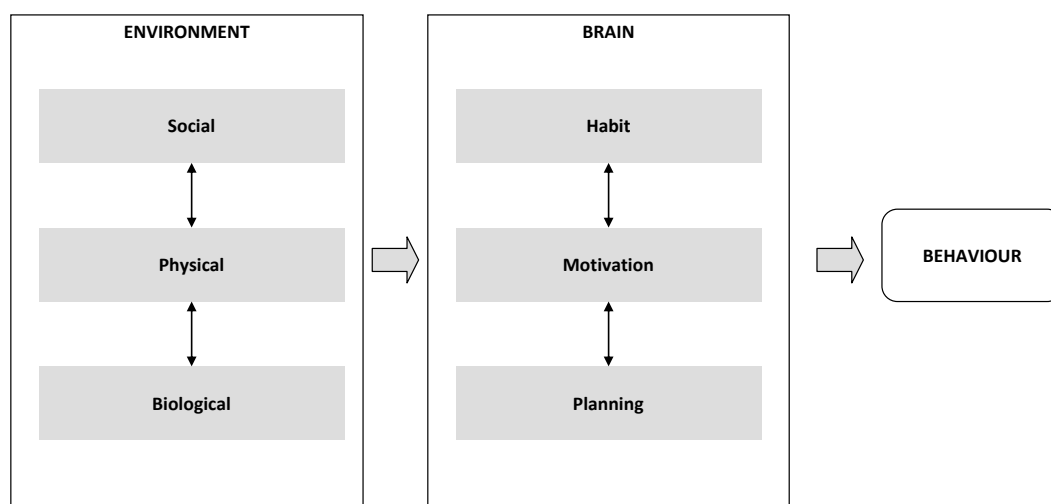


Figure 10: Conceptual model (framework) of the cause of hand hygiene behaviours (Curtis et al., 2009).

This model improved on the other hygiene assessment frameworks in that it included the 'brain' component and assumed that changes in the environment would lead to a change in the three types of discrete but interacting causes of hand hygiene behaviours, namely:

- **Habitual** hand hygiene behaviours which were classified as learnt behaviours that were 'triggered' by a primitive psychological systems cue, i.e. hand hygiene behaviours which were an automatic reflex as they were taught from young.
- **Motivated** behaviours which in the Curtis et al. (2009) review, were those which were practiced as a result of a reward or consequence system including hand hygiene behaviours which resulted from disgust, nurture, status, affiliation, attraction, comfort and fear.
- **Planned** behaviours which were those behaviours over which the individual has cognitive or executive control. Planned behaviours which had the intent of achieving some form of long-term

end or objective, differed from motivated behaviours which were driven by short-term rewards and habitual behaviours (i.e. were automatic and cue-based) (Curtis et al., 2009). Examples of planned behaviours were those hand hygiene behaviours which were practiced as a platform of good health of the family, for beneficial supernatural objectives and to socialize children correctly.

4.6 The Hand Hygiene Assessment Framework Recommended for South Africa

Over the years a number of theoretical models have been used to explain, predict and change human health related behaviour (Curtis et al., 1995). To prevent diarrhoea, at a minimum, individual determining variables of hand hygiene behaviours shown in the Curtis et al. (1995) model needed to be recognised and addressed. Individual determining variables of hand hygiene could be divided into two groups; those variables which remained constant but which influence behaviours (i.e. socio-economic some of the psycho-social determinants) and those determining variables which could change with hand hygiene interventions (i.e. improved knowledge; improvement in available hand hygiene technologies and materials; changes in beliefs and priorities).

To determine the effectiveness of any hand hygiene promotion and awareness intervention, these environmental and individual factors of hand hygiene, which could change with a hand hygiene intervention, need to be noted. In particular an individual's hand hygiene *knowledge*, namely knowing the critical times when hands should be washed, needed to be assessed. Any hand hygiene promotion and awareness intervention has the aim to improve hand hygiene knowledge of an individual. According to Billig et al., (1999) washing hands at critical times (knowledge) included washing (1) after defecation; (2) after cleaning babies' bottoms; (3) before food preparation; (4) before eating; and (5) before feeding children. In addition, Bloomfield et al. (2007) suggested further critical times for hand hygiene including:

- after contact with contaminated surfaces (e.g. rubbish bins, cleaning cloths, food contaminated surfaces);
- after handling pets and domestic animals;
- after wiping or blowing the nose or sneezing into the hands;
- after handling soiled tissues (self or others', e.g. children);
- after contact with blood or body fluids (e.g. vomit and others);
- before and after dressing wounds;
- before giving care to an "at-risk" person; and
- after giving care to an infected person.

In addition, an individuals' *procedure* of hand hygiene needed to be assessed. Again, any hand hygiene promotion and awareness intervention should focus on teaching individuals the correct procedure for hand hygiene. The correct procedures for hand hygiene recommended by Billig et al. (1999) included:

- Using water;
- Using soap or ash;
- Washing both hands;
- Rubbing hands together at least three times; and
- Drying hands hygienically—by air drying or using a clean cloth.

Finally, the EHP (2004) mentioned a third element to appropriate hand hygiene; namely the *availability of materials* (technology) required for hand hygiene. A hand hygiene promotion and awareness

intervention should not only provide 'soft' (awareness and promotion) technology, but also 'hard' technologies such as the materials necessary for correct hand hygiene. Based on Billig et al. (1999) hand hygiene procedure above, at a minimum, a hand hygiene intervention should include provision of:

- a water supply for handwashing;
- soap; and
- drying materials.

The review of hygiene assessment frameworks above showed that any assessment of effective hand hygiene in South Africa should include measurement or observation of community and individual factors that motivated hand hygiene. The South African hand hygiene assessment Framework was thus a modified framework from the Curtis et al.(1995) model, which also included the Hygiene Improvement Framework (EHP, 2004), the Curtis et al. (2009) model and inputs from a workshop with South African sanitation-related hygiene experts.

The hand hygiene Framework had three components, shown in Figure 11-13. Each of the components of the Framework addressed one of the hypotheses' of the research, determined by a number of determining 'variables' of hand hygiene. Determining variables were the determinants, indices, indicators and sub-indicators of the Framework. The hand hygiene hypotheses in the study were:

24. that the manner in which an individual washed their hands (Hand Hygiene Technique) during a hand hygiene demonstration would be influenced by 6 indices, namely: Cultural Influence, Media Exposure, Household Socio-economic Status, Service Environment, Hygiene Knowledge and Social Profile of the Individual (Figure 11). Each index in-turn would be determined by one or more indicators of hand hygiene behaviours (discussed in Section 5.3)
25. the 'cleanliness' of an individual's hands (i.e. the bacterial counts on a individuals hands) would be determined by the manner in which the individual washed their hands and the bacterial counts in the water which was used to wash hands during the hand hygiene demonstration (Figure 12).
26. international literature had shown a number of indicators which would determine hand hygiene and thus hand 'cleanliness' on an individual's hands (Figure 13) (discussed in Section 5.3).

The Framework thus assumed that a change in one or more of these variables will show a resultant change in an individual's hand hygiene behaviour. The Framework was focused exclusively on hand hygiene and provided a structure for the capturing and analysis of data collected during the assessment.

There was no simple, easily employed, reliable indicator or standardized set of indicators of effective hand hygiene. A set of **indicators** of hand hygiene effectiveness have therefore been developed. These indicators were selected based on what literature had shown to be potential determining variables of effective Hand Hygiene Techniques and on whether the indicator was SMART (specific/simple, manageable/measurable, achievable/applicable, reliable/relevant and targeted/timeous). The initial evaluation of indicators was based on only some of these criteria; namely:

1. Simple – indicators need to be descriptive and related hand hygiene directly to the determining variables;
2. Measurable – indicators need to be easily measured through direct observation, household interview or from other established data source, i.e. StatsSA;
3. Relevance – indicators must relate to the determinant to which they were targeted.

Each of the indices in Figure 11-13 were a combination of one or more of these indicators. For example, two indicators form the Media Exposure index, namely the indicator: *exposure to hand hygiene education, awareness and promotion* and the indicator: *exposure to disaster management*, while a range of indicators and sub-indicators underpin the Service Environment index. Indicators were categories into the index based on the hypothesis that that particular indicator will determine the score of the index, and change thereof.

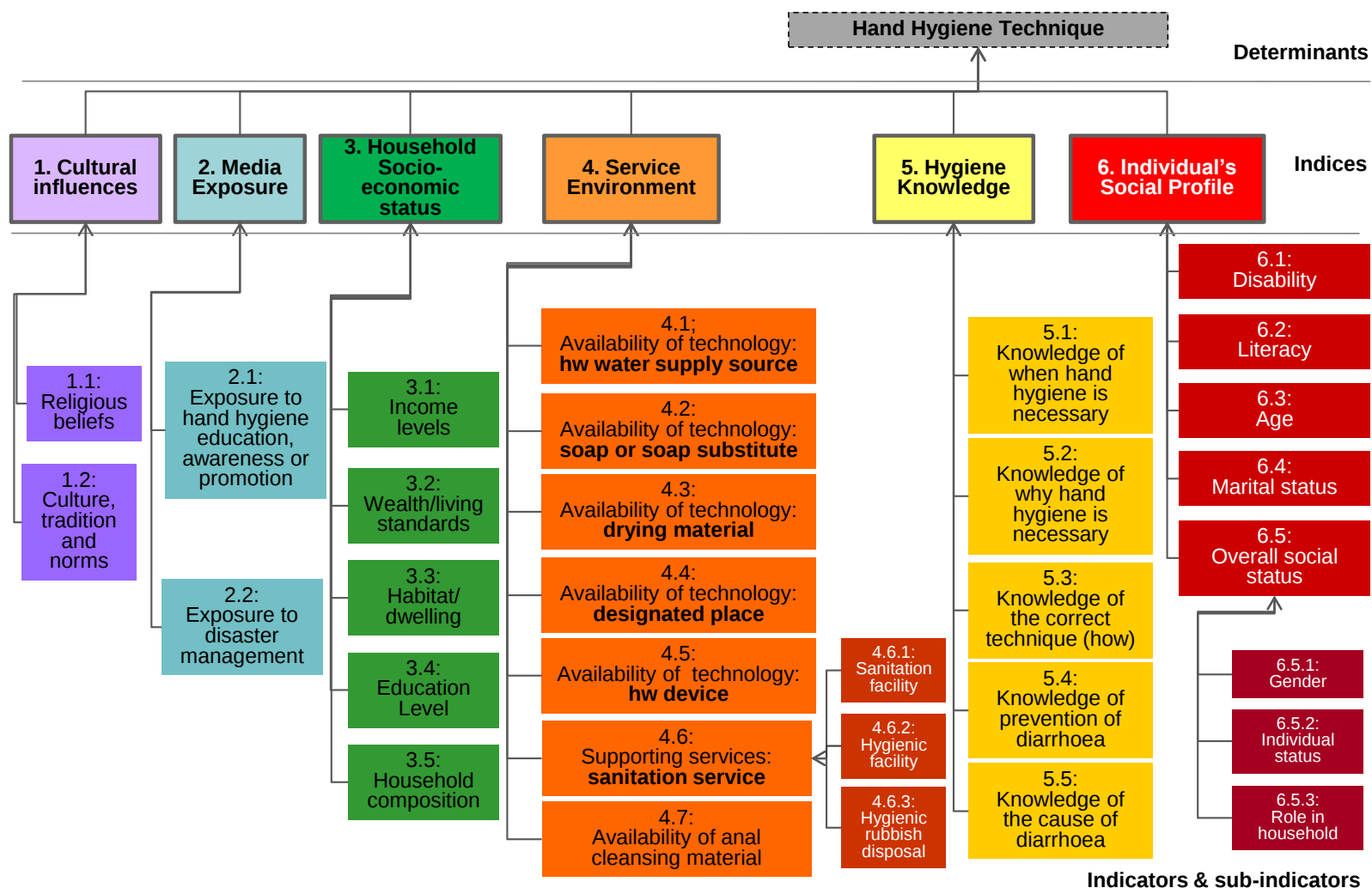


Figure 11: Showing the Hand Hygiene Technique determinant of the hand hygiene Framework. This component of the Framework was based on the hypothesis that an individual hand hygiene technique, shown during the hand hygiene demonstration, was determined by a number of *indices*, *indicators* and *sub-indicators*.

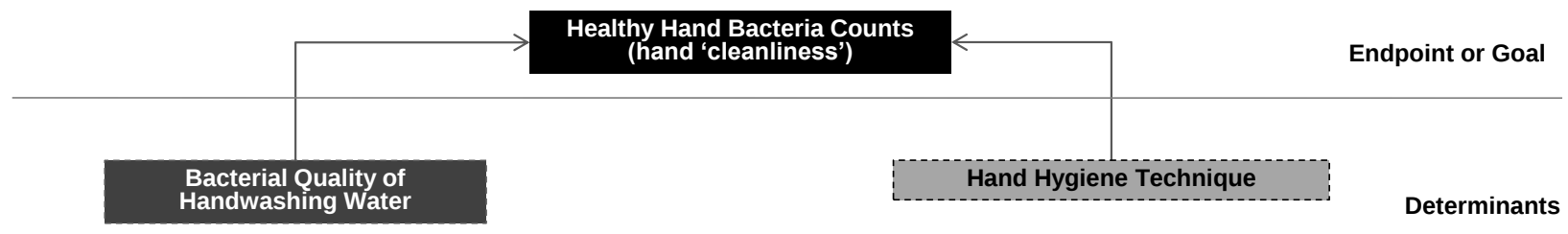


Figure 12: The hand hygiene assessment Framework applied as the guide to capturing and analysis of data in the assessment of hand hygiene in South Africa. The upper-most box showed the *desire end-point*, the second-level from the top were the *determinants* of effective hand hygiene behaviour. This component of the Framework was based on the hypothesis that the 'cleanliness' of an individual's hands (i.e. the bacterial counts on a individuals hands), the desired *end-point* of a hand hygiene interventions, was determined by the manner in which the individual washed their hands and the bacterial counts in the water which was used to practice hand hygiene during the hand hygiene demonstration.

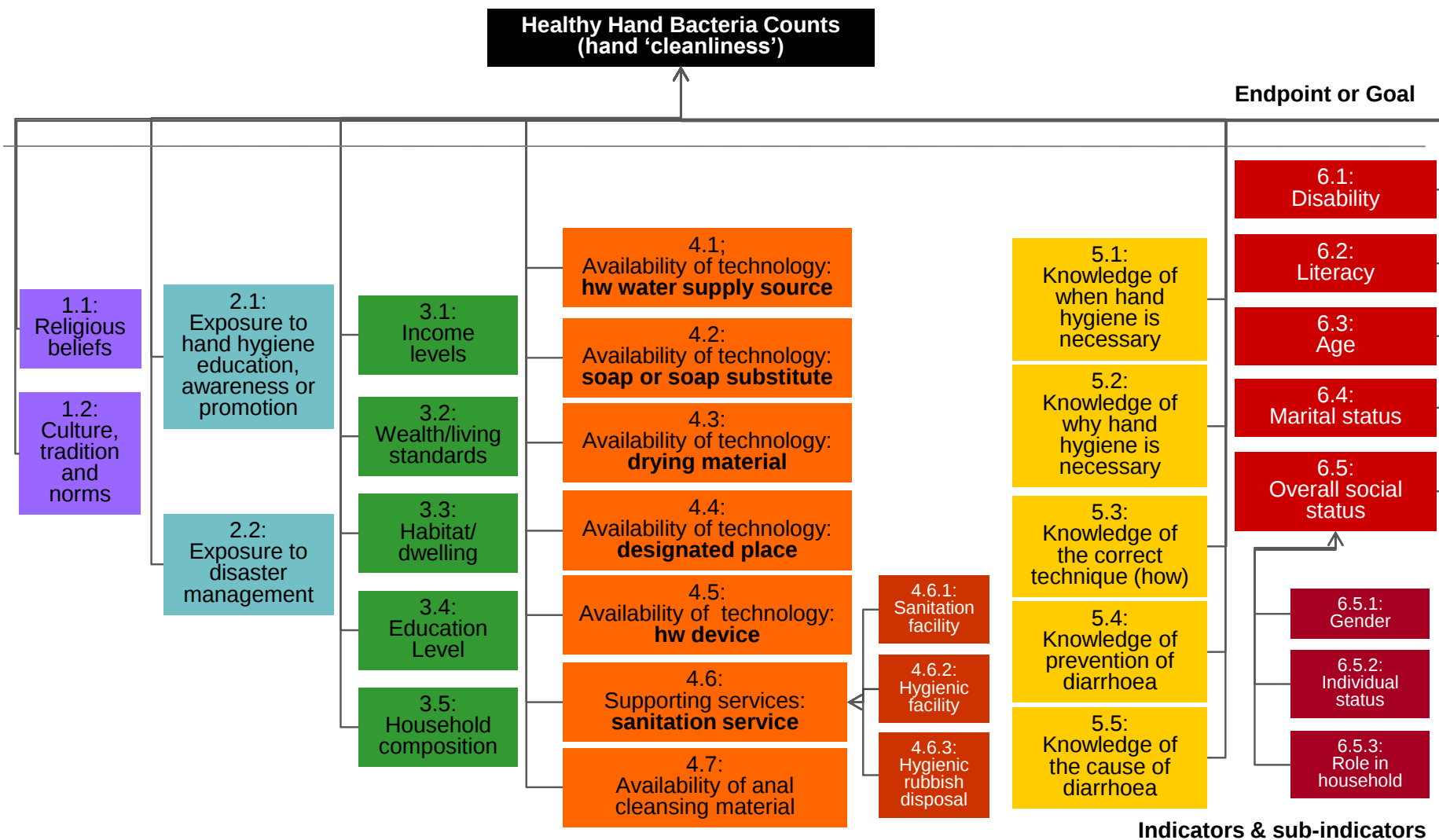


Figure 13: This component of the Framework was based on what international literature had shown as *indicators* and *sub-indicators* which would determine hand hygiene and thus hand 'cleanliness' on an individual's hands (the end-point).

5 ASSESSING THE EFFECTIVENESS OF HAND HYGIENE IN SOUTH AFRICA

The practices of hand hygiene and the factors that influence the hand hygiene behaviours of individuals in a community were complex. In recent years, a significant amount of research has been done to identify strategies for changing these hygiene behaviours (Bloomfield et al., 2007). The objective of the South Africa hand hygiene assessment was to provide a scientific basis for strategies that minimize the levels of undesirable bacteria on the hands and, therefore, reduce the risk of cross contamination during food preparation and hand-to-hand contact. The variables (determinants, indices and indicators) which make up the South African hand hygiene assessment framework were discussed in more detail in this section of the report.

The section below, which describes individual determinates, indices, indicators and sub-indicators, include a number of elements for each:

<i>Rationale:</i>	provided the reason why the descriptor/indicator was important in the assessment of the variables of hand hygiene;
<i>Definition of terms:</i>	described all the terms relevant to the descriptor/indicator to ensure no vagueness.
<i>Calculation:</i>	described how the indicator would be calculated. In the case of composite indicators, these elements would include a description of how the data would be aggregated from several measures. This did not apply to qualitative descriptors of hand hygiene.
<i>Sources of data:</i>	explained from where and how information was collected, i.e. household questionnaire, Statistics South Africa, etc.
<i>Model measures:</i>	described the measures (questions) necessary for establishing the indicator or descriptors. The measures linked to the data collection tools in Section 7 of this report.

5.1 Review of Microbiological Assessment of the Goal/ End-point: Hand Bacterial Counts

According to a number of hand hygiene assessments the microbial count on a 'cleaned' post-washed human hand was between log 4.89 and log 5.71 (Larson et al., 2001; Larson et al., 2003a; Larson et al., 2003b)

Ideally, to determine the effectiveness of any hand hygiene intervention a microbiological assessment of micro-flora on hands would be necessary. Linking bacterial levels on hands to the determining variables of hand hygiene would decide which variables could lead to the most effective hand hygiene. Studies linking community level hygiene interventions with micro-flora on hands were extremely limited. However, there were extensive studies which link hand hygiene in hospitals and food service to microflora on hands. Although these assessments were usually conducted in a controlled environment they could provide a basis for methods of how to assess microflora on hands at a community level.

5.1.1 Methods of Microbiological Assessment of Hand Hygiene

A number of methods have been used to assess microflora on hands.

- Larson et al. (2003) used a modified glove-juice procedure in their assessment of aerobic flora of hands of 224 healthy homemakers in northern Manhattan, New York. This method of assessment

required the subject to insert the hand into a sterile polyethylene bag containing 50 ml of sampling solution (0.075 mol/L phosphate buffer, pH 7.9, containing 0.1% polysorbate 80, 0.1% sodium thiosulfate, and 0.3% lecithin). This solution neutralized any residual antiseptic and disperses the macrocolonies into single cells for quantitation. The entire hand was massaged through the wall of the bag for 1 minute, and samples were taken to a laboratory for processing. In the laboratory, samples were diluted 10-fold in the transport medium, up to 10, and spread plated onto the following agar media. All plates were incubated at 35°C and observed daily for growth over 48 hours for bacteria and up to 7 days for yeast. Speciation of gram-negative bacteria were performed with MicroScan; *staphylococci* were identified with coagulase and Staphaurex (Alexon-Trend, Inc, Ramsey, Minn); *enterococci* were identified with MicroScan; yeast were identified with microscopic examination; and other standard methods were used as needed. Antimicrobial susceptibility testing was conducted against a predetermined panel of antibiotics for each species with the MicroScan semiautomated system (Larson et al., 2003).

- This modified glove-juice method of determining the level of bacteria on hands of volunteers was used in a South Africa study of the effects of water quality on the outcomes of hand hygiene (Venter and September, 2006). The levels of *E. coli* in each sample was determined in the laboratory using the Colilert system (IDEXX).
- Hoque et al. (1995) carried out an assessment of faecal coliform on hands by each hand being sampled separately using a slightly modified finger-tip count technique. Briefly, every individual in the study washed their hands separately into two plastic bottles containing 100 ml of Ringers solution with 10% v/v of Tween 20. They made washing movements inside the container by rubbing the fingers up onto their palms at least 10 times, with their hands immersed up to the palm in the solution. The containers were then tightly closed and stored chilled in insulated boxes. Water samples were also collected from the same source as the one used during standard rinsing. The faecal coliform count of these samples was determined at the laboratory within 2-3 hours of collection.

5.2 Review of the Variables of Hand Hygiene

The South African hand hygiene assessment framework was based on the hypothesis that there were the two key determinants of levels of bacterial counts on an individual's hands after handwashing, namely the quality of water used to wash the hands (Handwashing Water Quality) and the method that individuals used to wash their hands (Handwashing Technique). Each of these determining variables was discussed in more detail below.

5.2.1 Determinant: Handwashing Water Quality

Rationale: In many developing areas of South Africa, microbiologically safe water was supplied to communities at communal taps, yard taps or house connections. Despite municipal water supply in these forms, tap water could contain a variety of microorganisms including human pathogens (World Health Organisation, 2009). Even if hand hygiene practices were in place, organisms could still be transmitted from water to individuals via hands if contaminated water was used to wash them (World Health Organisation, 2009). Tap water, in addition to being a possible source of microbial

contamination, could include substances that could interfere with the microbial activities of antiseptics and disinfectants used in hand hygiene (World Health Organisation, 2009).

Studies have shown, in households where water supplies were outside the home, storing water was the norm. Handling stored water at point-of-use could cause the quality of the water to deteriorate to such an extent that the water poses potential risks of infection to consumers (Jagals et al., 1999).

Despite possible water contamination from the taps or through storage of water, available evidence suggested that it was not necessary to use potable water to wash hands (World Health Organisation, 2009). In a resource-limited area of rural Bangladesh education and promotion of handwashing with plain soap and the water that was available to individuals significantly reduced the spread of diarrhoeal diseases across all age groups (World Health Organisation, 2009). A similar study in Pakistan corroborated these findings (World Health Organisation, 2009).

In a South African study of the effect of water quality on the outcomes of hand hygiene, Venter and September (2006) found varied results of the effect of water quality on hand hygiene. None of the hand hygiene procedures using highly polluted water results in a reduction in the bacterial load on the hands. Also, no significant difference in bacterial loads was noticed between clean or moderately contaminated water used on hands. Venter and September (2006) concluded that hands with high bacterial load can be washed with water, even moderately contaminated water, to reduce microflora on the hands.

Thus, although not ideal, hand hygiene could still have a positive effect on reducing water-related diseases irrespective of the quality of water used in the procedure.

Calculation:

Level of bacterial counts (cfu) in the handwashing water sample.

Sources of data: The microbiological assessment handwashing water quality in the assessment was conducted through the taking of a sample of the water used by the individual to wash their hands during the handwashing demonstration. Samples were collected in a 1000 and 100 ml sterile sample collection bottle, stored and transported in a cooler box with ice packs to ensure samples remain cool and transported to the laboratory and processed within 24 to 48 hours of collection. Water quality analysis in South Africa was prescribed by the South African standard for drinking water (SANS 241:2005).

Model measures: Water sample of hand hygiene water.

5.2.2 Determinant: Hand Hygiene Technique (Actual Hand Hygiene Behaviours Practiced)

Rationale: If a water and sanitation intervention focused on provision of hardware – pumps, pipes and latrines – it would most likely not to achieve its target of reducing water-related disease. The most common indicator used to measure the success of such programs, however, has been the number of people who have access to the hardware that was provided. The benefits from sustainable water and sanitation interventions would not be fully realized unless reasonable hygiene behaviour was promoted and achieved. It was the correct use of the hardware that results in the greatest impact, whether health, protection of the environment or resource conservation was concerned (AEE INTEC, undated).

Key to preventing infection transmission via the hands (and other surfaces) was the application of effective hygiene procedures (Bloomfield et al., 2007). Good hand hygiene procedure was thus, one of the most effective determinants of the effectiveness of a health and hygiene education, awareness and promotion interventions. Good hand hygiene procedures usually resulted from good hand hygiene

knowledge or awareness. If the hand hygiene awareness and promotion interventions was poor, then hand hygiene knowledge was expected to be poor which leads to poor hand hygiene procedure.

A number of procedures have been recommended for hand hygiene, some of which were shown in Table 6. Intuitively one must argue that, in situations in which there was significant risk, the aim should be to rid the hands of as many organisms as possible. Organisms could be removed from hands and other surfaces by the following (Bloomfield et al., 2007):

- physical removal using soap or detergent-based cleaning; or
- microbes can be killed in situ by applying a disinfectant or sanitizer.

In principle, handwashing using soap or detergent and water mechanically dislodged organisms, but, to be effective, it must be applied in conjunction with a rubbing process that maximized the release of microbes from the skin and a rinsing process that washed the organisms off the hands. There was agreement between the studies in Table 6 hand hygiene should include water, soap, vigorous rubbing and drying. However, Table 6 showed that there were some disparities as to how long the hands should be vigorously rubbed, whether they should be washed with warm water and what materials should be used for drying of hands.

Table 6: Procedures of hand hygiene recommended by various sources.

Recommended activities for hand washing technique	National Health and Medical Research Council (2005)	Centre for Disease Control (2002)	Bruhn (2003)	WHO (2009)	Hygiene Council (undated)	WSSCC (2009)
Water	√	√	√	√	√	√
Warm water			√			
Soap	√	√	√	√	√	√
Vigorous rubbing	√	√	√	√	√	√
Time	10 seconds	15 seconds	15 seconds	not specified	not specified	20 seconds
Rinse	√	√	√	√	√	√
Dry with -	Paper towel of individual cloth towel	Disposable towel	Paper towel	Single use towel	Towel	Clean cloth or air dry
Turn tap off with -	Paper towel	Disposable towel		Towel		

From their assessment, Kampf and Kramer (undated) estimated that hand hygiene produced a mean reduction of *E. coli* on hands of up to 2.4 log within 1 minute. Data from studies shown in Table 7 suggested that, for *E. coli*, the greatest reduction was achieved within the first 30 seconds, ranging from 0.6 to 1.1 log after 15 seconds to 1.8 to 2.8 log after 30 seconds. Extending the washing time to 1 minute produced a reduction of 2.6 to 3.23 log. However, increasing the process for more than 1 minute did not appear to gain any additional reduction. Relatively few data were available on the effectiveness of hand hygiene in removal of viruses (Bloomfield et al., 2007) but suggestions were that hand hygiene could be less effective for viruses compared with bacteria.

Table 7: The effect of the duration of hand hygiene on reducing *E. coli* counts on hands.

Microorganism	Duration of handwash (seconds)	Mean log reduction
<i>E. coli</i>	10	0.5
	15	0.6-1.1
	30	1.37-3.0
	60	2.6-3.2
	120	3.27

*From Kampf and Kramer, Sickbert-Bennet et al, and Schurmann and Eggers

It was generally recommended that for hand hygiene, a hand-rubbing time of 15 seconds with soap was sufficient. Table 7 however indicated that 30 seconds to 1 minute was needed to achieve the optimum of 2- to 3-log reduction in *E. coli*. However, in practice it was doubtful whether people complete with even a 15-second hand wash, although there were few data to confirm this (Bloomfield et al., 2007). Field-based studies also suggested that efficacy of hand hygiene can vary quite significantly. In some cases, organisms could be attached to the hands too firmly and could not be removed by hand hygiene (Bloomfield et al., 2007).

Larson et al. (2003) found, in individuals which already had low bacterial counts on hands, that a single hand wash did not necessarily decontaminate the hands. To be most effective, hand hygiene had to be repeated more than once and need to be carried out at all the critical times mentioned in the previous section of this report.

In a baseline assessment of handwashing behaviour in Bangladesh, Bateman et al. (1995) found that the hand washing technique of individuals was weak (infrequently demonstrated) in the areas of using a cleaning agent (ash, soap, mud) and drying hands hygienically. There was also a strong association with handwashing technique and children with diarrhoea in the household (Bateman et al., 1995).

The Framework development study hypothesized that the observed manner in which hands were washed would determine the effectiveness of hand hygiene. A hand hygiene study of a small group of volunteers, by Burton et al. (2011), concluded that *the strong association between hand hygiene method (technique) and bacterial contamination of hands found in our study suggests that the prevalence of faecal indicator bacterial may also be used to monitor changes in hygiene behaviours in the general population, for example following hygiene promotion campaigns.*

Definition of terms: **Correct hand hygiene technique** included:

- the use of water
- the use of soap or a soap substitute
- the washing of both hands
- rubbing hand together at least 3 times
- hygienic drying of hands, i.e. on a paper towel

Calculation:

Number of respondents with correct technique divided by the total sample size.

Sources of data: Behaviour was challenging to measure, although useful techniques have been refined over the past two decades. Some methods used to assess behaviours include (Shordt, 2006):

- questionnaire-type interviews,
- the use of indirect indicators (i.e. observation of the presence of soap and a basin at a toilet could be an indirect indication of hand hygiene after using the toilet);
- structured observations on a long-term basis such as all day, for several days, yielded useful information about behavioural change, but were time consuming.

All these methods had shown to have some disadvantages including over-reporting of good behaviours by interviewees or changing of behaviours by individuals when hand hygiene practices were being observed. It was most effective to combine a number of these methods when assessing hand hygiene behaviours. Assessment of hand hygiene behaviours was usually carried out through observation of the procedure of hand hygiene. Interviewees were asked to demonstrate how they wash their hands, with the interviewer noting:

- Ask: Can you show me how you wash your hands?
- Observe: Does the person use water?

- Observe: Does the person use soap?
- Observe: Are both hands washed?
- Observe: Does he or she rub hands together three times or more?
- Observe: How does the person dry his or her hands?
- Observe: Does the towel or cloth the person uses appear to be clean?
- Handwashing can also be timed

5.3 Review of the Indices and Indicators of Hand Hygiene Technique

5.3.1 Index 1: Cultural Influences on Hand Hygiene Behaviours

Societal, political and economic contexts were the structural variables of health, which gave rise to the socio-economic status of an individual (Bloomfield et al., 2009). The societal, political and economic context of an individual drives social stratification, which gives rise to intermediary determinant of health such as living and working conditions, income and high-risk health behaviours (Bloomfield et al., 2009).

Some key cultural factors which commonly caused difficulties when carrying out hygiene and other development projects included.

- Community Structure: A community will have leaders, respected individuals and influential bodies within it, all of which could assist with changing hand hygiene behaviours. These roles within the society needed to be appreciated and efforts made to have these parties included in hand hygiene interventions. In addition, alienating people from (influential) peers could be damaging and hinder changes in hand hygiene behaviours.
- Habits and cultural norms: Hand hygiene campaigns must be designed to fit in with people's habits to ensure that they will be adopted. There could also be taboos or cultural norms that differ and need to be sensitively handled.
- Gender-related issues: The role of men and women varies from one society to another. In economically less developed parts of the world women tend to be expected to take on the role of provision of water and management of sanitation and hygiene. Hand hygiene interventions therefore, needed to be gender sensitive and to specifically target women, especially caregivers. Women could not have been able to speak freely about their discomforts or wishes in the presence of men, thus women, through women only activities, should be provided for in hand hygiene interventions.
- Demographics: The largest proportions of people in the home who were at increased risk of infection were the elderly and the very young. These demographic groups generally had reduced immunity to infection (Bloomfield et al., 2009). Hand hygiene interventions should thus have taken cognizance of these groups and should have been designed to address their needs, i.e. target caregivers and those individuals who took care of the aged and ill.

Thus, to understand the effectiveness of hand hygiene intervention, assessment of these underlying social and physical determinants of hand hygiene behaviour were necessary. In the South African hand hygiene assessment framework, two indicators made up the Cultural Influence index; namely:

1. Indicator 1.1: Individuals belonging to a particular religious group and which have specific hand hygiene practices
2. Indicator 1.2: Individuals specific hand hygiene traditions or norms

5.3.1.1 Indicator 1.1: Individuals belonging to a particular religious group and which have specific hand hygiene practices

Rationale: The complex association between religion and health, in particular hand hygiene practices, remains an essentially unexplored, speculative area, especially in South Africa. It was however; clear that religion was a determinant that could influence attitudes towards hand hygiene (World Health Organisation, 2009). Hand hygiene could be practised for hygienic reasons, ritual reasons during religious ceremonies, and symbolic reasons in specific everyday life situations. In some populations, both inherent (hand cleansing patterns usually established in the first 10 years of life) and elective (attitude to hand hygiene in more specific opportunities) hand hygiene practices were deeply influenced by religious factors. Not only were attitudes influenced by religion belief but the materials used and the procedure of hand hygiene could also vary.

The complex association between religion, culture, and health, in particular hand hygiene practices, still remains an essentially unexplored, speculative area, especially in South Africa. It was however; clear that both culture and religion were factors that could influence attitudes towards hand hygiene (World Health Organisation, 2009). Hand hygiene can be practised for hygienic reasons, ritual reasons during religious ceremonies, and symbolic reasons in specific everyday life situations.

In some populations, both inherent (hand cleansing patterns usually established in the first 10 years of life) and elective (attitude to hand hygiene in more specific opportunities) hand hygiene practices were deeply influenced by cultural and religious factors. Not only were attitudes influenced by culture and religion belief but the materials used and the procedure of hand hygiene could also vary. An example of culture determining materials used in hand hygiene was that of the Hindu culture which advocated hands being rubbed vigorously with ash or mud and then rinsed with water. The use of soap was not practice as it was believed that soap contains animal fat (World Health Organisation, 2009).

Judaism, Islam and Sikhism, based on holy text, had very precise rules for hand hygiene at several crucial moments of the day (World Health Organisation, 2009). As a result, believers who strictly adhere to these religious beliefs would carefully observe these hand hygiene requirements. Religion could underlay culture behaviour of some populations, i.e. Judaism within the Jewish population. Cultural behaviour was thus determined by these religious beliefs, resulting in both the strictly adherent and the non-adherent groups behaving according to religious principles in everyday life (World Health Organisation, 2009).

With the exception of the ritual sprinkling of holy water on hands before the consecration of bread and wine, and of the washing of hands after touching the holy oil (the latter only in the Catholic Church), the Christian faith seemed to refer more to spiritual hand hygiene behaviour. The Christian faith did not have specific pre-requisites regarding hand hygiene (World Health Organisation, 2009). Despite this, a study in Malawi found that in a largely Christians population some people believed that the reason some individuals got diarrhoea and not others was due to God's will (Bergqvist, 2008). Although religious belief was not given as the cause of the disease, it was given as the reason for why some were affected and others not, which indirectly led to a reduced belief in the efficiency of washing hands to prevent diarrhoea.

In a baseline assessment of handwashing behaviour in Bangladesh, Bateman et al. (1995) found handwashing before prayer was not associated with decreased risk of diarrhoea. They attribute this to handwashing before prayer being ritualistic rather than effective hand washing techniques.

Definition of terms: hand hygiene for **religious** purposes referred to the hand hygiene practiced for ritual purification to remove specifically defined uncleanness (spiritual) prior to a particular type of activity, and especially prior to worship. Most of these rituals existed long before the germ theory of disease was established.

Calculation:

- number of individuals belonging to a religious group divided by the total population in the sample;
- number of individuals belonging to a particular religious group divided by the number of individual who belong to a religious group;
- number of individuals indicating their religion has specific handwashing behaviours or practices divided by the number of individual belonging to a religious group.
- Number of individual indicating religious hand hygiene behaviours per categories of religious handwashing practices. Type of religious hand hygiene practices reported by individuals were categories into:
 27. After church;
 28. Before and after church;
 29. Before and during church;
 30. Before church;
 31. During church;
 32. Unsure; and
 33. When eating.
 34. Description of why these hand hygiene religious practices were necessary. Reasons reported by individuals were categorized into:
 35. Church custom;
 36. Cleanliness and hygiene;
 37. Do not know; and
 38. Spiritual healing.

Sources of data: Household Interview

Model measures:

7. Do you belong to a religious group?
8. To which religious group do you belong?
9. Does your religion have any special handwashing behaviours or practices?
10. Please describe these handwashing religious practices?
11. Why do you think these handwashing religious practices are necessary?

5.3.1.2 Indicator 1.2: Individuals specific hand hygiene traditions or norms

Rationale: It has been observed in South Africa that in many of the rural and peri-urban areas a bowl of water was made available for handwashing before a meal. The same bowl/basin was used by all individuals sharing the meal, while in other cases only men wash their hands in this device. However, the influence of religious and cultural beliefs and practices on hand hygiene in South Africa was an area which has not yet been explored.

Literature showed that in Kyrgyz culture hand hygiene before bread-making was seen as part of the respect for bread. In other cultures, handwashing with contact with infants would be tantamount to bringing bad luck on the child and various local traditions could suggest that soap can bring bad luck, reduce life expectancy or harm a pregnant woman (Curtis et al., 2009).

Hand hygiene beliefs were often diverse and specific to local cultures. Culture may have also been an influential factor whatever the religious background. In certain African countries (e.g. Ghana and some other West African countries) hand hygiene was commonly practised in specific situations of daily life according to some ancient traditions. For instance, hands always had to be washed before raising anything to one's lips (World Health Organisation, 2009). Furthermore, it was customary to provide facilities for hand aspersion (a bowl of water with special leaves) outside the house door to welcome visitors and to allow them to wash their face and hands before enquiring about the purpose of their visit (World Health Organisation, 2009).

Definition of terms: **tradition** refers to those hand hygiene behaviours that were "handed over, passed on" from generation to generation. Hand hygiene **social norms** were the hand hygiene behavioural expectations and cues within a society or group, i.e. the explicit or implicit rules that a group uses for appropriate and inappropriate hand hygiene values, beliefs, attitudes and behaviours with failure to follow the rules possibly result in severe punishments, including exclusion from the group.

Calculation:

39. Number of individuals with traditional hygiene practices, occasions or norms divided by total number of individuals in the sample;
40. Number of individuals per category of special times/traditions/occasions of handwashing divided by number of individuals that indicated having special times/traditions/occasions when they wash their hands. Responses were categories into:
 41. After bathing a corpse;
 42. After using the toilet;
 43. At funeral (when returning from the graveside);
 44. At weddings; and
 45. Before eating.
46. Number of individuals per category of 'reason for handwashing times/traditions/occasion' divided by number of individuals having special times/traditions/occasions when they wash their hands. Responses were categories into:
 47. Did not know;
 48. It was a tradition/habit;
 49. To avoid transfer of germs;
 50. To remove bad luck;
 51. To remove dirt; and
 52. To remove germs.

Sources of data: Household Interview

Model measures:

73. Are there any special times/traditions/occasions when you wash your hands?
74. Please describe these special times of handwashing?
75. Why was washing of hands necessary at these special times (*encourage by asking if there was anything else until there was nothing else mentioned?*)

5.3.2 Index 2: Media Exposure

In South Africa a budget, in the form of a household subsidy, was allocated annually to provide poor household health and hygiene (h&h) awareness, promotion and education. It was against this background that many sanitation programme and projects in the country have incorporated hygiene awareness, promotion and education as part of implementation process, using a number of approaches to achieve sanitation-related hygiene behavioural change.

Research and results related to the impacts of the different approaches to hygiene education or health and hygiene awareness in South Africa, was however, limited. As a result, little was known regarding the most appropriate hygiene promotion interventions for different contexts (Wilkinson et al., 2007).

Aiello et al. (2008) in a meta-analysis of hand hygiene interventions and disease found that non-antibacterial soap combined with hand hygiene education had the strongest protective effect against both gastrointestinal and respiratory illnesses. Interventions of hand hygiene education alone also showed a strong protective effect against gastrointestinal illness but only moderate protection for respiratory illness. Hand hygiene education thus can have a significant role in determining hand hygiene knowledge and thus behaviours.

An hygiene education intervention in Bangladesh, designed based on the research results from a small baseline assessment, developed an incremental approach to hygiene promotion in communities using messages and materials that reinforced or provided details of good hygiene behaviours (Bateman et al., 1995). The intervention focused on addressing behaviours in 6 key strategic hygiene behaviours areas, one of which was handwashing behaviours. Behaviours were assessed after the intervention to evaluate effectiveness and to determine which of two approaches were the most effective in communicating hygiene behaviour, namely communication approach 1 which included courtyard sessions with key stakeholders and communication model 2 which included courtyard session but added additional outreach activities in the form of school programs, child to child activities, and activities with key influencers in the community. The result of the assessment of the hand hygiene activities were shown in Table 8 below. The results showed a statistically significant improvement in handwashing knowledge and practices in both intervention villages when compared to their corresponding control villages. Both hygiene communication approaches therefore resulted in a dramatic improvement in hand hygiene knowledge, technique and technologies in the intervention villages. Knowledge of the six key hand washing times, demonstration of the good hand washing technique, and the observed availability of soap or ash in the household was also dramatically improved in intervention villages when compared to baseline results. However, communication approach 2 which used a number of hand hygiene outreach activities resulted in greater improvements in knowledge of the critical times of handwashing, actioning of the correct handwashing technique and the observed soap or ash available for hand hygiene. Communication approach was thus more effective than the courtyard sessions with key stakeholders approach.

Table 8: Summary of handwashing behaviours and related characteristics assessed in the Bateman et al. (1995) evaluation of the effectiveness of hygiene interventions and hygiene communication approaches in 2 villages in Bangladesh.

	% of households in intervention village	% of households in control village	% of households in intervention village	% of households in control village
Knowledge of handwashing at all 6 critical times	33	0	78	3
Demonstrated all 5 key elements of handwashing technique	74	3	82	16
Observation of ash/soap available in households				
New the kitchen	32	2	74	12
Near the toilet	56	2	17	1
Other place in household	7	21	11	2
Any place in household	92	25	99	16
Observation of rag available in households exclusively for hand hygiene	81	6	89	20

The result of the implementing these hygiene interventions lead Bateman et al. (1995) to recommend that hygiene behaviour change programs:

53. Focus on the relationships between behaviour, the environment, and health
54. Focus on behaviours, rather than messages or hardware targets
55. Base interventions on the local context (existing beliefs, norms, and practices)
56. Focus on a few key behaviours rather than a large number of “perfect” behaviours
57. Emphasize community participation in all aspects – design, development of interventions, extension, monitoring, problem solving, etc.
58. Emphasize the need for community-wide participation and community action to improve the environment and health for all community members
59. Develop and implement a behaviour-based monitoring and improvement

Converse to the Aiello et al. (2008) and Bateman et al. (1995) a study of handwashing behaviours in a number of villages in Guatemala by Arnold et al., (2009), found no differences between post-intervention and control groups in self-reported handwashing behaviours or spot-check observations of hygienic conditions. This led them to conclude that six months after a 3-year intervention there was minimal sustained improvement in water treatment and handwashing behaviour in the intervention villages.

A study by Biran et al. (2009) of the effectiveness of a hygiene intervention modelled on an existing marketing campaign promoting the use of a commercial soap brand in India also found that despite the intervention reaching a large proportion of the target population there was, in the short-term, no effect on actual handwashing behaviour at key times of this population. This supported the Arnold et al., (2009) study of no significant changes in hand hygiene behaviours as a result of a hygiene intervention.

Similarly in a South African study, of the effectiveness of a Health and Hygiene Awareness and Education (HHA&E) programme on the practice of storing and handling water, it was found that the study group did not have a significant shift in their hand hygiene practices after the implementation of the programme (Jagals et al., 2004). This was despite many of the interviewees indicating that hand hygiene was important. This implied that attending the HHA&E meetings had no impact on changing the hand hygiene practices of the whole study group.

Biran et al. (2009) suggested a number of reasons for the results of their study; namely:

- intervention could not have reached the correct target audience;
- the intervention could not have been effective in providing hygiene education and germ-awareness;
- the hygiene education and germ-awareness which formed part of the intervention could have been ineffective drivers of hygiene behaviour change; or
- the timing of the assessment by Biran et al. (2009) could have been too soon after the intervention to capture changes in behaviour. Timing of hand hygiene assessment determines knowledge, i.e. if a programme had recently happened then individuals more likely to remember messages, etc. It was the retention and recall of these message in the long-term which was necessary to demonstrate change in hand hygiene behaviours.

The duration of a hand hygiene intervention could also affect the outcome of an assessment as hygiene interventions which were on-going and repeat hygiene messages were more likely to imprint messages. However, studies have found some evidence to the contrary, showing that that hygiene, including hand hygiene, improves with hygiene interventions irrespective of the time lapse since the intervention (Shordt and Cairncross, 2004; Shordt, 2006). Hoque et al. (1996) found that faecal

colony-forming bacteria on hands of women were lower in a sample group 4 years after the conclusion of an intervention in Bangladesh. Shordt and Cairncross (2004) found a similar result in an assessment of behaviours in five countries, where hygiene behaviours were seen to be similarly sustained whether the projects ended 4 years or only 1 or 2 years before the assessment.

Hand hygiene promotion approaches in South Africa

Hand hygiene promotion and awareness interventions in South Africa were usually a component of a much larger health and hygiene education, awareness and promotion intervention, linked to a subsidized sanitation programme. These interventions usually had two approaches, determined by the audience to which it was targeted. Firstly, and most common, was an intervention targeted at the individual or household level; and secondly, an intervention which targeted a wider audience, referred to in this report as community-wide interventions. Each of these was discussed in more detail below.

Household level h&h awareness, promotion and education programmes were usually implemented at an individual or household level using participatory approaches such as Participatory Hygiene and Sanitation Training (PHAST). PHAST was an approach that helps people to feel more confident about themselves and their ability to take action and make improvements in their communities. The key steps in the PHAST approach were:

- assessment of the individuals knowledge base;
- investigation of their environmental situation;
- visualization of future scenario/s;
- analysis of the constraints to change;
- planning for change;
- implementing these changes;
- monitoring and evaluation of implementation (Naidoo et al., 2008).

The PHAST approach to h&h awareness, promotion and education was the preferred approach to hygiene interventions both in the rural and in the peri-urban areas of South Africa.

A study related to development of an approach to health and sanitation integration found that the majority (75%) of projects being implemented by 12 service providers (between 2003-2006) in the Limpopo and Eastern Cape provinces of South Africa made use of the PHAST approach, with between 5 and 20 PHAST tools being used (Onabolu and Ndlovu, 2006).

Using the PHAST approach and tools, hygiene messages were conveyed to an individual or a household using a training-the-trainer approach. Trainers were individuals selected from the community and trained, by Health and Hygiene Specialists (usually a social consultant), to assume responsibility for the rolling-out of the h&h awareness programme to individuals or household. These trained individuals, referred to as village health workers, made use of household level door-to-door visits to convey h&h awareness, promotion and education messages, including hand hygiene messages, to an individual or household. In the same study by Onabolu and Ndlovu (2006), of the six hundred and three projects being implemented, four hundred and twenty five (70%) utilized community-based means of conducting households level awareness and promotion.

Other means of communicating health and hygiene messages, other than household-based, were those which target a wider audience than the individual or household; including:

- Mass media – messages crafted to be transmitted through and optimized mix of radio, TV, billboard, pamphlet, posters and other channels

- Direct consumer contact – events organized by professional event management agencies, held in schools, public places, community groups.
- Public channels – using the ability of government agencies to deliver hand hygiene messages through schools and health centers i.e the WASH programme (World Bank, 2005),
- Community events – events and special days that raise awareness at a neighbourhood level (Naidoo et al., 2008),
- Drama and theatre: drama provided the opportunity to present facts and issues in an entertaining, culturally sensitive and accessible way.
- Community focus groups, liaison groups, workshops and cultural activities – presentations to groups within the community could be effective in communicating hand hygiene to larger groups, but could also be targeted to the needs of the group.

Media which was used should be targeted to the audience which needs to be reached. For example radio tended to be used more rural areas while television could have a greater presence in urban areas. Simpson-Herbert (in Short, 2006) distinguishes three population groups which required targeted hand hygiene interventions using different approaches:

1. Urban: households usually have some disposable income; usually have access to radios and perhaps other media; and have easy access to shops where soap was sold. For this group, Sawyer and Simpson-Herbert suggests, social marketing and PPP might be most relevant.
2. Rural and urban poor: households usually have little disposal income and little access to media. For this group, soap would be a luxury. Their current purchase of choice would be laundry soap. Strong promotion was needed.
3. Rural population: households were usually very poor, with no disposal income, they rarely visit town and therefore do not buy soap. With this population, handwashing with ash or soil could be the only option.

Most health and hygiene interventions in South Africa would include both a household-level approach and a community-wide approach.

Content of a Hand Hygiene Awareness and Promotion Programmes

In the community-based hygiene train-the-trainer education programmes messages were focused on breaking the key sanitation-related disease transmission routes and on sensitizing household on how to operate and maintain the toilet which was provided by the sanitation programme. The key hand hygiene awareness, promotion and education messages would include:

- The need for correct and appropriate hand hygiene at critical times;
- The correct procedure of hand hygiene; and
- the technologies required for effective hand hygiene.

A number of tools have been developed and applied for sanitation training in South Africa. Of particular mention was the Sanitation Improvement Tool (SIT) which was a toolkit that provided all the supporting documentation and tools necessary to implement a h&h awareness, promotion and education programme.

Methods of Assessment of Hand Hygiene Awareness and Promotion Programmes

A study by Shordt (2006) which reviewed a number of hand hygiene interventions which resulted in sustained behaviour change found a number of commonalities in these interventions, including:

- all the successful programs used a range of activities for communication including mass media (i.e. posters, radio, drama) and interpersonal communication (i.e. home visits or neighbourhood meetings).
- most programs focused on more than hand hygiene objectives however; all of the interventions targeted only a small number of behaviours.
- most were implemented as a collaborative effort with local groups and/or local government and line departments.
- all had full-time or voluntary field workers.
- most appeared to design and use materials and media events.
- many appeared to have some type of formative research, such as behavioural trials; testing or trying out behavioural change strategies.
- many interventions prepared baselines (initial measurement of behaviours) that were used to demonstrate measurable changes in behaviours.

Shordt and Cairncross (2004) suggested a number of ways in which the effectiveness of a hand hygiene intervention could be assessed. Some of these include:

1. comparing results of the intervention (exposed to a hand hygiene intervention) and control groups (not exposed to a hand hygiene intervention),
2. showing changes over time, using baseline information (i.e. before and after comparison),
3. finding evidence of direct links between inputs during the project period in terms of hygiene activities and outputs after the project had ended in terms of hygiene practices,
4. examining some standard external variables such as improved access to drinking water, education and socio-economic levels.

When assessing the effectiveness of a hand hygiene education, awareness and promotion programme in South Africa interviews with the service providers/implementer of these projects and the village level promoter (i.e. community health workers) would be the means to determine the approach, tools and content of the programmes.

Onobolu and Ndlovu (2006) in an assessment of the approach, content and tools used by implementers of hygiene training, promotion, monitoring and evaluation projects in South Africa used the following questions to assess the hygiene interventions:

Related to training (usually of village health workers):

- who trained the selected community members in h&h?
- was the health promotion plan developed in conjunction with the community?
- how many days did the h&h training of community member take?
- was PHAST used as a method of training?
- how many PHAST tools were the community trained in?
- what aspect of sanitation did the h&h training specifically cover?

related to promotion (usually by village health workers at a household level):

- who carried out the h&h promotion?

- how long was the planned h&h?
- how many contact sessions were planned?
- what type of promotion method was used?
- cost per hour as paid to promoters?
- what aspects of sanitation did the h&h promotion cover specifically?
- were there any reporting tools specifically used to report disease incidence?

In a similar study in the informal settlements of South Africa, Naidoo et al. (2007) used a criteria based approach to determine the effectiveness of sanitation awareness and education programmes. One of the criteria used in the assessment was the quality of information provided to the target audience, determined by whether the relevant and applicable information was provided by the programme. Relevant and applicable information included:

- the reasons for and benefits of good hygiene and sanitation, e.g. reduction of incidence of disease and the improvement in overall quality of life;
- useful and practical information, e.g. practical suggestions and helpful hints and tips that were easy to carry out and possible within the budget of the target audience.

In addition, effectiveness of h&h programmes were measured on whether a baseline assessment was carried out before the programme started; the approach used for the programme; the extent and nature of participation and sustainability factors.

The results of the assessments of a hand hygiene intervention implemented in a community needed to be related to the individual determining variables of hand hygiene, namely; the hand hygiene knowledge of the individual exposed to the intervention, hand hygiene materials available to this individual and the hand hygiene procedures of the individual, to determine the effectiveness of the interventions. Tools such as semi-structure interviews, questionnaires and observation were all used for this purpose.

The Media Exposure index in the South African hand hygiene assessment framework was a compilation of two indicators, namely:

1. Indicator 2.1: Percentage of respondents who had been reached through different communication channels regarding hand hygiene in the last month
2. Indicator 2.2: Individuals exposed to water- or sanitation-related disaster management interventions

5.3.2.1 Indicator 2.1: Percentage of respondents who had been reached through different communication channels regarding hand hygiene in the last month

Rationale: In many basic sanitation service hygiene programs in South Africa, community volunteers, health workers, or extension agents meet regularly with community members in their homes or as a group to talk about hygiene. However, these types of programmes were generally targeted to the peri-urban and rural poorest-of-the-poor, with more affluence or urban-based individuals reached by other means of communication (i.e. at community events, in schools or in health facilities). Research has found that there was a major upturn in hand hygiene behaviours of mothers after attending more than six health education sessions linked to hygiene awareness programmes (Curtis et al., 1995). In an assessment of a hygiene intervention in Bukino Faso which focused on changing key risky behaviours, Curtis et al. (2001) determine that after 3 years of intervention there was a significantly positive improvement in both handwashing with soap and handwashing with only water after using the

toilet and after cleaning children. Luby et al. (2004) found exposure to 8 weeks of hand hygiene promotion not only translates into behaviour change but also lowered the incidence of diarrhoea in children in households exposed to the promotion programme. In contrast, research by Biran et al. (2009) found there was no difference in the hand hygiene behaviours between a group of individuals that had been exposed to hand hygiene promotion when compared with a control group.

Definition of terms: **Reached** refers to at least one exposure in the last month. **Communication channels** were shown in Table 9.

Table 9: Categories of hand hygiene communication channels through which respondents could be reached

Print and visual media	Family	Community institutions
Radio or TV	Grandmother/mother	Health outreach worker
Newspaper or magazine	Other friends or family	Health clinic staff
Koran/bible		Social worker
Other books, poster or brochure		School
		At work
		Mosque/church
		Woman's/youth or similar group
		Community committee (health, development, agriculture, etc.)
		Community festival or other event

Calculation:

- Number of individual who indicated that they had heard from *someone or somewhere that hand washing was important* divided by the total sample.
- Number of individuals per communication source divided by the number of individual that had heard from *someone or somewhere that hand washing was important*. Communication sources mentioned by individuals were categorized into:
 - At the clinic;
 - From a relative;
 - At school;
 - From work;
 - From a magazine;
 - From a poster;
 - From TV; and
 - From the radio.
- Number of individuals which indicated that they had studied hygiene at school divided by the total sample
- Number of individual that had heard at least one hand hygiene messages from this source in the last month divided by the number of individuals that had heard from *someone or somewhere that hand washing was important*
- Number of individuals per category of hand hygiene message divided by number of individuals who had heard at least one hand hygiene messages from this source in the last month. Hand hygiene messages were categories as:
 - Always use soap to wash your hands;
 - Before eating and after using the toilet;
 - Boil water before drinking;
 - Clean hands to remove germs;
 - Do not know;
 - Keep hands clean for food preparation;

- Not to infect other people with germs;
- Soap protects you from disease;
- Use handgloves;
- Wash hands after using the toilet;
- Wash hands before eating;
- Wash hands regularly/thoroughly; and
- Water was life (save water).

Sources of data: Household Interview

Model measures:

- 66. Have you heard from someone or somewhere that hand hygiene was important?
- 67. Where/how did you hear about the importance of hand hygiene?
- 68. Have you learnt at least one hand hygiene messages from this source in the last month?
- 69. What was the message/s you learnt?
- 17. Did you study hygiene at school?

5.3.2.2 Indicator 2.2: Individuals exposed to water- or sanitation-related disaster management interventions

Rationale: Natural disasters, such as droughts, floods, disease outbreaks and economic crises can worsen diarrhoea prevalence despite program interventions. Exposure to a disaster management intervention could influence hand hygiene, especially if this intervention focuses on a water-related disaster such as a cholera outbreak.

Definition of terms: **Disaster management intervention** was any intervention which has the focus of addressing a water- or sanitation-related disaster, i.e. typhoid or cholera outbreak.

Calculation:

- Number of individuals exposed to a disaster management programme divided by the total population in the sample;
- Number of individuals exposed to a hand hygiene awareness as part of a disaster management programme divided by the number of individual exposed to a disaster management programme

Sources of data: Household Interview

Model measures:

- 70. Has there been a disaster (drought, cholera, flood, etc.) programme in your areas?
- 71. Did the programme show/teach you about hand hygiene?
- 72. What did the programme teach you about hand hygiene?

5.3.3 **Index 3: Household Socio-economic Influence on an Individual's Hand Hygiene Behaviours**

Societal, political and economic contexts were the structural determining variables of health, which give rise to the socio-economic status of an individual (Bloomfield et al., 2009). Some key socio-economic factors which commonly cause difficulties when carrying out hygiene and other development projects include:

- **Education levels:** education could affect health and hand hygiene through its influence on lifestyle behaviours, problem-solving ability and preventative behaviours (Westaway and Viljoen, 2000). A National Demographic and Health Survey (ENDES) of the prevalence of diarrhea in children showed that children of mothers with low literacy had double the prevalence of the disease when compared to children of mothers with higher education (in PRISMA, 2004).

Similarly, the PRISMA (2004) study showed that mothers who came into contact with faeces washed their hands more frequently in households in which the head of the household had a higher educational level. In households in which the father or the head of the household and the mother have a primary school education or less, handwashing with soap was less frequent in risk events involving faeces.

- **Household ‘wealth’:** Diarrhoea was a disease that had a more significant effect on poorer segments of the population (World Bank, 2005). A study by Curtis et al. (1995) found that households with higher income had better child-related hygiene. One could thus speculate that individuals with lower household economic status could have poorer hand hygiene knowledge and behaviours which resulted, in part, in the increase in prevalence of diarrhoeal disease. A study conducted in 2007 related to *socio-economic* barriers to handwashing with soap found that poverty played a critical role (Water and Sanitation Programme-Africa, 2007). Poverty affected hand hygiene both directly and indirectly. Directly, poverty could influence the use of certain materials for hand hygiene, i.e. soap as they were perceived to be expensive. Indirectly, poverty could hinder the sustainability of the hand hygiene behaviour change through lack of services and lower education levels.

In reality it was very difficult to identify the social and economic interplay of a community. There was very little work carried out to document the social situation in which people live and relating this to effective hand hygiene behaviours and practices. Despite this, the South African hand hygiene assessment framework was developed based on the understanding that the socio-economic status of an individual’s household will determine their hand hygiene behaviours and thus included a Household Socio-economic Status index which was compiled from 5 household indicators, namely:

1. Indicator 3.1: Percentage of households per income level
2. Indicator 3.2: Wealth index score
3. Indicator 3.3: Durability of Dwelling
4. Indicator 3.4: Highest education level in the household
5. Indicator 3.5: Household composition

5.3.3.1 Indicator 3.1: Percentage of households per income level

Rationale: Studies conflict on the correlation between income and hand hygiene. However, it was possible that hand hygiene could improve with income level as income was linked to education levels and the wealth index of an individual. Curtis et al. (1995) in a study of mothers hygiene behaviour in Bukino Faso determined that the economic activity of the father, categorised by the regularity of income, had the most direct relations with a child’s report defecation and stool disposal behaviours.

Definition of terms: **Household income** was defined as all receipts by all members of a household, in cash and in kind, in exchange for employment, or in return for capital investment, or receipts obtained from other sources such as pension, etc. (StatsSA, 2009).

Calculation:

Number of households per income level divided by the total sample. Monthly household income was categories into Statistics South Africa’s General Household Survey categories of (StatsSA, 2007):

- No income
- R1-R400
- R401-R800
- R801-R1 600
- R1 601-R3 200
- R3 201-R6 400
- R6 401-R12 800

- R12 801-R25 600
- R25 601-R51 200
- R51 201-R102 400
- R102 401-R204 800
- R204 801 or more

Sources of data: Household Interview

Model measures:

37. What was the total income of the household per month? (the interviewer could show the respondents the categories on the right and allow her/him to choose the income category)

5.3.3.2 Indicator 3.2: Wealth index score

Rationale: Research had shown that the 'wealth' of a household determines not only hand washing behaviour, knowledge and frequency but also the availability of hand hygiene supplies (Luby and Halder, 2008). This research found that indicators of good hygiene were less common in poorer household. Curtis et al. (1995) in a study of hygiene behaviours of mothers of children under the age of 36 months in Burkina Faso determined better hygiene behaviours of mothers based on increase income of the parents of the child, increased house size and ownership of a television and radio.

Similarly, in a study of the relationship between maternal and household factors and child care in Accra, Armar-Klemesu et al. (2000) found a significant positive association between household income and hygiene (i.e. mother and child cleanliness, nappy cleanliness, surrounding environment cleanliness and no stagnant water in the yard). This study also found a positive association between assets (i.e. ownership of a refrigerator, electric stove, tape deck and television set) and type of dwelling.

Definition of terms: **Wealth index score** refers to the score calculated in a similar manner as Luby and Halder (2008) using principle component analysis of 12 household characteristics.

Calculation: Sum of scores for each household characteristic (measure). A wealth index was created for each individual, in a similar manner to the wealth index by Luby and Halder (2008), based on the 12 measured items mentioned below. The wealth index effectively reflected the living standard of an individual as it links an individual's access to households accessories such as fridge, TV and radio with the permanence of the building structure in which the individuals resides. Table 10 showed the measures used in the wealth index and the coding for each measure. Each measure was scored out of 10, with the most attractive or correct answer to the question/observation receiving this score, and the least attractive or incorrect answer 0. The average score for an individual's was used in this assessment.

Table 10: Measures, with coding, used in creating the wealth index score.

#	Question or Observation	Coding
16	What is your level of education?	No education=0; Complete primary school=2.5; Incomplete high school=5; Complete high school= 7.5; Complete tertiary= 10
18	What is the highest education level of the people living in the household?	No education=0; Complete primary school=2.5; Incomplete high school=5; Complete high school= 7.5; Complete tertiary= 10
21	What is the total number of rooms in the dwelling that the household occupies? (excluding toilets and bathrooms)	1=0; 2-3=2.5; 4-5=5; 6-9=7.5; ≥10=10
22 a.	Do you or someone in your household own a radio?	no=0; yes=10
22 b.	Do you or someone in your household own a TV?	no=0; yes=10
22 c.	Do you or someone in your household own a fridge?	no=0; yes=10
22 d.	Do you or someone in your household own a computer?	no=0; yes=10
23	Do you or someone in your household own a bicycle?	no=0; yes=10
24	Do you or someone in your household own a car/truck/vehicle?	no=0; yes=10
25	Do you or someone in your household own a cell phone or telephone?	no=0; yes=10
26	What type of energy/fuel does this household mainly use for cooking?	Electricity/solar=10; gas=7.5; paraffin=5; coal=2.5; wood/animal dung=0
oo 1.	What is the main material used for the floor of the main dwelling? (observation)	Carpet/tile = 10; concrete=5; earth=0
oo 2.	What is the main material used for the walls of the main dwelling? (observation)	Bricks/concrete blocks/concrete=10; zinc/corrugated iron/wood/asbestos=5; plastic/cardboard/mud and cement/wattle and daub/mud=0
oo 3.	What is the main material used for the roof of the main dwelling? (observation)	Tile/thatch=10; Corrugated iron/zinc/wood/asbestos=5; Plastic/cardboard=0

Sources of data: Household Interview and spot observation

Model measures:

16. What is your level of education?
18. What is the highest education level of the people living in the household?
21. What is the total number of rooms in the dwelling that the household occupies? (*excluding toilets and bathrooms*)
22. a. Do you or someone in your household own a radio?
22. b. Do you or someone in your household own a TV?
22. c. Do you or someone in your household own a fridge?
22. d. Do you or someone in your household own a computer?
23. Do you or someone in your household own a bicycle?
24. Do you or someone in your household own a car/truck/vehicle?
25. Do you or someone in your household own a cellphone or telephone?
26. What type of energy/fuel does this household mainly use for cooking?
- oo. What was the main material used for the floor, walls and roof of the main dwelling? (*observation*)

5.3.3.3 Indicator 3.3: Durability of Dwelling

Rationale: A Luby and Halder (2008) study of the associations among handwashing indicators, wealth, and symptoms of childhood respiratory illness in urban Bangladesh found that whether or not the house of the participating individual had a cement floor was a household characteristic that could most explain the variance among households, capturing 34% of the total data variability.

Definition of terms: **Durability** was the combination of construction materials used for walls, floor and roof of the dwelling. **Dwelling** was defined as any structure intended or used for human habitation (StatsSA, 2009).

Calculation: Durability was the combined average score of material used for walls, floor and roof.

- Number of dwelling by durability score divided by the total sample

Sources of data: Spot observation

Model measures:

- oo. What was the main material used for the floor, walls and roof of the main dwelling? (*observation*)

5.3.3.4 Indicator 3.4: Highest education level in the household

Rational: Education can affect health and hand hygiene through its influence on lifestyle behaviours, problem-solving ability and preventative behaviours (Westaway and Viljoen, 2000). A PRISMA (2004) study showed that mothers who came into contact with faeces washed their hands more frequently in households in which the head of the household has a higher educational level. In households in which the father or the head of the household and the mother have a primary school education or less, handwashing with soap was less frequent in risk events involving faeces. Similarly, in a study of the relationship between maternal and household factors and child care in Accra, Armar-Klemesu et al. (2000) found a significant positive association between maternal education and hygiene (i.e. mother and child cleanliness, nappy cleanliness, surrounding environment cleanliness and no stagnant water in the yard).

Definition of terms: Education refers to formal schooling, university or collage

Calculation: total of individuals per education level divided by the total sample.

Sources of data: Household Interview

Model measures:

18. What was the highest education level of the people living in the household?

5.3.3.5 Indicator 3.5: Household composition

Rationale: The composition of a household has been shown to correlate to hand hygiene behaviours. Curtis et al. (1995) showed that the age of a child in household influenced mother's hygiene behaviours and the higher the number of children in a households, the poorer the hygiene behaviours of mothers.

Definition of terms: **Household composition** referred to the number of persons, who live together and provide themselves jointly with food and/or other essentials for living, or a *single* person who lives alone; number of children in the household and number of under 5 years children in the household.

Calculation:

- Number of individuals in the respondents household;
- Number of individuals reporting at least 1 child (newborn-17 years) in the household divided by the total sample
- Number of individual reporting a child under 5 years in the household divided by the total sample

Sources of data: Household interview

Model measures:

4. How many people, including children and babies, live in this household?
5. How many household members are:
 - Under 5 years;
 - Under 17 years.

5.3.4 Index 4: Hand Hygiene Service Environment

Physical barriers to handwashing with soap related to the convenient placement of handwashing device; the availability of soap next to the device; the amount of time spent on hand hygiene especially where people were busy; and availability of water for hand hygiene. Best hand hygiene practices were motivated/stimulated by the presence of hand hygiene hardware (technologies). "Hardware" was defined as the inputs related to appropriate equipment and construction, such as taps, handwashing device, soap.

There was insufficient data to make definitive recommendation on which hand hygiene technologies should be used (Jumaa, 2004). None of the materials on their own were ideal and all had advantages and disadvantage. However the EHP (2004) suggests that the ability of an individual to wash hands at appropriate times was dependent on immediate and easy access to all of the following technologies:

1. Water of sufficient quantity and quality from tap or container
 2. Soap, ash, or other detergent
 3. A device that facilitates unassisted hand hygiene such as a basin, sink, bucket, or tippy tap
 4. Clean towel or cloth, although this was optional because air drying was an acceptable alternative
- The EHP (2004) recommended a fifth component to hand hygiene, namely a designated 'place' for hand hygiene practices.

All households should have immediate access to all essential items for washing hands at all appropriate times. Poor households could not have a dedicated room, but should make it a habit that people wash hands properly and keep items within reach at all times (EHP, 2004).

Assessment of hand hygiene materials was done through specific interview questions and through observation of the presence/absence of these items in a household. Interview questions could include:

- What was the main source of water used by this household for hand hygiene?
- What hand hygiene supplies were available (Can you show me everything you use to wash your hands?), and
- Where do you usually wash your hands?
- Do you have soap in your household? (Only ask for the availability of soap here, not of other cleaning agents like detergents, ash, sand)
- Have you used soap today or yesterday?
- When you used soap today or yesterday, what did you use it for? If for washing my or my children's hands was mentioned, probe what was the occasion, but do not read the answers.
- Schools: Does your school have a place for washing one's hands?
- Schools: Is the handwashing place in the school toilet facility or within 10 metres?
- Clinics and other institutions: was there a place for handwashing in the toilet facility or next to it?
- Clinics and other institutions: were the following items present at the place for hand hygiene? (same materials required as listed above)

The interviewer would then also observe and note hand hygiene materials, visible or produced within 1 minute, and the area in which hand hygiene was carried out. The model offers the interviewee the option to bring out the necessary items within one minute or less, which would indicate that the items were readily accessible when needed for hand hygiene. According to EHP (2004) observation of hand hygiene materials should include:

- Ask: Can you show me everything you use to wash hands?
- Observe: Is there water? The interviewer should turn on tap and/or check the container and note if water was present;
- Observe: Is there soap or detergent or ash?
- Observe: Is there a handwashing device such as a tap, basin, bucket, sink, or tippy tap?
- Observe: Does the washing device allow unassisted washing and rinsing of both hands, for example, a tap, basin, bucket, sink, or tippy tap?
- Observe: Is there a towel or cloth to dry hands?
- Observe: Does the towel or cloth appear to be clean?

The South African hand hygiene assessment frameworks was developed based on the understanding that the availability of hand hygiene technologies to which an individuals had access would determine their hand hygiene behaviours and thus included a Service Environment index which was compiled from 5 household indicators, namely:

1. Indicator 4.1: Access to improved hand hygiene water
2. Indicator 4.2: Availability of a cleansing agent (soap or a soap substitute) for hand hygiene
3. Indicator 4.3: Availability of **hygienic** hand drying materials

4. Indicator 4.4: Presence and position of a designated handwashing station for hand hygiene
5. Indicator 4.5: Presence of a safe and hygienic handwashing device
6. Indicator 4.6: : Availability of a sanitation service
 - a. Sub-indicator 4.6.1: Access to an improved toilet facility
 - b. Sub-indicator 4.6.2: Access to a hygienic toilet facility
 - c. Sub-indicator 4.6.3: Hygienic solid waste disposal system
7. Indicator 4.7: Presence of safe anal cleansing materials

Each of these technologies and their influence on effective hand hygiene were discussed in more detail below.

5.3.4.1 Indicator 4.1: Access to improved hand hygiene water

Rationale: Before a household's hand hygiene situation can improve, it must have easy access to a water supply which provided sufficient water to allow for hand hygiene.

In a Bangladesh study of household characteristics that were significantly associated with washing both hands with soap after faecal contact, the presence of water at the place to wash hands doubled the probability of washing both hands with soap (Luby et al., 2009).

Similarly, a study by Biran et al. (2009) in India found that the availability of water was associated with safe hand hygiene. It had been suggested that the health benefits of water supply was only realised when the supply was delivered on-site, i.e. yard or house tap. Howard and Bartram (2003) suggest that water quantities used by households were primarily depended on access to water, determined by the distance to the source and/or the time taken to collect the water. Indoor water supply greatly facilitated the practice of handwashing with soap when there was a risk of contact with faeces (PRISMA, 2004). The Biran et al. (2009) study showed that households which had an in-house water source practiced safe handwashing 6% more than households making use of a water source in the yard, while those using a water source in the yard practiced more safe handwashing than households with a water source placed elsewhere.

Similarly the PRISMA (2003) study showed a statistically significant difference in hand hygiene behaviours when comparing water supply options, showing that a water supply service outside the home reduced the regularity and quality of hand hygiene. When water supplies were further than a kilometre from the home, individuals would restrict their use of water for hand hygiene.

A study by Scott et al. (2007) of hygiene motivation in Ghana showed similar result with households with on-site water connections four times more likely to wash their hands with soaps after cleaning their child's behind and over twice as likely after defecation. Thus, when water was freely available at close range, hand hygiene becomes more frequent (Cairncross 1997).

This could provide at least a partial explanation for why interventions to improve water supply had been shown to have a health benefit in a number of settings. Howard and Bartram (2003) argued that to act as a positive driver for improved hygiene, water should be available at high service levels and ideally supplied at least through one tap in the house. Increased close-range water quantity also allows individuals to wash hands more thoroughly (EHP, UNICEF/WES, USAID, World Bank/WSP, WSSCC, 2004).

According to Gleick (1996) basic water requirements could be categorized into four groups in terms of quantity and quality. These were drinking water for survival; water for hygiene; water for sanitation services and water for food preparation (Gleick 1996). Gleick (1996) recommends, at a minimum, 20 litres per person per day was necessary to maximise the benefits of having a sanitation facility and for sanitation hygiene. This minimum level does however apply to households with dry toilets. Where waterborne systems were used, a much higher quantity of water will be necessary for sanitation services. In addition, he recommends an additional 5-25 litres per person per day for personal hygiene purposes such as bathing. According to these requirements, a person would require a minimum of 25-45 litres per person per day for sanitation and hygiene purposes, including hand hygiene.

Halder et al. (2010) however, found that although hand cleanliness was associated with the presence of handwashing water at a handwashing station, the presence of water at the station was not associated with the observed handwashing behaviour of individual. Howard and Bartram (2003) concluded that while benefits were accrued from an increased availability of water, this improvement cannot be attributed solely to quantities of water used. They suggested that effective use of water and cleansing agents and the timing of hygiene practices could be more important than the volume of water used for hygiene.

Definition of terms: **Access** implies that the water supply for handwashing was available at all times. **Improved** implies a safe, hygienic source such as a municipal hand hygienic water supply.

Calculation:

- Number of individuals per reported handwashing water source divided by the total sample.

Sources of data: Household Interview and spot observation

Model measures:

- 56. Do you wash your hands?
- 57. Where do you get water from for handwashing, most of the time?
- x. Is there water in, or within arms-reach, of the handwashing device? (*observation*)

5.3.4.2 Indicator 4.2: Availability of a cleansing agent (soap or a soap substitute) for hand hygiene

Rationale: An essential component of correct hand hygiene was the use of soap or a soap substitute (mud, ash). The effectiveness of handwashing with soap was still inconclusive, with little consensus on whether the use of soap to reduce disease and pathogens on hands was more effective than washing hands with water alone, whether the use of antibacterial soap was more effective than non-antibacterial soap and whether the use of soap substitutes such as mud, soil or ash was as effective as washing hands with soap.

Soaps were detergent-based products that contain esterified fatty acids and sodium or potassium hydroxide (World Health Organisation, 2009). They were available in various forms including bar soap, tissue and liquid preparations. Their cleansing activity of soap can be attributed to the removal of lipid and adhering dirt, soil, and various organic substances from the hands. (World Health Organisation, 2009).

A study of the drivers and obstacles to handwashing in Malawi found that it was more common for individuals to wash their hands with soap only when their hands *looked* dirty and less often after visiting the toilet when hands might look clean. The primary motivator to washing hands with soap in this study was the desire to remove bad odour and the observed dirt on hands (Bergqvist, 2008). The main barrier to handwashing with soap in was found to be that soap was viewed as expensive and thus it was not readily available or prioritized for handwashing (Bergqvist, 2008). Soap was priorities

for (1) washing clothes; (2) bathing; (3) washing dishes and (4) washing hands. Soap was also used for washing windows, house cleaning, cleaning chairs and as a lotion on skin. Similarly, formative research for hygiene promotion in Kyrgyzstan, conducted by Biran et al. (2005), found laundry soap was the most common use of soap in a household and the primary purpose of soap. Handwashing with soap was usually associated with the cleaning of visibly (dusty) dirty hands. Soap was also expensive, with households using it sparingly, when it was available.

The availability of soap for hand hygiene has also been linked to the economic status of the households. Aunger et al. (2010) also found that poor Kenyan households perceived the cost of soap and water to outweigh the benefits of handwashing. Soap was seen as a valuable commodity and the use of soap for hand hygiene was 'wasteful'. Affordability of soap can therefore, be the greatest obstacle to hand hygiene.

Table 11 provides a summary of disease reduction attributed to hand hygiene interventions in developing countries. Hand hygiene interventions were grouped into those which report using soap, soap and education; antibacterial soap and education; sanitizers and hand hygiene education alone.

Table 11: Summary of developing country intervention studies in which assessing effects of hygiene on infections in communities

Handwashing with soap	Diarrhoeal disease	35% reduction in diarrhoeal disease 44% decrease in risk of diarrhoeal disease (high quality studies which mentioned soap). 42-48% reduction in diarrhoea	Aldemon et al.1997 Curtis and Cairncross (2003) Cairncross et al. (2010)
Handwashing with nonantibacterial soap and hygiene education	Gastrointestinal illness	39% reduction of cases compared with no intervention in a control group	Aiello et al. (2008)
	Respiratory illness	51% reduction of cases compared with no intervention in a control group	Aiello et al. (2008)
Handwashing with antibacterial soap and hygiene education	Gastrointestinal illness	50% reduction of cases compared with no intervention in a control group	Aiello et al. (2008)
Handwashing with bezalkonium chloride-based hand sanitizers	Respiratory illness	40% reduction of cases of respiratory illnesses, compared with no intervention in a control group	Aiello et al. (2008)
	Combined illnesses	41% prevention of illness	Aiello et al. (2008)
Alcohol-based hands sanitizers	Combined illnesses	26% prevention of illness	Aiello et al. (2008)
Alcohol-based hands sanitizers combined with education	Combined illnesses	21% prevention of illness	Aiello et al. (2008)
Hand hygiene education alone	Gastrointestinal illness	31% reduction of cases compared with no intervention in a control group	Aiello et al. (2008)
	<i>Shigella</i> sp.	67% reduction in the risk of <i>Shigella</i> sp. Secondary infections	Khan, 1982

Water only vs. water and soap handwashing

Epidemiological evidence suggested that handwashing with soap was one of the most effective methods of preventing transmission of water-related disease. The simple act of washing hands with soap was shown to be capable of reducing incidence of diarrhoea by 47% (WaterAid, 2006).

Focused intervention studies have consistently demonstrate that handwashing with soap reduces diarrhoea (Curtis and Cairncross, 2003). There was also evidence that handwashing with soap reduces respiratory disease (Luby et al., 2005; Rabie and Curtis, 2006). Bloomfield and Hath, (2009)

found that while handwashing with water only reduced the total level of faecal bacteria on hands by 49%, handwashing with soap and water reduced the total level of faecal bacteria by 81%.

However, a South African laboratory study by Venter and September (2006) found little difference in *E. coli* counts between hands that were just rinsed with spiked water only and hands which were wash with soap and spiked water (not drying).

A controlled hand hygiene study of a small group of volunteers by Burton et al. (2011) also found that handwashing with only water did substantially reduce the prevalence of bacteria on the hands of these individuals. However, this also found that handwashing with non-antibacterial soap was more effective in reducing the prevalence of contamination, especially for specific bacteria under investigation.

Non-antibacterial vs. antibacterial soap handwashing

There seems to be some disagreement as to the value of hand hygiene and normal (non-antibacterial) soap. A number of studies have pointed out the basic misconception that simple handwashing with plain soap consistently and reliably prevents microbial transmission (Larson, 1999).

Ehrenkranz (1985) reported an upper limit of approximately 2 to 3 log¹⁰ reduction in bacterial numbers in experimental studies of applying bacteria to hands and washing these hands with none antiseptic soap, the same study reported that washing hands with antiseptic soap was more effective in removing bacterial transients by an order of magnitude of at least 1 to 2 log¹⁰ more. He concluded that hand antisepsis had been found to be much more effective than washing hands with none antiseptic soap.

Luby et al. (2004) and Aillo et al. (2008) found in that households that handwashing with non-antibacterial soap, in conjunction with education, had lowered the incidence of diarrhoea by 53%, prevented 51% of cases of respiratory illness when compared to the control group and results in a 50% prevention of cases of gastrointestinal illness. This led Aillo et al. (2008) to conclude that the use of non-antibacterial soap with hand hygiene education interventions were the most effective for preventing both gastrointestinal and respiratory illness.

However the Aillo et al. (2008) study also concluded that there was no evidence that the use of antibacterial soap was more effective than non-antibacterial soaps in preventing gastrointestinal or respiratory illnesses. Luby et al. (2004) also found that households which received antibacterial soap had similar incidence of diarrhoea as those with plain soap.

Research has also shown that handwashing with plain soap can result in a paradoxical increase in bacterial counts on the skin due to skin irritation and drying of the skin. Occasionally, plain soaps can become contaminated, which could lead to transmission of transient flora between hands. Nevertheless, there was some evidence that the actual hazard of transmitting microorganisms through handwashing with previously used soap bars was negligible (World Health Organisation, 2009).

Perceptions of handwashing with soap more than three times per day were that this was an exaggeration of what was necessary, and was believed to lead to dry skin and food infused with a soapy smell (PRISMA 2004).

Soap vs. soap substitutes

Unfortunately, there was little research related to the effectiveness of low cost/no cost soap substitutes on hand hygiene (Shordt, 2006). Soap substitutes which have no cost attached to them include mud, ash and soil.

Under experimental conditions, washing agents – soil, soap and ash – showed similar results producing a greater than 80% (of the order of 1-2 logs) reduction in coliforms on hands (Bloomfield and Hath, 2009). Data presented in the review suggests that the use of contaminated soil, mud or ash as an alternative to soap for handwashing in low income communities has potential microbiological and toxicological risks. However, in cases where soap was unaffordable the promotion of clean and dried soil and ash was preferable to using no agent at all, in that it was more effective in achieving the removal of organisms from the hands (Bloomfield and Hath, 2009).

In the pre-testing of handwashing behaviours with ash or mud for a hygiene intervention in Bangladesh, participants were asked to clean their hands using either ash or mud (depending on their preference) for one week. Participants were then asked to describe the advantages and disadvantages of each agent, the perception of the agents and the practical ways they had adapted and modified the advice given to them by the intervention team. Interestingly, feedback from participants included that mud was associated with “worms and germs,” while ash was seen as relatively “cleaner” (Bateman et al., 1995).

There was however, one study related to the effectiveness of these substitutes in reducing faecal coliforms on hands of the women in Bangladesh (Hoque et al., 1995). The study showed of the women who washed their hands outside defecation sites, 38% used mud to wash their hands, 2% used ash, 19% used soap, and 41% used water only and no rubbing agent (Hoque et al., 1995). Faecal coliform counts from the hands of these women, post-cleansing, showed that hand cleansing with mud and ash was as efficient as hand cleansing with soap (Hoque et al., 1995). The bacteriological quality of the soil which was used to wash hand showed no significant negative effect on bacterial counts on hands. The soil appeared to have a scrubbing effect comparable to the other agents, including soap, under similar standard conditions (Hoque et al., 1995).

Definition of terms: **Soap** refers to either homemade or commercial soap in bar, liquid or powder form. **Soap substitute** refers to any agent used in handwashing which was not soap, i.e. soil, mud, ash.

Calculation:

- Number of individuals reporting availability of soap in the household divided by the total sample
- Number of individuals per reported soap type divided by number of individuals reporting availability of soap in the household
- Number of individuals reporting the use of soap today or in the last day divided by the number of individuals reporting availability of soap in the household
- Number of individual that use a soap substitute for hand hygiene divided by the total sample.

Sources of data: Household Interview and spot observation

Model measures:

51. Do you have soap in your household? (only ask for the availability of soap here, not of other cleaning agents like ash, sand)
52. What types of soap do you have in the household?
64. Do you use anything else besides soap or water to wash your hands?
65. What else do you use, apart from soap or water, to wash your hands?
62. Do you believe that washing hands just with water but without soap was as good as washing hands with water and soap?
63. Why was using soap to wash hands better?

- z. Is there a cleansing agent (soap, ash, detergent) next to the handwashing device? (*observation*)

5.3.4.3 Indicator 4.3: Availability of hygienic hand drying materials

Rationale: Because wet hands can more readily acquire and spread microorganisms, the proper drying of hands was an integral part of routine hand hygiene (World Health Organisation, 2009). Careful hand drying was an essential component of effective hand hygiene as hand drying was a critical factor in determining the level of bacterial transfer associated with touch contact after hand cleansing (Jumaa, 2004; World Health Organisation, 2009). Paper towels, cloth towels, and warm air dryers were commonly used to dry washed hands.

There was much debate regarding the most effective means of hand drying. A study by Gustafson et al. (2000) compared 4 hand drying methods; namely drying with a cloth towel from a roller; paper towels left on a sink; warm air dryer; and letting hands dry by evaporation. Results showed no significant difference in the efficacy of the methods of hand drying.

Conversely, in a comparison of methods to test the efficiency of hand drying for the removal of bacteria from washed hands, warm air drying of stationary hands was more effective for removing bacteria than was paper towel drying, however, warm air drying while rubbing the hands was not more effective than drying with paper towels (Yamamoto, 2005). However, the uses of air dryers were less practical because of the longer time needed to achieve dry hands and the impracticality of using hand dryers in homes. Furthermore, one study suggested that some air driers could lead to the aerosolization of waterborne pathogens. Further studies were needed to issue recommendations on this aspect.

Potgieter (2008) in an assessment found that only 57% of individuals interviewed indicated that they used a clean towel to dry their hands. Interestingly 34% of the rural households interviewed in this study said they dried their hands on their clothing, 12% used a dirty towel, while 7% air-dried their hands. In the peri-urban settlements more (75%) individuals indicated that they used a clean towel or a dirty towel to dry their hands. No interviewees indicated that they air-dried their hands in the peri-urban study (Potgieter, 2008).

World Health Organisation (2009) recommends that hands should be dried using either *individual paper towels or hand driers which can dry hands effectively and as quickly as it can be done with paper towels, and have been proven not to be associated with the aerosolization of pathogens*. When clean or disposable towels were used, it was important to pat the skin rather than rub it, to avoid cracking. However, drying with paper towel or a clean cloth was not feasible for the majority of people in the rural and peri-urban areas of South Africa. Hoque et al. (1995) recommend that, if drying of hands with paper towel or a single use clean cloth was not feasible, hands be dried in the air.

Definition of terms: **Hygienic hand drying** in this assessment refers to paper towel at the handwashing station most often used to wash hands at home.

Calculation:

- Number of handwashing stations where hand drying material was observed divided by the number of observed handwashing stations.
- Number of handwashing stations per drying material type divided by the number of handwashing stations where hand drying material was observed

Sources of data: Spot observation

Model measures:

- bb. Is there something on which to dry hands? (*observation*)

- cc. Type of drying material available? (*observation*)
- dd. Does the material or paper towel or cloth appear to be clean? (*observation*)

5.3.4.4 Indicator 4.4: Presence and position of a designated handwashing station for hand hygiene

Rationale: An essential component of correct hand hygiene was having a designated handwashing station (place) to practice hand hygiene, especially after visiting the toilet. Hand hygiene behaviour was strongly influenced by both access to a device for handwashing and by having a specific place designated to hand hygiene. Ideally, to be most effective, the hand hygiene place should be located within or in close proximity to the toilet facility so that it was convenient to clean hands after defecation.

According to the EHP (2004) a proper handwashing place would meet all of the following criteria:

1. At least one handwashing place was located in or near the toilet facility.
2. All necessary items for handwashing are present (discussed above):
3. Grey water from handwashing can be safely disposed of in the following ways:
 - in a grey-water pit, soak-away pit
 - via a connection to a septic system or toilet facility.

Research has shown that when comparing hand hygiene behaviours of households with and without a handwashing station, those households with handwashing station showed a significantly higher rate (67%) of hand hygiene following toilet use, compared to 20% for households without handwashing station (Biran et al., 2005).

In the Spot check Assessment of water supply and sanitation project in the rural areas of South Africa, a distance of 1 metre from the toilet was selected as the distance which would encourage hand hygiene and would result in the most effective hand hygiene. However, the 2006/2007 Spot checks showed that, for completed projects; only 58% of the toilets with handwashing facilities had the device where within 1 metre of the toilet (Duncker et al., 2007). Similar poor figures were shown in the 2007/2008 Spot check with which nearly a third of handwashing facilities not having water, two-thirds did not have soap and just less than two-thirds were not within 1 metre of the toilet (Duncker et al., 2008).

The distance to the handwashing stations also could play a role in hand hygiene. Luby and Halder (2008), in a study that controlled for socio-economic status of study individuals, found that the presence of a handwashing station inside the house with water to wash hands was the only handwashing indicator significantly associated with a child in the household who reported cough or difficulty breathing in the preceding 7 days. This study found that households with a handwashing station inside their house were more likely to have soap at the station for handwashing, when compared with households without a station. The further away the station of handwashing was from the house, Luby and Halder (2008) found that it was less likely soap was available at this handwashing station.

Definition of terms: **Designated handwashing station** refers to a handwashing place located in or near the toilet facility.

Calculation:

- Number of individuals per location reported where they most often washed their hands divided by the total sample.
- Number of individuals who agreed to show fieldworkers where they washed their hands divided by the total sample.

- Number of handwashing stations by observed location divided by the number of individuals who agreed to show the fieldwork their handwashing station.
- Number of households with access to an appropriate handwashing station within 2 metres of the toilet divided by the total number of households in the sample.

Sources of data: Questionnaire and Spot observation

Model measures:

- s. Ask: Where do you most often wash your hands at home? (*observation*)
- t. Ask: Can you show me the place where you most often wash your hands? (*observation*)
- u. Is the hand washing place inside or within 2 metres of the toilet? (*observation*)

5.3.4.5 Indicator 4.5: Presence of a safe and hygienic handwashing device

Rationale: An essential component of correct hand hygiene was having a handwashing device to facilitate the easy and safe practice of hand hygiene, especially after visiting the toilet. The presence of a device such as a tap, bucket, basin, etc. specifically available to facilitate hand hygiene will affect the frequency of handwashing in a household.

In an assessment of hand hygiene devices in 14 villages, which were part of the Department of Water Affairs and Forestry's community sanitation programme in Mpumalanga and Limpopo, 5 devices were found to be commonly used by these households (CSIR, 2004); namely:

1. A bucket and wine tap system;
2. A bucket and plastic tap system;
3. A systems where a plunger was attached to a 2 liter bottle;
4. Basin or bucket
5. A hanging 2 liter bottle (tippy tap).

Despite the cost of these devices being relatively low, and this cost being covered under the household sanitation subsidy provided for a free basic sanitation services, figures for households with handwashing devices were greatly varied. In Mpumalanga more than 60% of households had no device, while in Limpopo only 12% of households did not have some form of handwashing device (CSIR, 2004). The most common device used for hand hygiene in these provinces was a yard tap (18%) or closed bucket with a tap (10%) in two areas of Mpumalanga (CSIR, 2004). In Limpopo, the majority of visited households were using a closed bucket with tap (42%) or a 2 liter bottle with a plunger attached (52%) (CSIR, 2004).

With an increased focus of sanitation service provision on to be more inclusive of health and hygiene and especially hand hygiene and the initiation of the South African WASH initiative which should have increased awareness of the need for hand hygiene, it could be expected that the percentage of households with hand hygiene devices would have increased in recent years. However, a Spot check Assessment of water supply and sanitation project in the rural areas of South Africa checked for the presence of a 'handwashing' device at or near the toilet. In the 2006/2007 and 2007/2008 spot checks of completed project it was found that only 39% and 46% of the toilets, respectively, had a handwashing device (Duncker et al., 2007; Duncker et al., 2008). This was as low as the percentages collected in the CSIR (2004) study.

However, this low coverage of hand hygiene devices was not necessarily universal in South Africa. In an assessment of 3 rural villages in the Limpopo Province and 2 peri-urban areas of South Africa, Potgieter (2008) found that 71% of households in the rural villages had their own washing device where they could wash their hands, usually a small tub with soap next to it, while in the peri-urban areas only 12% of interviewees indicated having a similar tub for hand hygiene. In 38% of the cases

in the rural villages and 59% of the households in the peri-urban settlements the same tubs were also used for washing dishes and food preparation utensils.

Definition of terms: A **handwashing device** refers to a basin, sink, bucket, plunger and 2litre bottle, tippy tap or tap that facilitates unassisted handwashing (EHP et al., 2004). A **safe and hygienic** device refers to grey water from handwashing being safely disposed of in the following ways:

- Grey-water pit, soak-away pit
- Connection to a septic system or toilet facility

Calculation:

- Number of handwashing stations observed with handwashing devices at a station divided by the number of individuals willing to show their handwashing stations.
- Number of handwashing stations per handwashing device type divided by number of individuals willing to show their handwashing stations.
- Number of handwashing stations per reported greywater management type divided by the total sample.
- Number of handwashing stations per observed greywater management type divided by divided by number of individuals willing to show their handwashing stations.

Sources of data: Household Interview and spot observation

Model measures:

- v. Is there a hand-washing device such as a tap, basin, bucket, sink, plunger and 2 liter bottle or tippy tap? (*observation*)
- w. What type of handwashing device was there? (*observation*)
- y. Does the washing device allow unassisted washing and rinsing of both hands? (*observation*)
- nn. What happens to the handwashing water after the interviewee washed their hands? (*observation*)
- 58. What happens to the handwashing water after you have washed your hands?

5.3.4.6 Indicator 4.6: Availability of a sanitation service

In a study of the relationship between maternal and household factors and child care in Accra, Armar-Klemesu et al. (2000) found a significant positive association between the availability of services such as waste disposal, toilet facilities and water source and hygiene (i.e. mother and child cleanliness, nappy cleanliness, surrounding environment cleanliness and no stagnant water in the yard).

This indicator was a composite of a number of sub-indicators, namely; access to an improved toilet facility; availability of hygienic toilet facility and safe and hygienic storage and disposal of solid waste.

5.3.4.6.1 Sub-indicator 4.6.1: Access to an improved toilet facility

Rationale: For the hygiene situation of a household to improve, it must have easy access to functioning and hygienic toilet facilities. In a three country African study, the type of sanitation facility appeared to be closely related with diarrhoea morbidity. Among the households with piped water, 14% with a pit latrine had had at least one case of diarrhoea compared with only 7.4% of the households with a flush toilet. Among the households with un-piped water without sanitation, the prevalence was 66%, while for those with a pit or Ventilated Improved Pit (VIP) latrine the figures were about 20% (Tumwine et al., 2002). This composite indicator incorporates the access and quality of a facility.

Definition of terms: **Access** refers to member of the household being able to use the facility at any time day or night. Access should also consider the following (EHP, 2004):

- Whether the facility was shared, public, or private: safe disposal of faeces requires a private latrine (one facility per family) or a well-maintained shared facility (private or publicly owned). Shared facilities that were not cleaned regularly commensurate with the number of users could discourage use because of unhygienic conditions.
- The distance of the facility from the dwelling (in metres): A toilet facility should be located within a convenient distance from the user's dwelling—20 metres or less—bearing in mind use at night and use by children and the elderly.
- Whether the facility was easily reached, i.e. clear path to the toilet.

An **improved toilet facility** should meet the following criteria:

- Flush toilet with connection to a public sewer;
- Flush toilet with connection to a septic system;
- Pour-flush toilet;
- Urine diversion toilet; and
- Ventilated improved pit latrine.

Calculation:

- Number of individuals reporting having access to a toilet divided by the total sample.
- Number of individuals per observed toilet type divided by number of individuals that agreed to allow observation of the toilet.
- Number of toilets reported per individual.
- Average number of people using the toilet reported per individual.
- Number of individuals per observed toilet location divided by number of individuals that agreed to allow observation of the toilet.
- Number of individuals per observed toilet distance divided by number of individuals that agreed to allow observation of the toilet.

Sources of data: Spot observation

Model measures:

- a. Do you have access to a toilet?
- i. May we see the toilet facility?
- d. Do you share the toilet with other households?
- e. How many people share this toilet facility?
- n. What type of toilet facility does this household use? (*observation*)
- j. Where was the toilet facility located? (*observation*)
- k. How far was the toilet facility from the house? (*observation*)
- l. Are there obstacles in the path to the toilet? (*observation*)

5.3.4.6.2 Sub-indicator 4.6.2: Access to a hygienic toilet facility

Rationale: For the hygiene situation of a household to improve, it must have easy access to functioning and hygienic toilet facilities.

Definition of terms: An improved **hygienic** facility means the facility was clean and there were no faeces on the floor, seat, or walls.

Calculation:

- Number of observed tidy toilet facilities divided by the total number of observed toilets in the sample.

- Number of observed toilet dirty facilities divided by the total number of observed toilets in the sample.
- Number of individuals that reported cleaning the toilet divided by the total sample

Sources of data: Household Interview and spot observation

Model measures:

- g. Is the facility cleaned?
- h. When was the facility last cleaned?
- o. Is the facility (toilet/walls/floors) clear of rubbish, dirty and dust? (*observation*)
- p. Is there faecal matter present inside the facility on floor or walls (human or animal)? (*observation*)

5.3.4.6.3 Sub-indicator 4.6.3: Hygienic solid waste disposal system

Rationale: For the hand hygiene situation of a household to improve, it must have a safe way to dispose of solid waste.

Definition of terms: **Solid waste** refers to all household refuse in non-liquid form. **Hygienic disposal system** consists of the following:

- Safe storage in the household (dustbin with lid)
- A solid waste pit near the household where solids were discarded and eventually buried
- A waste removal system where rubbish was collected and removed from the household vicinity on a regular basis

Calculation:

- Number of individuals that reported using a hygienic solid waste storage divided by the total sample.
- Number of individuals per reported solid waste disposal type divided by divided by the total sample.
- Number of observed tidy yards divided by the total sample.

Sources of data: Household Interview and spot observation.

Model measures:

- 81. Where do you keep (store) your garbage until you get rid of it?
- 82. How do you get rid of/dispose of your garbage?
- pp. Is there rubbish (paper, plastic, general household waste) lying around the yard? (*observation*)

5.3.4.7 Indicator 4.7: Presence of safe anal cleansing materials

Rationale: Anal cleansing materials used in South Africa include toilet paper (occasionally), newspaper, magazines, stones, rags, plastic bags and chip packets (Buckley et al., 2008). It was to be expected that the type of material used for anal cleansing will determine the level of microbiology on hands, and thus the effectiveness of hand hygiene behaviours.

Definition of terms: **Safe anal cleansing material** refers to toilet paper or newspaper next to the toilet.

Calculation:

- Number of observed toilet with safe anal cleansing material near or next to the toilet divided by the number of observed toilets.
- Number of households with safe anal cleansing materials next to the toilet divided by the total number of households in the sample.

Sources of data: Spot observation

Model measures:

- q. Is there toilet paper or newspaper next to the toilet? (*observation*)

5.3.5 Index 5: Individuals Hygiene Knowledge Influence on Hand Hygiene Behaviours

Health impact from promoting hand hygiene could be further increased by getting people to practice hand hygiene not just more frequently but also at the right time (Bloomfield et al., 2007). A number of studies showed the relatively poor understanding of the principles of hygiene that were present in the community (Bloomfield et al., 2007). For example, knowledge regarding the need for handwashing after coughing or sneezing could not be as pervasive as knowledge about handwashing after defecation, and it could be that people understand better when to wash their hands during food-associated activities but not, for example, while handling contaminated tissues (Bloomfield et al., 2007). Because visible soiling was an unreliable indicator of the presence of pathogens on the hands, people were unlikely to wash their hands at the correct time unless they have been taught to do so or have some awareness of the chain of infection transmission in the home, i.e. they were aware of when their hands could be contaminated (Bloomfield et al., 2007). Hygiene education needed to be consistently incorporated as part of hand hygiene promotion programs if people were to properly understand the risks and adapt their behaviour accordingly (Bloomfield et al., 2007).

Hand Hygiene Knowledge Requirements

It was important to distinguish between hand hygiene as a primary barrier (to remove faecal matter after contact with stools) and hand hygiene as a secondary barrier (before preparing food, handling fluids, feeding, eating) (Curtis et al., 2000).

Surprising, studies that reported a significant reduction in diarrhoea have promoted different critical time for hand hygiene (Shordt and Cairncross, 2004). However, the following practices were related to a reduced risk of diarrhoea and were the 'critical times' most promoted by hand hygiene interventions:

- Washing hands after defecating
- Washing hands after handling child's faeces or cleaning a child's bottom
- Washing hands before preparing food
- Washing hands before feeding children
- Washing hands before eating

Other 'critical times' mentioned by the literature include (EHP, 2004; Bloomfield et al., 2007):

- Washing children's hands
- Washing hands after eating
- washing hands after contact with contaminated surfaces (e.g. rubbish bins, cleaning cloths, food contaminated surfaces);
- washing hands after handling pets and domestic animals;
- washing hands after wiping or blowing the nose or sneezing into the hands;
- washing hands after handling soiled tissues (self or others', e.g. children);
- washing hands after contact with blood or body fluids (e.g. vomit and others);
- washing hands before and after dressing wounds;
- washing hands before giving care to an "at-risk" person; and
- washing hands after giving care to an infected person.

It was important to promote only a small number of 'critical times' for hand hygiene. It was unreasonable to expect handwashing with soap on every conceivable occasion. Research by Graeff et al. (1993) in Guatemala requested mothers to wash their hands at the five standard critical times, as

well as before touching the cooking or drinking water, and before going to bed. Results showed that handwashing at all these times required mothers to wash their hands an average of 32 times in a day, which required an additional 20 litre of water and an additional hour per day (Graeff et al., 1993). Curtis (2001) suggests focusing on hand hygiene as a primary barrier to remove faecal matter from hands after contact with faeces, i.e. focus on hand hygiene at the critical times of:

- after defecation; and
- after cleaning babies.

In the Potgieter (2008) assessment of rural villages and peri-urban settlements in South Africa households were aware of the importance of washing their hands after using the toilet and before eating meals. However, the majority of households in this study admitted to not washing hands at the other critical times, i.e. before food preparation, after changing nappies and when hands were visibly soiled. Similarly, Bergqvist (2008) found that individuals in a Malawi study considered the most important time for handwashing to be after defecating and before eating.

It was therefore important that in addition to knowing how to wash their hands, it was essential that household members, especially the caretaker and those responsible for preparing food, know *when* to wash their hands in order to decrease the prevalence of diarrhoea.

Methods of assessment hand hygiene knowledge

Assessment of an individual's knowledge of hand hygiene should, at a minimum, measure some of the five critical times of hand hygiene (see above). Assessment was done through interviewing individuals and interview questions include:

- When was it important to wash your hands?
- Do you believe that washing hands just with water but without soap was as good as washing hands with water and soap?
- Why was it important to wash hands with soap?
- When was it important for a young child (3 years or older) to wash his/her hands or have his/her mother wash them for him/her?
- Schools: Do your friends wash their hands after they use the toilet facility?
- Schools: If not, what was the main reason why not?

It was critically important that interviewers do not prompt responses (i.e. read out the answers). According to EHP (2004), the respondent should, at a minimum, mention two critical times for washing hands, one of which must be "after defecating."

It was widely recognised that improving knowledge of hand hygiene does not necessary lead to a change in attitude or hand hygiene behaviours. To determine the effectiveness of a health and hygiene education, awareness or education intervention it was vital to measure knowledge, attitudes and behaviours before the interventions (baseline) and again after the intervention (Westaway and Viljoen, 2000). Thus the effectiveness of such interventions in improving knowledge, correcting misconceptions and re-enforcing or changing hand hygiene attitudes and behaviours can be evaluated.

The South African hand hygiene assessment frameworks was however, developed based on the hypothesis that individuals with better hand hygiene knowledge should have better hand hygiene technique and thus cleaner hands. The framework thus includes a Hand Hygiene Knowledge index which was compiled from 4 indicators, namely:

1. Indicator 5.1: Knowledge of at least two critical times of handwashing
2. Indicator 5.2: Knowledge of at least two reasons **why** handwashing was necessary at critical times
3. Indicator 5.3: Knowledge of the appropriate technique of hand hygiene
4. Indicator 5.4: Knowledge of diarrhoea and at least two ways to prevent diarrhea

5.3.5.1 Indicator 5.1: Knowledge of at least two critical times of handwashing

Rationale: In addition to knowing how to wash their hands, it was essential that household members, especially those responsible for preparing food, know *when* it was most important to wash their hands in order to decrease the prevalence of diarrhoea (EHP et al., 2004). Although knowledge of the critical times for handwashing was important, it was not always practical to wash hands at all these times. Graeff et al. (1993) in Guatemala requested mothers to wash their hands at the five standard critical times, as well as before touching the cooking or drinking water, and before going to bed. Results showed that handwashing at all these times required mothers to wash their hands an average of 32 times in a day, which required an additional 20 litre of water and an additional hour per day. It was also important to link this knowledge of the critical times for handwashing with handwashing with soap.

Definition of terms: **Critical times** include the following (listed by WHO as instances for maximum effect on diarrheal disease reduction):

- After defecation;
- After handling child's faeces or cleaning a child's bottom;
- Before feeding others;
- Before eating; and
- Before preparing food.

After gardening or working in the fields was added as a 6th option of critical times of hand hygiene in this assessment.

Calculation:

1. Number of individuals reporting per critical times for hand hygiene divided by the total sample size.
2. Number of individuals who know critical times to wash hands divided by the total sample size.
3. Number of individual who reported using soap per critical time of hand hygiene divided by the total sample.
4. Number of individuals that mention handwashing with soap at critical times divided by the total sample size.
5. Number of individuals that report handwashing with soap *after visiting the toilet* divided by the number individuals who reported having soap in their household.

Sources of data: Household Interview

Model measures:

59. When was it important to wash your hands? (***do not read the answers, encourage by asking if there was anything else until s/he says there was nothing else and check all mentioned***)
53. Have you used soap today or yesterday?
54. When you used soap today or yesterday, what did you use it for? (*if for washing my or my children's hands was mentioned, probe what was the occasion, but do not read the answers*)
55. Why did you wash your hands WITH SOAP before/after the occasions mentioned above?

5.3.5.2 Indicator 5.2: Knowledge of at least two reasons why handwashing was necessary at critical times

Rationale: In addition to knowing when and how to wash their hands, it was essential that household members, especially those responsible for preparing food, know **why** it was most important to wash their hands at critical times (EHP et al., 2004). It does not matter whether they cite health or removal of germs as reasons to wash hands, but rather that they have a motivating factor, which can include social pressure.

Definition of terms: **Valid reasons** for washing hands include the following (EHP et al., 2004):

- Prevents disease;
- Prevents diarrhoea;
- Cleans hands/removes dirt;
- Is good hygiene;
- Prevents dirt from getting into mouth;
- Prevents dirt from getting into food;
- Removes germs;
- Heard from parents/other family;
- Heard from other people;
- Heard from radio/TV;
- Have seen other people do so;
- Smells good; and
- Looks/feels clean.

Calculation:

- Number of individuals who provide a valid reason for handwashing at critical times divided by number of individuals that reported at least one critical time to wash hands. Reasons reported were categorised into:
 - Habit;
 - Health reasons;
 - Remove dirt/general cleanliness; and
 - Remove/kills germs or bacteria.

Sources of data: Household Interview

Model measures:

53. Why was it important to wash hands at these times? (mentioned in 51 above) (do not read the answers, encourage by asking if there was anything else until s/he says there was nothing else and check all mentioned)
56. Have you used soap today or yesterday?
57. When you used soap today or yesterday, what did you use it for? (*if for washing my or my children's hands was mentioned, probe what was the occasion, but do not read the answers*)
58. Why did you wash your hands WITH SOAP before/after the occasions mentioned above?

5.3.5.3 Indicator 5.3: Knowledge of the appropriate technique of hand hygiene

Rationale: To improve hand hygiene, it was important that individuals, especially those responsible for food preparation wash their hands at critical times. This behaviour was associated with their knowledge about proper handwashing behaviours techniques (how to wash hands).

Definition of terms: **Appropriate hand hygiene technique** involves the following activities (EHP et al., 2004):

1. Use water;
2. Use soap, ash, or other detergent;
3. Wash both hands;
4. Rub hands together at least three times; and
5. Dry hands hygienically — by air or with a clean cloth (note: the questionnaire shows this as the 'correct' means of hand drying however, the Hand Hygiene Technique score generated for each individual assumes paper towel as the correct hand hygiene activity).

Calculation:

- Number of individuals who reported 1-5 of the appropriate hand hygiene technique divided by the total sample

Sources of data: Household Interview

Model measures:

61. Can you explain to me how you washed your hands the last time you wash them?(do not read the answers, encourage by asking if there was anything else until s/he says there was nothing else and check all mentioned)

5.3.5.4 Indicator 5.4: Knowledge of diarrhoea and at least two ways to prevent diarrhoea

Rationale: Diarrhoeal diseases were one of the most important causes of morbidity and morbidity in South Africa in children under five years old. Hand hygiene behaviour change cannot be expected until the target population knows what must be done to improve the hygiene situation in the household and the surrounding community (i.e. proper protection of drinking water and washing of hands). Once such knowledge was acquired, then it must be combined with positive attitudes, identification of barriers to behaviour change, and other factors before practices can be expected to change (EHP et al., 2004).

Definition of terms: To **prevent diarrhoea** implies a reduction in the number of episodes that were experienced. The list of ways to prevent diarrhoea includes many items not related to water supply, sanitation, and hygiene (EHP et al., 2004), including:

- Wash hands;
- Use soap;
- Use toilet facility to defecate;
- Dispose of children's faeces in toilet facility;
- Bury faeces;
- Drink clean water;
- Store water safely (keep water container covered/closed);
- Treat water (boil, filter, chlorinate);
- Wash child's bottom and hand after defecation;
- Wash body daily;

- Prepare and protect food hygienically (keep food covered, keep dishes/utensils clean);
- Eat fresh food;
- Dispose of garbage in a pit;
- Breast feed babies in general;
- Breast feed only until 6-months old;
- Do not offer other food/drink before 6 months;
- Get measles vaccination;
- Take vitamin A; and
- Practice good nutrition.

Calculation:

- Number of individuals who reported they knew what diarrhoea was divided by the total sample.
- Number of individuals that knew that diarrhoea can be prevented divided by the number of individuals who reported they knew what diarrhoea is.
- Number of individuals per reported category of diarrhoea prevention divided by the number of individuals who knew that diarrhoea can be prevented. Categories of what diarrhoea was include:
 - Running stomach;
 - Bowl problems;
 - Disease from dirty water;
 - Illness causing dehydration; and
 - Food poisoning.
- Number of individuals by number of reported means of preventing diarrhoea divided by the number of individuals who knew that diarrhoea can be prevented. Reported means of preventing diarrhoea were categorized into:
 - Avoid physical contact with people;
 - Being hygienic/good lifestyle;
 - Boiling water/purifying water;
 - Clean environment;
 - Do not pollute water;
 - Drink/use clean water;
 - Eat healthy;
 - Eat safe/fresh food;
 - Jik in water;
 - Keep food in a safe place (away from flies);
 - Other;
 - Use clean utensils;
 - Wash fruit/food before eating;
 - Wash hands with soap; and
 - Washing hands.

Sources of data: Household Interview

Model measures:

76. Do you know what diarrhoea is?
77. Can you describe what diarrhoea is?
78. Do you think diarrhea can be prevented?
79. How do you think diarrhea can be prevented? (***do not read the answers, encourage by asking if there was anything else until s/he says there was nothing else and check all mentioned***)

5.3.5.5 Indicator 6.5: Knowledge of causes of diarrhoea

Rationale: To achieve significant progress in reducing the number of deaths attributed to diarrhoea, its underlying causes must be addressed. Westaway and Viljoen (2000) in their assessment of health and hygiene knowledge, attitudes and behaviour found that the key causes of diarrhoea mentioned by households was germs, dirty water, dirty food, dirty dishes/utensils, not having a toilet and breathing in bad smells. However, respondents were more familiar with the symptoms and prevention of diarrhoea than the cause (Westaway and Viljoen, 2000).

Definition of terms: **Causes of diarrhoea** includes (EHP et al., 2004):

- Bad/dirty water;
- Bad/dirty food (includes milk, yoghurt, meat and fish);
- Reheated cooked food;
- Dirty dishes/utensils;
- Children eating dirt;
- Poor hygiene;
- Faeces/defecating in the open;
- Dirty hands;
- Germs; and
- Flies.

Calculation:

- Number of individuals cited a reason for the cause of diarrhoea divided by the number of individuals who knew what diarrhoea is. Reported causes of diarrhoea were categories as:
 - Bad/dirty food;
 - Bad/dirty water;
 - Dirty hands;
 - Dirty utensils/dishes;
 - Germs;
 - Other; and
 - Poor hygiene.

Sources of data: Household Interview

Model measures:

80. What do you think causes diarrhoea?

5.3.6 Index 6: Individuals Social Profile Influences on Hand Hygiene Behaviours

Not only does an individual household socio-economic status play a role in hand hygiene behaviours, but the social profile of individuals could also influence these behaviours. The South African hand

hygiene assessment frameworks was developed based on the hypothesis that individuals with better or higher social profile should have better hand hygiene technique and thus cleaner hands. The framework thus includes an Individual Social Profile index which was compiled from 5 indicators, namely:

1. Indicator 6.1: Affected by a disability
2. Indicator 6.1: Affected by a disability
3. Indicator 6.3: Age category Indicator 6.4: Marital status category
4. Indicator 6.4: Marital status category
5. Indicator 6.5: Overall Social Status

5.3.6.1 Indicator 6.1: Affected by a disability

Rationale: Disability plays a critical role in an individual's access to water services, and thus hand hygiene behaviours. Disability relates to whether an individual can collect and use water from the water source, whether they can access the toilet facility and thus whether they can reach the handwashing device and wash hands after visiting the toilet.

Definition of terms: A **disability** was defined as a physical or mental handicap which has lasted for six months or more, or was expected to last at least six months, which prevents the person from carrying out daily activities independently, or from participating fully in educational, economic or social activities (StatsSA, 2009).

Calculation:

- Number of individuals reporting a disability divided by the total population of the sample.

Sources of data: Household interview

Model measures:

19. Are you limited in your daily activities because of a long term physical, sensory, hearing, intellectual r psychological condition, lasting six months or more?
20. What condition or difficulty do you have? Is it...? (cross-check question)

5.3.6.2 Indicator 6.2: Literacy

Rationale: A hand hygiene study in Kenya found that higher levels of education and literacy were associated with handwashing with soap (Schmidt et al., 2009). Literacy can play a key role in hand hygiene behaviours as individuals that can read and write were able to be reached through print media. Print media plays a critical role in hand hygiene awareness and promotion, and can play a crucial role in changing hand hygiene behaviours.

Definition of terms: **Literacy** refers to the ability to read and write with understanding in any language. A person was literate who can, with understanding, both read and write a short simple statement on their everyday life (StatsSA, 2009).

Calculation:

- Number of individuals that can read AND write in at least one language divided by the total sample.

Sources of data: Household interview

Model measures:

14. Can you read at least one language?
15. Can you write in at least one language?

5.3.6.3 Indicator 6.3: Age category

Rationale: Roles and priorities of individuals vary with age which was expected to influence hand hygiene behaviours. Increasing age has been linked to a decline in 'disgust' sensitivity, attributed to older individuals having a lesser role to play in nurturing. However, in the case of South Africa, children were very often raised and cared for by grandparents. Thus, hand hygiene behaviours could not change with age.

Definition of terms: **Age categories** are:

- Students – 18-24 years
- Youth – 25-35 years
- Adult – 36-60 years
- Pensioners – 61+

Calculation:

- Number of individuals per age category divided by the total sample

Sources of data: Household interview

Model measures:

3. How old are you?

5.3.6.4 Indicator 6.4: Marital status category

Rationale: The marital status of an individual could influence hand hygiene behaviours. It has been shown that separated and divorced individuals can have poorer hand hygiene behaviours.

Definition of terms: **Marital status** refers to personal status of each individual in relation to the marriage laws or customs of a country. Customary unions were now recognised as a legal *marital status*. Categories under marital status include *single, married, living together as a married couple, divorced, separated and widowed*.

Calculation:

- Number of respondents per marital status category divided by the total sample size. Marital status categories include:
 - Divorced;
 - Living with a partner as married;
 - Married;
 - Never married;
 - Separated; and
 - Widowed.

Sources of data: Household interview

Model measures:

6. What was your marital status?

5.3.6.5 Indicator 6.5: Overall Social Status

This indicator was a composite of a number of sub-indicators, namely; gender; individual social status and role in households.

5.3.6.5.1 Sub-Indicator 6.5.1: Gender

Rationale: Research had shown that males reported significantly less hygiene-related behaviour compared with females (Stevenson et al., 2009); were less likely than women to engage in appropriate handwashing practices in hospitals (Morrison and Yardley, 2009) and washed their hands less

frequency when using a restroom at a university (Edwards et al., 2002). Genders were expected thus to display difference in hand hygiene behaviours. This could be due, in part, to the roles play by each group, i.e. women play a key role in caring for babies, men could work in the fields, and difference in exposure of the genders to hand hygiene promotion and awareness programmes.

Definition of terms: **Gender** refers to the social distinction between males and females (StatsSA, 2009).

Calculation:

- Number of male and female individuals divided by the total sample.

Sources of data: Household interview

Model measures:

A4. Is the interviewee male or female?

5.3.6.5.2 Sub-indicator 6.5.2a: Individual Status – Individual Education Level

Rationale: Studies have shown there was a crude relation between mother's education levels and their hygiene behaviours (Curtis et al., 1995). In contrast, Stevenson et al., (2009) found there was no significant association between education level of the participants of the study and hygiene related behaviours.

Definition of terms: **Educational level** was aggregated into no formal education, primary school (grade 1 to grade 7), secondary school (grade 8 to grade 12) diploma or certificate without grade 12 (from lower to grade 11), diploma or certificate with grade 12, degree and other post-graduate degree (StatsSA, 2009).

Calculation:

- Number of individuals per educational level divided by the total sample

Sources of data: Household Interview

Model measures:

16. What was your highest level of education?

5.3.6.5.3 Sub-indicator 6.5.2b: Individual Status – Employment category

Rationale: Economic activity has been shown to influence hygiene behaviours, and should thus have some correlation to hand hygiene. A study by Judah et al. (2009) of faecal contamination of commuters hands in various cities in the United Kingdom found commuters whose main employments duties include manual labour had less contamination on hands than those in administrative duties, students, retired and unemployment individuals and especially professionals who interestingly had the highest levels of contamination of hands.

Definition of terms: **Employment** was an activity in which a person performs work for pay, profit or family gain. Such a person can be self-employed, an employer, an employee or a working family member (StatsSA, 2009).

Calculation:

- Number of individuals who had worked in the last 7 days divided by the total sample
- Number of individuals in an employment category divided by the total number of individual who have worked in the last 7 days. Employment duties were categories into:
 - Administrative;
 - Cleaning, gardening and domestic work;
 - Manufacturing;
 - Not answered/other;
 - Part-time worker;
 - Professions (training, education, etc.);

- Selling products; and
- Technical and construction.
- Number of 'other' individuals reported worked in the last 7 days divided by the total sample
- Number of 'other' individuals reported per employment category divided by the number of 'other' individuals reported worked in the last 7 days. Employment duties were categories into:
 - Administrative;
 - Cleaning, gardening and domestic work;
 - Manufacturing;
 - Not answered/other;
 - Part-time worker;
 - Professions (training, education, etc.);
 - Selling products; and
 - Technical and construction.

Sources of data: Household Interview

Model measures:

31. What were the main tasks or duties of your work? (example: selling fruiting, feeding and watering cattle, street vending, hair dressing)
35. What were the main tasks or duties of their work? (example: selling fruiting, feeding and watering cattle, street vending, hair dressing)

5.3.6.5.4 Sub-Indicator 6.5.3: Role in Household

Rationale: The composition of a household has been shown to correlate to hand hygiene behaviours. Curtis et al. (1995) showed that the age of a child in household influenced mother's hygiene behaviours and the higher the number of children in a households, the poorer the hygiene behaviours of mothers (Curtis et al., 1995). The position of an individual in the household could also influence hand hygiene behaviours as it has been shown that mothers have better hand hygiene behaviours in a household.

Definition of terms: **Role in household** refers to the relationship to the head of the household

Calculation:

- Number of individuals per r relationship to head of housed divided by the total sample;

Sources of data: Household interview

Model measures:

3. What was your relationship to the head of the household?

6 SAMPLE SELECTION FOR THE HAND HYGIENE ASSESSMENT

Commonly used survey designs that were also applicable to hygiene improvement involve these three types of sampling procedures:

- *Cluster sampling* — involved a systematic sampling process that was rapid and less costly than a true random sample, but yields less precise estimates and generally only for the program as a whole.
- *Lot Quality Assurance Sampling (LQAS)* — took small random samples from many different communities or some other relatively small sampling unit and yields local as well as program wide estimates. It employs short questionnaires, was usually carried out by program personnel, and serves as capacity building.
- *Purposeful selection* — might be used by community workers or supervisors for spot visits to a few households. Because it does not involve any form of random sampling, it could serve as rough orientation, but it cannot objectively ascertain progress or change in a way that was grounded in survey science.

The sampling method used in the hand hygiene assessment Framework need to provide a number of levels of sites and sample sets. Firstly, the study area needed to be selected, then the study sites, followed by the selection of households which will participate and finally, the individuals to be interviewed. Predetermined criteria were used to select the study area (in this Framework a city) and study sites (in the Framework the suburbs). Once the study area and study sites had been selected, the households and individuals to be interviewed in each household needed to be selected. Households and individuals were selected using *convenience sample*, also called an accidental or availability sampling. This sampling technique takes all cases on hand until the sample reaches the desired size, i.e. all households with someone home at the time of the visit were selected as part of the sample. Interview individuals were selected based on predetermined criteria (in the Framework their gender and age)

7 TOOLS FOR THE HAND HYGIENE ASSESSMENT

Two tools underpin data collection for the hand hygiene assessment Framework:

1. a semi-structure household interview – see Appendix 3;
2. an spot-check observation – see Appendix 4.

Tools were designed, to fit within the hand hygiene assessment Framework, based on or adapted from the following documents:

1. The South African report *Activity over time. Further analysis of the time use survey* (Chobokoane and Budlender, 2002);
2. The Statistics South Africa questionnaires related to the 2006 General Household Survey and the 2007 Community Survey household questionnaire (StatsSA, 2006. StatsSA, 2007);
3. The Environment Health Projects report *Strategic Report 8. Assessing Hygiene Improvement. Guidelines for Household and Community Levels* which is a comprehensive review and collation of the best available knowledge of surveys and indicators from Demographic and Health Survey and instruments used by the Environmental Health Project and the London School of Hygiene and Tropical Medicine (EHP *et al.*, 2004).
4. The Master Thesis report *Methodology for Health and Hygiene Baseline Surveys for WSUP Projects: Case study in Antananarivo, Madagascar* which provides a shorter and adapted questionnaire similar to the EHP tools (Lagardere, 2007);
5. *The African Gender and Development Index* which provides indicators to measure gender status;
6. Luby and Halder's (2008) journal article which provides background to creating a wealth index score for water supply and sanitation initiatives;
7. The World Bank *et al.*, (undated) report *The Handwashing Handbook. A guide for developing a hygiene promotion program to increase handwashing with soap* which provides survey and observation measures for handwashing with soap;
8. Curtis *et al.*, (2009) journal article *Planned, motivated and habitual hygiene behaviour: an eleven country review* which provides a background for the measurement of internalization of hand hygiene behaviours.

There was always the potential of bias in collecting qualitative and quantitative data from individuals. Types of bias include:

- Strategic bias – where questions were answered by the individual to ensure highest level service, or lowest outcome (over- or under-reporting of behaviours);
- Compliance bias – where questions were answered to please or questions are not answered;
- Starting-point bias – where ticklist were used which eliminates outlying answers; and
- Miscommunication between enumerator and the respondent

Attempts were made to minimise bias in the testing of the hand hygiene assessment Framework through a number of processes:

- 'cross-check' questions were used which are questions with the same answer as another, but which is asked using slightly different wording;

- behaviours reported by individuals in the interview were checked through observation of the actual behaviour;
- ticklists were complemented with open-ended questions; and
- enumerators spoke the same language as interviewees.

The model questions shown in the interview sheet of Appendix 3 and the observation sheets of Appendix 4, were structured as follows

1st column: Sequence number (assigned automatically)

2nd column: Questions, observations, instructions, and filters

3rd column: Question answer options

4th column: Coding categories. Questions answered as don't know, refused and other are coded as follows:

- don't know = 98
- Refused = 99
- Other = 100

5th column: Skip instructions indicating the number of the next question to be asked. The symbol "→" followed by a number instructs the interviewer to "go to question number #," if the respondent mentions the coding category to the left of "→".

8 REVIEW OF METHODS APPLIED IN DATA ANALYSIS OF HYGIENE RESEARCH

The earlier sections of this report highlight, from international and national literature, potential determining variables of hand hygiene behaviours, i.e. use of soap, length of rubbing required, social aspects determining behaviours, etc. Details related to the methods, approaches and frameworks applied in the structuring of the *data capture* of hand hygiene assessment were also provided.

This section of the report provided a review of literature of the methods applied in the analysis of data collected during hygiene research initiatives.

8.1 Fault Trees Analysis (FTA)

Fault tree analysis was a logical, systems analytical technique found in the operations research discipline (Park and Lee, 2009). It was particularly suited to identifying and analysing the causes of failure in engineering and biological system or subsystem, i.e. the cause of failure to reduce *E. coli* counts on hands through hand hygiene. The advantage of using fault tree analysis to understand failures in a system was that this method can identify more than one failure and combinations of these as the cause of the system failure.

Analysis of a system (i.e. handwashing behaviours) using FTA required the construction of a logic fault tree diagram that displayed the cause of failure related to a specific undesired (hazardous) event (i.e. undesirable *E. coli* counts on hands) and the interrelationship between the undesired event and the causes of the event. The undesired event was taken as the root ('top event') of the fault tree, with this event analysed step-by-step to formulate the fault tree. The interrelationship between the top event and the underlying causes (called basic events) were displayed in the fault tree using logic gate symbols, i.e. AND, OR (see Figure 14). Figure 14 shows that the top event of the fault tree was a result of either Event A OR Event B occurring. Event A results from either Event 1 OR Event 2 occurring, while both Event a AND Event b must occur in order for Event B to occur. The route through a tree, from the initiator to the event was called a Cut Set.

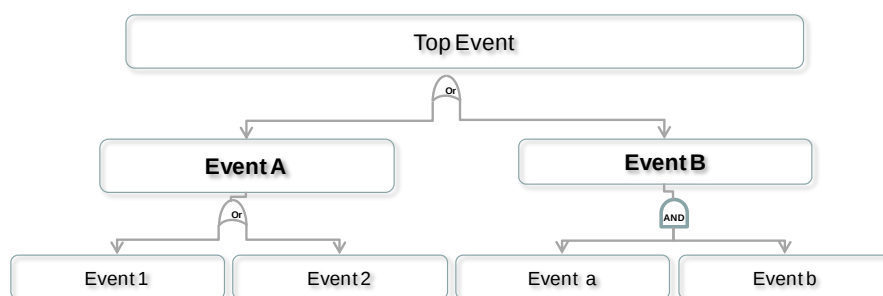


Figure 14: Fault tree showing AND and OR gates of the tree

FTA has been applied in a number of industrial working fields that require safe operating systems (Park and Lee, 2009). Park and Lee (2009) used Fault Tree Analysis on handwashing to enhance hygienic management of handwashing in a structured and systematic manner. The outcome of the FTA was a hygienic management system for handwashing related to a basic event.

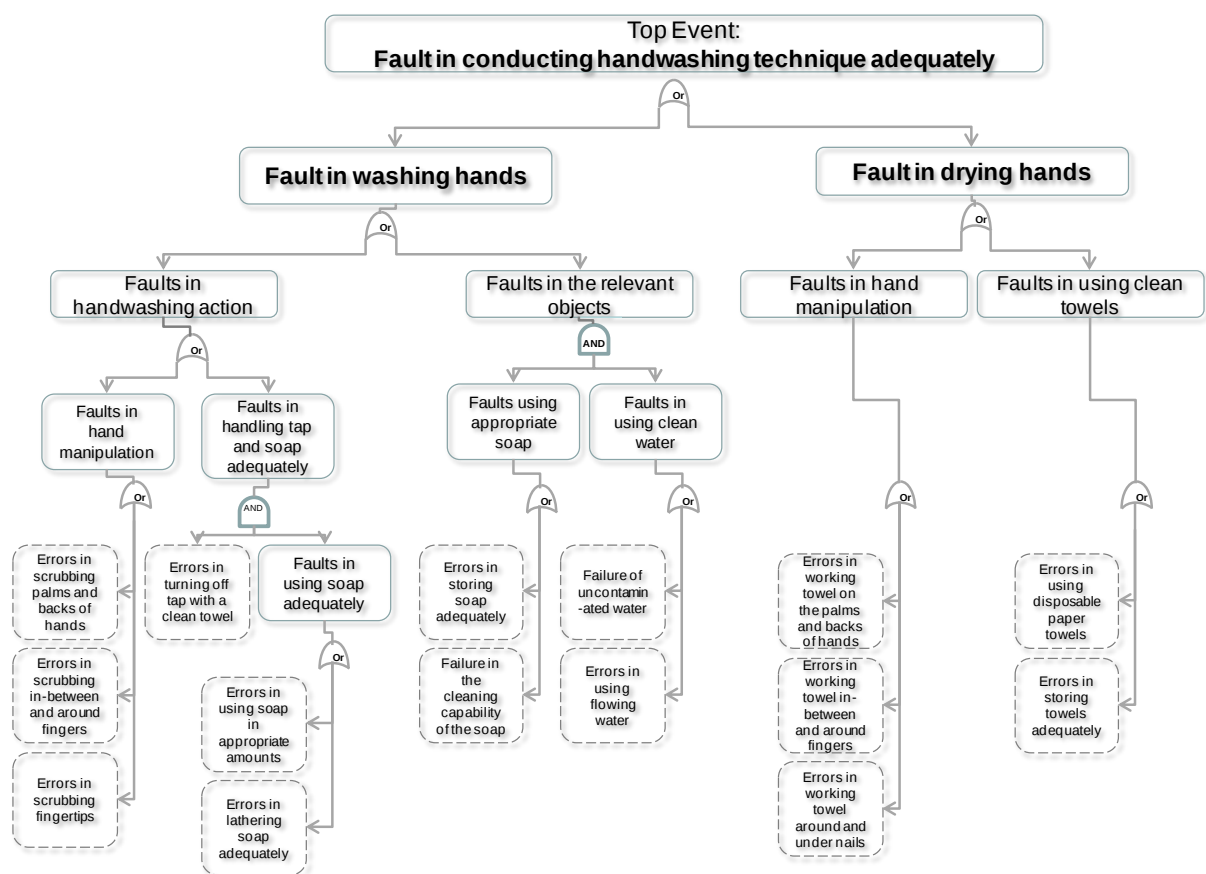


Figure 15: Fault tree diagram, taken from Park and Lee (2009), showing the top event as a fault in conducting handwashing technique adequately

Park and Lee (2009) constructed the fault tree shown in Figure 15, showing the top, intermediate and basic events related to the event 'fault in conducting handwashing technique adequately'. The fault tree showed that the top event of not conducting handwashing technique adequately occurs as a result of a 'fault in washing hands' OR a 'fault in drying hands'. Thus, the top event was caused by a 'fault in washing hands' regardless of whether there was a 'fault in hand drying' therefore the two events were combined by an OR logic gate. If both a 'fault in washing hands' and a 'fault in drying hands' was necessary for the top event to occur, then these two events would be combined by an AND logic gate (see the example under the 'fault in relevant objectives' event).

Applying the model shown in Figure 15, Park and Lee (2009) used mathematical equations to determine the minimal cut sets for the fault tree (Figure 16). The shortest credible way through the tree from fault to initiating event was called a Minimal Cut Set.

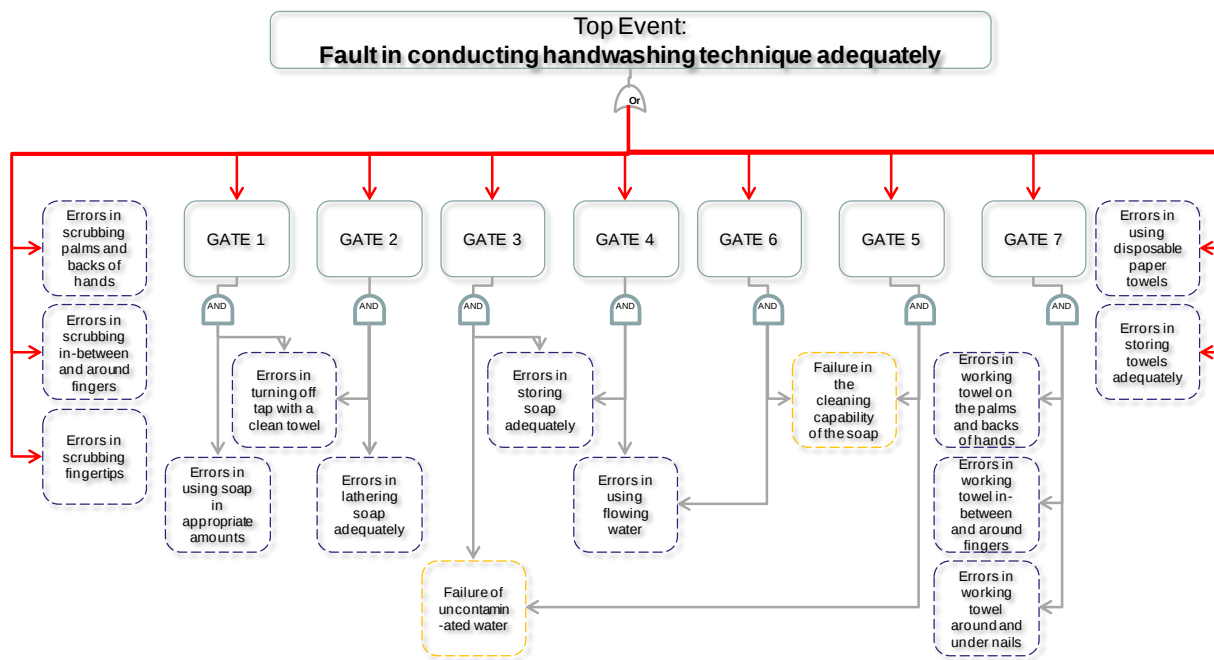


Figure 16: Fault tree diagram, taken from Park and Lee (2009), showing minimal cut sets for the top event of ‘fault in conducting handwashing technique adequately’.

Using this mathematical analysis to determine the cut sets, Park and Lee (2009) in Figure 16 showed that ‘fault in hand manipulation’ (i.e. errors in scrubbing palms and back of hands; errors in scrubbing in-between and around fingers; and errors in scrubbing fingertips) and ‘faults in hand drying (i.e. errors in using disposable paper towels and errors in storing towels adequately) were critical in safety management of the handwashing process. The study also calculated that the top event of ‘faults in conducting handwashing technique adequately’ was caused by human-oriented error (i.e. handwashers actions or decisions shown as blocks outline in blue in Figure 6) and material-oriented failures (i.e. availability of clean water and soap with cleaning capability shown by the blocks outline in orange in Figure 16).

The usefulness of using FTA to guide hand safety analysis was that the Park and Lee (2009) study showed that:

1. Both human- and material-oriented errors result in faults in handwashing technique;
2. Human error was identified as the main source of the fault in handwashing technique, hence emphasis should be placed on training to ensure adequate handwashing practice;
3. FTA split the handwashing components into fifteen basic hand hygiene events which were then given priority for control, resulting in a practical tool to guide safety management of handwashing.

8.2 Indices

In a study of the relationship between maternal and household resources and child care in Accra, Armar-Klemesu et al. (2000) determined the relationship between a number of maternal and household variables and child care practices. The study tested the relationship between material child care practices and material age; body mass index; schooling; marital status, head of household, maternal employment and use of alternative child care using a number of indices.

Associations between maternal child care and household characteristics such as crowding; household income; food budget share; households food availability per adult equivalent; type of dwelling; availability of water, sanitation and garbage disposal services and ownership of assets were also calculated using a number of indices. Of interest was the hygiene index of this study. Data was collected through observational 'spot-checks' of a set of predetermined hygiene behaviours of caregivers. These observed behaviours provided a proxy for positive and negative behaviours, in the absence of the time available to conduct long-term observation studies of individuals. The list of hygiene variables observed in this study was shown in Table 12 below.

Table 12: Hygiene behaviours observed and used to create the hygiene index of Armar-Klemesu et al. (2000)

Mother was clean	Yes
Index child was clean	Yes
Diaper was clean	Yes
Compound swept	Yes
No poultry faeces	Yes
No stagnant water	Yes
No human faeces	No
No unwashed utensils	No
Drinking water covered	No
House swept	No

The hygiene index was constructed by Armar-Klemesu et al. (2000) using only those variable which had <50 observations missing or not observed (i.e. observations on whether the 'house was swept' was missing for 254 of the 512 observation, therefore this variable was not used in the hygiene index) and for which there was sufficient variability in observations (i.e. 'presence of human faeces in compound' was excluded from the hygiene index as 98% of observations showed no faeces in the compound). The hygiene index was constructed by providing each positive hygiene behaviour with a score of 1 and a negative behaviour as 0. The index was thus the sum of the 6 variable, with scores ranging between 0 and 6. Armar-Klemesu et al. (2000) categorized index scores for individuals into three categories, namely; poor (score 0-3); average (score 4-5) and good (score 6). Associations between child care resources (maternal and household variables) and this hygiene index were determined using chi-square tests. The objective of the analysis was to determine whether the hygiene behaviours identified as potential constraints to child care remained significant after controlling for potentially confounding factors. Maximum likelihood ordered probit estimates were used for the hygiene index.

The key results showing associations between child care resource and hygiene index scores were shown in Table 13. Table 13 shows only those child care resource which had $p < 0.05$ association with the health index scores. The table shows that the key findings of the Armar-Klemesu et al. (2000) study were that education was a crucial for good hygiene behaviours of caregivers, as were the household resources of household income, dwelling type, ownership of assets and access to water, sanitation and waste disposal service.

Table 13: Associations between child care resource and hygiene index scores of Armar-Klemesu et al. (2000)

	% with poor score	% with average score	% with good score
Maternal education			
None	45.6	24.6	29.8
Primary and middle school	33.8	42	24.2
≥ Secondary	20.3	34.7	44.9
Gender of Household			
Head: male	23.5	40.8	35.7
Head: female	43.2	36.9	19.9
Workplace			
Home	33.6	41.6	24.8
Market/streets	41.2	36.6	22.2
Shop/factory/office	8	46	46
Quality of housing and asset index (quintiles)			
Lowest	44.1	35.4	20.2
2 nd	35.6	42.5	21.8
3 rd	37.5	39.8	22.7
4 th	25.8	36.6	37.6
Highest	11.1	37.8	51.1
Expenditure (quintiles)			
1	45.3	35.8	18.9
2	40.7	31.9	27.5
3	30	43.3	26.7
4	29.5	38.9	31.6
5	14.7	38.9	46.3
Waste disposal			
Gutter/empty lots	27.8	41.7	30.6
Bury/burn	38.2	38.2	23.5
Public bins	35.4	37.7	26.9
Households collection	14	35.1	50.9
Toilet facility			
Open space	36.4	39	24.7
Public latrines	38.7	33.6	27.7
Private latrines	23.7	49.5	26.9
Flush toilet	2.2	37.8	60
Water Source			
Vendor	34.7	43	22.3
Piped outside house	32.4	30.6	37
Piped inside house	2.9	40	57.1

8.3 Indicators

Biran et al. (2008), in a comparison of performance indicator of handwashing practices in rural Indian households, compared indicators generated from a questionnaire survey, an environmental check, a handwashing demonstration and pocket voting with indicators generated from structure observation of hand hygiene behaviours and practice in the households. Indicators were compared using the Kappa statistic which was a measure of the extent to which two sets of ratings coincide, irrespective of what

would be expected by chance, i.e. a Kappa score of 0 between indicators indicates complete chance, while a Kappa scores of 1 indicates a match between indicators. Scores between indicators of 0-<0.2 indicates slight agreement; 0.2-0.4 indicates fair agreement; 0.4-0.6 shows moderate agreement between the indicators; 0.6-0.8 substantial agreement and finally, 0.8-<1 near perfect agreement between indicators (Biran et al., 2008). A total of 26 indicators were generated in the study, with each indicators providing a binary score for each household. These scores were applied to determine the 'handwashing' households and the 'none handwashing' households. Analysis of the 26 indicators reported prevalence of 'handwashing' households ranging from 1% to 99%.

In the case of the structured observation households were again grouped into 'handwashing' households and the 'none handwashing' households. Households where inconsistent handwashing with soap after contact with faeces was observed (i.e. hand of caregivers were not washed on all potential events of contact with faeces) were classified as non-handwashing households, while households where caregivers were observed to wash their hands with soap at all potential contact events with faecal matter were classified as handwashing households. This resulted in, based on the results of the observation 27% of households in the study being classified as 'handwashing' households.

When comparing the indicators to structure observation, all indicators performed poorly. None of the indicators showed even moderate or strong agreement with the structure observation results. This led Biran et al. (2008) to conclude that none of the 26 indicators have the potential to replace structured observation of handwashing behaviour.

9 SUMMARY OF THE TESTING OF THE FRAMEWORK

The hand hygiene assessment Framework was tested in Tshwane Metro Municipality. The result of this assessment can be found in the report *1886/1/11 Assessment of handwashing and hand hygiene behaviour*.

Two data collection tools, namely a hand hygiene *observation* and a hand hygiene *interview* were used for in-field data collection (Appendix 3&4). Each question or observation in the data collection tools was a **measure** of an individual's hand hygiene behaviour. Each measure was assigned a score; measure scores were combined and averaged to give a score for each indicator in the Framework. Similarly indicator score were combined and averaged for their related index. Microbiological data was collected to determine the levels of bacteria on an individual's hands post-washing and to determine the levels of bacteria in the water used to wash hands. Various statistical methods were used to analyse the data for the variables within the Framework.

The Framework was tested using data from three study sites in the Tshwane metro, namely an urban, peri-urban and rural study setting. The sites were selected based on the perceived economic status and service levels to reflect a diversity of individuals. This would ensure that the Framework was not limited to capturing hand hygiene behaviours of a single sector and group in the country.

Hypothesis 1: The manner in which individual practice hand hygiene is determined by a number of indices and indicators

Analysis of the variables in the Framework clearly showed that the manner in which an individual practices hand hygiene (i.e. their handwashing technique) was not determined by all six hand hygiene indices but rather could be determined by three of the indices, namely Household Socio-economic Influence, Service Environment and Hygiene Knowledge. However, it was the combination of two indices, Service Environment and Hygiene Knowledge which significantly influence the Hand Hygiene Technique. This suggested that the indicators which make up these indices were the most influential of the manner in which an individual practiced hygiene.

Hypothesis 2: Hand 'cleanliness' is determined by the bacterial count in the water used to wash hands and the manner in which hands were washed

Analysis of the variables in the Framework clearly showed that:

- how well an individual demonstrated hand hygiene could be related to the bacterial counts on an individual's hands, suggesting that the better the handwashing technique of an individual the cleaner their hands post-washing; and
- the bacterial levels in the water used to wash hands during the demonstration was not related to the cleanliness of an individual's hands, suggesting that the bacterial quality of water did not determine the 'cleanliness' of hands in this sample.

Hand hygiene hypothesis 3: a number of indicators determine hand hygiene and thus hand 'cleanliness'

Table 14 clearly showed that the 'cleanliness' of an individual's hands was determined by a combination of indicators of household living standards, availability and type of technologies required for appropriate hand hygiene and an individual's hand hygiene knowledge. Indicators of the cultural behaviours, media exposure and the social profile of an individual do not determine hand 'cleanliness' in the sample (see Table 14).

Table 14: Summary of the relationship of indicators to bacterial counts on interviewee's hands

Determinants	Indicator	Sig Relationship with Hand Bacteria Counts
Cultural Influence	Reported belonging to a religious group	No
	Reported having specific handwashing religious behaviour or practice	No
	Reported type of religious affiliation (Christian or Traditional)	Yes
	Reported having special times/traditions/occasions for handwashing	No
Media exposure	Reported having heard from someone or somewhere that handwashing is important	No
	Reported studying hygiene at school	No
	Reported learning at least one handwashing message from the source in the last month	No
	Reported being exposed to a disaster management intervention	no (small sample)
Household socio-economic	Reported household income level	Yes
	Calculated Wealth Index	Yes
	Observed durability of dwelling	Yes
	Reported educational level of the household	Yes
	Reported size of an individuals household	No
	Reported presence of at least 1 child under 17 years in an individuals household	No
	Reported number of children under 5-years in an individuals household	No
Service Environment	Reported type of handwashing water source	Yes
	Distance to handwashing water source	not measured
	Reported availability of soap in the household	No
	Observed availability of soap next to handwashing station most often used to wash hands	Yes
	Observed type of cleansing agent observed next to the handwashing station	No
	Observed availability of hand drying material at handwashing station	Yes
	Availability of <i>hygienic</i> drying material	insufficient data
	Reported position of handwashing station most often used to practice hand hygiene	Yes
	Observation of a handwashing station within 2 meters of the toilet	Yes
	Presence of a handwashing device at the handwashing station	No
	Observed type of handwashing device at the handwashing station	No
	Observed <i>hygienic and safe</i> handwashing device at the handwashing station	Yes
	Observed type of toilet	Yes
	Observed location of toilet	Yes
	Observed distance to sanitation facility	No
	Observed toilet tidiness	Yes
	Observed faecal matter is observed on walls or floor of the toilet (i.e. dirty toilet)	No
	Reported cleaning of the toilet	No
	Reported safe storage of household rubbish	Yes
	Reported safe disposal of household rubbish	Yes
	Observed tidiness of the yard	No
	Observed presence of anal cleansing material next to or within arms-reach of the toilet	Yes
Hygiene Knowledge	Reporting of more critical time for handwashing	No
	Reporting at least 1 reason why it is important to wash hands at critical times	No
	Reporting more of the activities require for appropriate hand hygiene technique	Yes
	Reported knowledge of what diarrhoea is	Yes
	Reported knowledge that diarrhoea can be prevented	No
	Category of report of how to prevent diarrhoea	No
	Level of reporting of how to prevent diarrhoea	No
	Level of reporting of what causes diarrhoea	No
Social Profile	Having a disability	insufficient data
	Literacy	insufficient data
	Age category	No
	Marital status	No
	Gender	No
	Education level	No
	Employment activities or duties	No
	Relationship to the head-of-household	No
Others	Reported type of drinking water source	Yes
	Reported distance to drinking water source	not measured

The testing of the Framework clearly demonstrated that the Framework and underlying process and tools provide details of which hand hygiene variable determine hand hygiene in the sample sites. The results of applying the Framework could provide hand hygiene data and information to inform and guide future hand hygiene interventions at the sites. The application of the Framework could also provide baseline data against which the effectiveness of future hand hygiene interventions can be assessed.

The Framework showed that effective hand hygiene interventions in an area site specific hand hygiene interventions are required. It was clear from the distinct hand hygiene characteristics of the three sample sites that a *one-size fits all* approach to hand hygiene awareness and promotion may not be effective.

The results from applying the Framework in other areas of the country can inform national policies and strategies. For example results from the testing of the Framework suggest that national hand hygiene policies and strategies should focus on providing guidance and direction on hand hygiene technologies and linking to strategies, policies and interventions which contribute to improving individual and household socio-economic status.

The test of the Framework also showed that measuring the effectiveness of hand hygiene interventions in South Africa may be more difficult than initially anticipated and may rely on a number of variables, which were not yet clear at this point in time. What was clear was that hand hygiene in South Africa showed significant difference with what had been found in international literature, with many gaps in the local and international understanding of hand hygiene.

10 CONCLUSION

There was a vast quantity of international literature related to assessing of hygiene behaviours. However, international literature related to hand hygiene behaviours and assessment were limited, especially assessments within developing country communities. These assessments were almost non-existent in South Africa. The research which underpins this report was the first study of this kind in South Africa. This report thus provided the 'blue print' for hand hygiene assessment in the country.

The testing of the Framework clearly demonstrated that the Framework and underlying process and tools provide details of which hand hygiene variable determine hand hygiene in the sample sites. The test of the Framework also showed that measuring the effectiveness of hand hygiene interventions in South Africa may be more difficult than initially anticipated and may rely on a number of variables, which were not yet clear at this point in time. What was clear was that hand hygiene in South Africa showed significant difference with what had been found in international literature, with many gaps in the local and international understanding of hand hygiene.

The hand hygiene assessment Framework has the potential to:

- Provide information which could guideline future hand hygiene intervention to ensure the most effective and efficient issues, technologies and messages to ensure sustainable behaviour change, i.e. which issues, technologies and messages;
- Provide a structured manner of collecting hand hygiene baseline data against which the effectiveness of hand hygiene interventions can be assed;
- Provide a scientific manner of assessing hand hygiene behaviours and interventions using standardized methods, tools and data analysis processes.
- Provide information which can inform future sanitation-related and development policy ad strategic intervention.
- Standardize hand hygiene assessment; if practitioners continue to use and refine the Framework, it has the potential to become the standard hygiene assessment Framework in the country.

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12 APPENDIX 1: HAND HYGIENE EDUCATION MATERIAL



Let Them Watch. Help Them Learn.

Wash your hands



Wash your hands
to keep clean and healthy

WASHING OUR HANDS SONG

To stay clean and healthy,
You need to wash your hands.
Take some water and a soap,
And rub on both of your hands.
Rub your hands together
And scrub, scrub, scrub.
One time three times
Rub-wash-dub.

*Ngobho emhlophe ngokwenkqubo
Kuba imihlanjane yehlabathi. (X2)
Kuba imihlanjane yehlabathi. (X2)
Kuba imihlanjane yehlabathi. (X2)*

How do we wash our hands?

- 1 Wet your hands with water and rub the soap in your hands.
- 2 Rub your hands together four times. Now wash off the soap.
- 3 Dry your hands on a paper towel or give them a good shake.

Why do we wash our hands?

Oh, break time is over. Let's go to class.

Why should we wash our hands, children?

Because our hands carry germs when they are dirty. Like after you go to the toilet.

When do we wash our hands?

After using the toilet

Before making or eating food.

Clean hands feel nice too!

Class, it is nearly break time. Let's sing our HAND WASHING song to remind us to wash our hands before eating food and also after using the toilet.

Hurry up Colin, the bell is going to ring soon!

I can see that all of you have clean hands. I can even smell the soap!

Class, you may now eat your lunch. Remember to share your food with friends who could not bring lunch today.

Yes, you are right. Those germs can make you very sick. So always wash your hands after using the toilet and before you eat!

Clean hands feel nice too!

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13 APPENDIX 2: HAND HYGIENE PROMOTION AND AWARENESS MATERIALS

Handwashing Techniques

Wet both hands before application of soap (liquid is preferable). Follow the technique below for 15 – 30 seconds ensuring that each step consists of at least three strokes backwards and forwards.

Step 1

Step 1
Rub palm to palm



Step 2

Right palm over back of left hand and left palm over back of right hand



Step 3

Step 3
Palm to palm, with bent and spread out fingers



Step 4

Step 4
Backs of fingers to opposing palms with fingers interlocked



Step 5

Step 5
Circular rubbing of left thumb in closed right hand and vice versa



Step 6

Step 6
Circular rubbing, backwards and forwards with closed right hand fingertips in left palm and vice versa.



Finally, rinse and dry hands thoroughly

Special attention should be paid to fingertips, thumbs and other areas of hands likely to contact a contaminated site. Hands should be rinsed in clean water. Care should be taken to dry the skin with paper towels to avoid skin damage. If frequent washing has been performed hand cream should be applied at the end of duties to prevent skin desiccation and cracking.

Handwashing SAVES lives!
TELL-A-FRIEND card

School/Org.Name: _____

Address:

Student/Participant _____

Physical Address [illegible][illegible]

FREE! Airtime voucher R5 with each accurately completed form, for the first 1000 cards returned.

You could WIN a Cell Phone with R1200 Airtime in a lucky draw by submitting the completed form.

[illegible]

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3. Prepare Safe Food

- Wash your hands with soap (or ash) before you eat or prepare food.
- Keep all food utensils clean.
- Wash fruit and vegetables with safe water before you eat them.
- Cook all meat, fish and vegetables well. Keep Food covered in a clean, cool place. Store raw and cooked food separately.

Diarrhea

Germ from human waste (faeces) causes diarrhea, including cholera.

Wash your hands (with soap or ash and safe water) before eating or preparing food, or after you have been to the toilet. If you get sick with diarrhea (runny tummy) or start vomiting, prepare this mixture and drink it regularly:



- Take 1 Litre of safe water
- Add 8 teaspoons of sugar
- Add half a teaspoon of salt
- Mix well and drink a glass of it every hour.

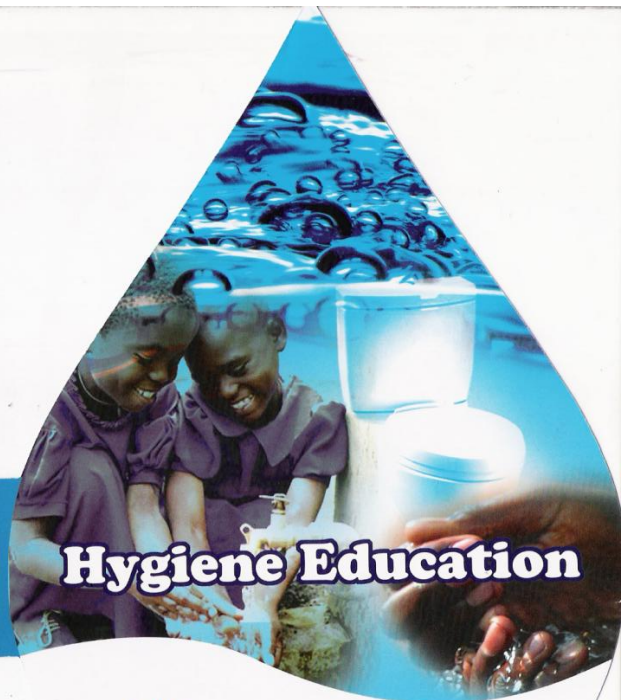
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HYGIENE EDUCATION

Personal hygiene and environmental health is a key to healthy living. Germs grow in spots of dirt or food. Always wash your hands with soap and keep your toilet clean.

1. Wash Your Hands

Hand-washing with soap, when done correctly, is the single most effective way to prevent the spread of communicable diseases. Good hand washing technique is easy to learn and can significantly reduce the spread of infectious diseases among both children and adults.



WHEN?

- Before cooking or handling food
- Before feeding children or eating
- After going to the toilet
- After you change a baby's nappy

HOW?

- Always wash both hands
- Always wash hands with soap and water
- Scrub hands together at least four times
- Dry hands on a clean towel or shake hands dry

Why?

- Faeces have millions of germs that you cannot see or smell
- The germs go from your hands to your mouth and make you sick
- Washing hands regularly greatly reduces the spread of disease
- Clean hands keep children safe and healthy

NB: Handwashing has the potential to reduce diarrheal diseases by 50%

2. Keep your Toilet Clean

- Clean the entire toilet with soap and water to keep it safe and clean from germs
- Always keep toilet seat down
- Keep toilet door closed
- Do not throw waste in the toilet



u Bveledza madi o tsireledzeaho



1 Kha vha ke madi duvha linwe na linwe.



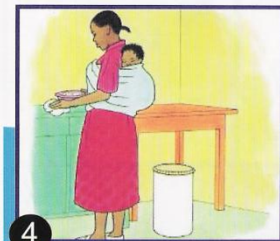
2 Kha vha shulule madi nga labi lokuwaho.



3 Kha vha shele lebulu nthihi ya bleach kha 20-25 lithara dza madi vha dzi tanganyise zwavhudi vha lindele lwa miniti dza furaru (30 min).



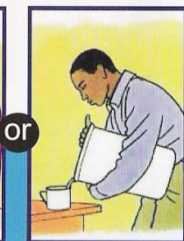
Vha vhlise madi vha lindele madi atshi fhufhuma lwa miniti muthitii (1min) uri avhe okunaho dhovhe avhe o tsireledzeaho.



4 Madi o tsireledzeaho a nga vha na tshika. Kha vha vhee madi o tsireledzeaho kha zwifaro zwo kunaho zwino valea.

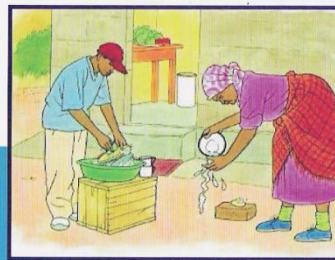


5 Vha shumise bigiri yo kunaho vha tshi ka madi khamufaro uyo tshifhinga tshothe.



vha shele madi u bua kha mufaro musi vha tshi toda u a shumisa.

u Lugisa zwiliwa zwo tsireldzeaho

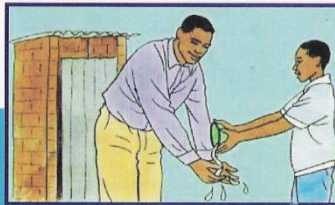


Kha vha tambe zwanda nga tshisibe (kana miora) na madi a vhudi vha sa thu ula kan ulugisa zwiliwa zwishumiswa zwa ulugisa zwi liwa kha zwivhe zwo kunaho.

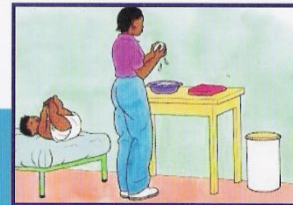


Kha vha tanzwe mitshelo na miroho musi vha sa a thu la. Kha vha bike nama, khovhe na miroho zwavhudi. Vha dzule vho zwi tibela kha mufaro wo kunaho fhethu hu rotholelaho. Kha vha vhee zwo bikiwaho na zwi songo bikiwaho fhethu ho fhambanaho.

Kha vha tambe zwanda zwavho.

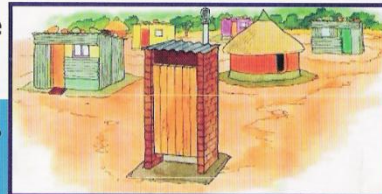


Kha vha tambe zwanda nga tshisibe (kana miora) na madi a vhudi musi vho no shumisa mabunga kana u tshintsha maleri a nwana na musi vho no lata mathukhwi.



Kha vha kunakise mabunga a vho

Kha vha shumise mabunga ado vhe adzule o kuna. Kha vha vale tshidulo na vothi la mabunga uri zwitshili zwisa phadaladze nga thunzi.



14 APPENDIX 3: SOUTH AFRICAN HAND HYGIENE ASSESSMENT INTERVIEW SHEET (QUESTIONNAIRE)

WATER RESEARCH COMMISSION

HAND HYGIENE IMPROVEMENT HOUSEHOLD SURVEY QUESTIONS

INTRODUCTION TO THE HOUSEHOLD

We are **conducting research** for the Water Research Commission of South Africa (www.wrc.org.za) on sanitation practices in the Tshwane Metropolitan Municipality.

We are collecting information to understand people's knowledge and behaviour of **household sanitation practices**. The research includes four activities:

1. firstly, we interview one of the adult household members asking a number of water and sanitation-related questions, which takes about ½ hour;
2. we then ask this person to demonstrate how they usually wash their hands;
3. after washing their hands, we take a 'swab' of their hands. A hand 'swab' is where an earbud is run across the surface of the hand to take a sample from the sample after washing; and
4. lastly we take a sample of the water used to wash his/her hands.

All samples and results of the study will be confidential.

Would someone in your household be willing to talk to me for about half an hour?

Yes

No

We would like to speak to a person in your household 18 years or older [*interviewer select interview using the table below*]. Would all people over this age be willing to participate in the study? If, yes the start by asking how many people in the household (at the time of the interview) are over 18. List the age and gender of each in the table below. Select the person to participate using the Selection Grid in the second table. If no, then interview the willing individual.

Write from oldest to youngest, the ages and gender of persons in selected household that qualify and is available to participate in survey Respondent number								Age	Gender
1									
2									
3									
4									
5									
6									
7									

Questionnaire number		Number of adults respondents to be selected from									
		1	2	3	4	5	6	7	8	9	10
1	26	1	1	1	4	2	6	4	8	3	3
2	27	1	2	3	1	3	3	2	6	9	10
3	28	1	1	2	3	5	4	3	7	5	8
4	29	1	2	1	2	2	2	5	5	7	2
5	30	1	2	3	3	4	3	7	6	8	5
6	31	1	1	2	4	1	1	6	8	4	7
7	32	1	1	3	1	3	4	4	6	2	10
8	33	1	1	2	2	5	6	3	3	1	9
9	34	1	2	1	3	2	2	5	2	9	1
10	35	1	2	2	4	4	6	6	5	1	6
11	36	1	1	1	2	1	5	4	7	3	5
12	37	1	1	3	1	3	4	3	1	8	4
13	38	1	2	3	4	5	1	1	4	6	9
14	39	1	1	2	3	4	3	7	2	7	3

15	40	1	2	3	2	2	2	6	6	5	8
16	41	1	1	2	1	1	6	2	3	2	10
17	42	1	2	1	4	3	2	3	7	4	1
18	43	1	1	3	2	5	4	4	8	9	2
19	44	1	2	2	3	4	1	1	1	8	1
20	45	1	1	3	1	1	2	2	4	3	8
21	46	1	2	2	4	3	3	7	2	2	3
22	47	1	1	1	2	2	6	5	3	7	7
23	48	1	2	3	3	5	4	3	6	5	2
24	49	1	1	1	1	4	3	6	7	4	10
25	50	1	2	2	4	3	5	2	6	1	9

Respondent no. selected	
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Could I speak to [age of person show in table 2 to be interviewed?]

Are you willing to participate?

Yes

No

Interviewer, if the individual refuses to participate, try briefly to convince them but do not pressure. Thank them and leave. If the survey cannot be done at the present time for other reasons, make an appointment for another time.

Please could you provide us with:

your name: _____

telephone number: _____

You can continue with your tasks if you wish, and I will just follow you around

EXPLAIN HOW THE INTERVIEW WORKS:

- You can say anything you want as long as that is truly how you feel.
- There are no right or wrong answers, only your ideas and opinions.
- Be assured that I will NOT tell anyone what you say in the interview. All information will be confidential.

A-LOCATION

A1: City/ town/ village name

A2: Suburb/Zone/Section

A3: Household no.

(In case where there is no household no. write the name and surname of the head of the household)

No.	Observation	Tick/circle the code or fill in the answer	Code
A4:	Is the interviewee male or female?	Male..... 1 Female..... 2	

INTERVIEWEE AND HOUSEHOLD PROFILE

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
1	What were you doing just before we arrived? (Write exactly what the respondent was doing and probe for more)			
2	What is your relationship to the Head of the Household? (Ask, you are the of the head of the household?) (Head-of-household is the main decision-maker, or the person who owns or rents the dwelling, or the person who is the main breadwinner).	Interviewee is the head of the household... 1 Husband/wife/partner..... 2 Son/daughter/step child/adopted child..... 3 Brother/sister/step brother/step sister..... 4 Father/mother/step father/ step mother..... 5 Grandparent/great grandparent..... 6 Grandchild/great grandchild..... 7 Nephew/niece 8 Other relative (e.g. in-law or aunt/uncle)..... 9 Non-related persons..... 10		
3	How old are you? (write in age)	YEARS		
4	How many people, including you, children and babies, live in this household? (excluding domestic workers) (write in number)	NUMBER		
5	How many household members are:	Over 65 years NUMBER		
		18-64 years NUMBER		
		5-17 years NUMBER		

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
		under 5 years	NUMBER	
6	What is your marital status?	Married civil/religious/traditional/customary. 1 Living together as married partners..... 2 Never married..... 3 Widowed..... 4 Separated..... 5 Divorced..... 6		
7	Do you belong to a religious group?	Yes..... 1 No..... 2		→12
8	To which religious group do you belong?	Buddhist..... 1 Christian (Catholic, Methodist, Anglican, AFM, Lutheran, Dutch Reform, etc.)..... 2 Jewish..... 3 Hindu..... 4 Muslim..... 5 Traditional (Zionist, Mapostolo)..... 6 Other (specify).....		
9	Does your religion have any specific hand washing behaviours or practices?	Yes..... 1 No..... 2 Don't know..... 98		→12
10	Please describe these hand washing religious practices?			
11	Why do you think these hand washing religious practices are necessary/important?			
12	Are you part of a decision-making committee, society within your community	Ye..... 1 N..... 2		→14
13	What type of committee/society?			

INTERVIEWEE AND HOUSEHOLD EDUCATION AND INCOME

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
14	Can you read at least one language?	Yes..... 1 No..... 2		
15	Can you write in at least one language?	Yes..... 1 No..... 2		
16	What is your level of education? (record the highest level COMPLETED)	No formal schooling..... 1 Primary schooling incomplete..... 2 Primary schooling complete (grade 6)..... 3 Middle schooling incomplete..... 4 Middle schooling complete (grade 9)..... 5		→18 →17 →17 →17 →17

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
		High schooling incomplete.....	6	→17
		High school complete (grade 12).....	7	→17
		College or university incomplete.....	8	→17
		College or university complete.....	9	→17
		Don't know.....	98	→18
17	Did you study hygiene at school?	Yes.....	1	
		No.....	2	
		Don't know/cant remember.....	98	
18	What is the highest education level of the people living in the household? (tick only one) (record the highest level COMPLETED)	No formal schooling.....	1	
		Primary schooling incomplete.....	2	
		Primary schooling complete (grade 6).....	3	
		Middle schooling incomplete.....	4	
		Middle schooling complete (grade 9).....	5	
		High schooling incomplete.....	6	
		High school complete (grade 12).....	7	
		College or university incomplete.....	8	
		College or university complete.....	9	
		Don't know.....	98	
19	Are you limited in your daily activities because of a long-term disability (condition), lasting six months or more?	Yes.....	1	
		No.....	2	→21
20	What condition or difficulty do you have? Is it...?	Sight (blindness/sever visual limitation).....	1	
		Hearing (deaf, profoundly hard of hearing).....	2	
		Communication (speech impairment).....	3	
		Physical (needs a wheel chair, crutches or prosthesis; limb or hand usage limited).....	4	
		Intellectual (serious difficulties in learning, mental retardation).....	5	
		Emotional (behavioural, psychological).....	6	
		Other, specify in the space below.....		
21	What is the total number of rooms in the house? (excluding toilets and bathrooms) (write in number)	NUMBER		
22	Do you or someone in your household own the following appliances? (list the items and tick all that are answered yes)	Radio.....	1	
		Television.....	2	
		Refrigerator.....	3	
		Computer.....	4	
		None of above.....	5	
23	Do you or someone in your household own a bicycle?	Yes.....	1	
		No.....	2	
24	Do you or someone in your household own a car/truck/vehicle?	Yes.....	1	
		No.....	2	
25	Do you or someone in your household own a cellphone or telephone?	Yes.....	1	
		No.....	2	
26	What type of energy/fuel does your household MAINLY use for cooking? (tick only ONE)	Electricity.....	1	
		Gas.....	2	
		Paraffin.....	3	
		Wood.....	4	
		Coal.....	5	
		Animal dung.....	6	
		Solar.....	7	
		Other, specify in the space below.....		
27	During the past 12 months, did you or someone in your households receive a government grant?	Yes.....	1	
		No.....	2	→29

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
		Don't know.....	98	→ 29
28	What type of government grant did you or they receive? <i>(read them out, the interviewee may select more than one)</i>	Old age pension..... 1 Disability grant..... 2 <i>(person between 18 to 59 years with a disability)</i> Child support grant..... 3 Foster care grant..... 4 Social relief..... 5 Care dependency grant..... 6 <i>(child under 18 years with permanent, severe disability)</i> Grant-in-aid..... 7 <i>(receipt of a Older Persons, Disability or a War Veteran's grant that requires full-time attendance by another person due to a disability)</i> Don't know..... 98		
29	In the last 7 days did you work?	Yes..... 1 No..... 2		→ 33
30	Did you earn a wage, salary, commission or any payment for this work?	Yes..... 1 No..... 2		→ 33
31	What were the main tasks or duties of your work? <i>(example: selling fruiting, feeding and watering cattle, street vending, hair dressing)</i>			
32	What is your total income per month? <i>(take-home income after tax and deductions)</i> <i>(The interviewer may show the respondent the categories on the right to allow her/him to choose the income category)</i>	None..... 1 R1-R400..... 2 R401-R800..... 3 R801-R1600..... 4 R1 601-R3 200..... 5 R3 201-R6 400..... 6 R6 401-R12 800..... 7 R12 801-R25 600..... 8 R25 601-R51 2000..... 9 R51 201-R102 400..... 10 R102 401-R204 800..... 11 R204 801 or more..... 12 Don't know..... 98 Refused..... 99		
33	In the last 7 days did any other person in your households work? <i>(if there is more than one other person working in the households, ask them to discuss the one with the highest salary)</i>	Yes..... 1 No..... 2		→ 36
34	Did they earn a wage, salary, commission or any	Yes.....	1	

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
	payment for this work?	No.....	2	→ 36
35	What were the main tasks or duties in their work? (example: selling fruiting, feeding and watering cattle, street vending, hair dressing)			
36	How does your household support itself? (The interviewer may show the respondent the categories on the right to allow her/him to choose the income category)	My salary, wages, income..... 1 Someone else's salary, wages, income.. 2 Did odd jobs during the past 7 days..... 3 Supported by a person not in the household..... 4 Supported by charity, church, welfare, etc. 5 Unemployment Insurance Fund (UIF).... 6 Savings or money previously earned..... 7 Old age or disability government grant... 8 Pension (not government)..... 9 Other, e.g. bursary, study loan (specify in the space below).....		
37	What is the total income of your household per month? (The interviewer may show the respondent the categories on the right to allow her/him to choose the income category)	None..... 1 R1-R400..... 2 R401-R800..... 3 R801-R1600..... 4 R1 601-R3 200..... 5 R3 201-R6 400..... 6 R6 401-R12 800..... 7 R12 801-R25 600..... 8 R25 601-R51 2000..... 9 R51 201-R102 400..... 10 R102 401-R204 800..... 11 R204 801 or more..... 12 Don't know..... 98 Refused..... 99		

WATER SUPPLY

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
38	Where does your household get drinking water from most of the time? (tick only ONE)	Piped (tap) water in the dwelling..... 1 Piped (tap) water on-site or in the yard..... 2 Rain-water/yard tank on-site..... 3 Neighbours tap..... 4 Public/communal tap..... 5 Water-carrier/tanker..... 6 Borehole off-site/communal..... 7 Flowing water/stream/river..... 8 Stagnant water/dam/pool..... 9 Well..... 10	1 2 3 4 5 6 7 8 9 10	→ 48 → 48 → 48

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
		Spring..... Other, <i>specify</i>	11	
39	How far is the drinking water source from your house (100m is equal to 1 football field)?	Less than 200 metres..... Between 201-500 metres..... Between 501-1 kilometre..... More than 1 kilometre..... Don't know.....	1 2 3 4 98	
40	In the last seven days, did your household spend at least one hour fetching drinking water from a source outside the property?	Yes..... No.....	1 2	
41	Are you the only one that collects water for the household?	Yes..... No.....	1 2	→44
42	How many others also collect water for the households? (write in number)	NUMBER		
43	In the last seven days, how many hours did you and others in your household spend fetching drinking water? (write in number of hours)	You : HOURS Others : HOURS		
44	In the last seven days, how many trips did you or someone in your household make to fetch drinking water? (write in number)	You : NUMBER Others: NUMBER		
45	How long does it usually take you to go there (to the water source), get water, and come back? (write in number of minutes)	MINUTE DON'T KNOW.....	98	
46	In what type of container do you use to carry water per trip from the water source?	Small bucket (5 litres)..... Normal bucket (20 litres)..... Jerry can/scoop (25 litres)..... Other, (<i>specify</i>).....	1 2 3	
47	How many of these containers do you carry at a time? (write in number)	NUMBER		
48	In the last year did you have 2 consecutive days without water from this source?	Yes..... No..... Don't know.....	1 2 98	→51 →51

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
		Other, (specify)		
55	Why did you wash your hands WITH SOAP before/after the occasions mentioned above? <i>(probe for the reasons for handwashing with soap)</i>			→ 57
56	Do you wash your hands?	Yes..... 1 No..... 2		→ 66
57	Where do you get water from for handwashing, most of the time? <i>(check one)</i>	Tap water in the dwelling..... 1 Tap water on-site or in the yard..... 2 Rain-water/yard tank on-site..... 3 Neighbours tap..... 4 Public/communal tap..... 5 Water-carrier/tanker..... 6 Borehole off-site/communal..... 7 Flowing water/stream/river..... 8 Stagnant water/dam/pool..... 9 Well..... 10 Spring..... 11 Other, specify.....		
58	What happens to the handwashing water after you have washed your hands?	Goes down the drain..... 1 Stays in the bucket or basin..... 2 Spills onto the ground..... 3 Thrown in the yard/garden..... 4 Thrown down the toilet..... 5 Thrown in the street..... 6 Don't know..... 7 Other, specify.....		
59	When is it important to wash your hands? <i>(do not read the answers, encourage by asking if there is anything else until s/he says there is nothing else and check all mentioned)</i>	Before preparing food or cooking..... 1 Before eating..... 2 Before feeding children 3 After cleaning/changing baby 4		

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
		After visiting the toilet.....	5	
		After gardening or working in the fields.....	6	
		Other.....		
60	Why is it important to wash hands at these times? <i>(encourage by asking if there is anything else until there is nothing else is mentioned)</i>			
61	Can you explain to me how you washed your hands the last time you wash your hands. <i>(do not read the answers, encourage by asking if there is anything else until s/he says there is nothing else and check all mentioned)</i>	Mentioned using water	1	
		Mentioned using soap, ash, or other detergent	2	
		Mentioned washing both hands	3	
		Mentioned rubbing hands together at least three times	4	
		Mentioned drying hands hygienically — by air or with a clean cloth or towel.....	5	
62	Do you believe that washing hands just with water is as good as washing hands with water and soap?	Yes.....	1	→64
		No.....	2	
		Don't know.....	98	→64
63	Why is using soap to wash hands better? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			
64	Do you use anything else besides soap or water to wash your hands?	Yes.....	1	
		No.....	2	→66
65	What else do you use, apart from soap or water, to wash your hands?	Ash.....	1	
		Sand, soil or mud.....	2	
		Other (<i>specify</i>).....		
66	Have you heard from someone	Yes.....	1	
		No.....	2	→70

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
	or somewhere that hand washing is important?	Don't know.....	98	→70
67	Where/how did you hear about the importance of hand washing? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			
68	Have you learnt at least one hand washing message from this source in the last month?	Yes..... No.....	1 2	→70
69	What was the message/s you learnt? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			
70	Has there been a disaster (drought, cholera, flood, etc.) programme in your areas?	Yes..... No.....	1 2	→73
71	Did the programme show/teach you about hand hygiene?	Yes..... No.....	1 2	→73
72	What did the programme teach you about hand hygiene? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			
73	Are there any special time/traditions/occasions when you wash your hands?	Yes..... No.....	1 2	→76
74	Please describe these special times of handwashing?			
75	Why is washing of hands necessary at these special times? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			

DIARRHOEA CAUSE AND PREVENTION

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
76	Do you know what diarrhoea is?	Yes..... No.....	1 2	→81
77	Can you describe what diarrhoea is? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			
78	Do you think diarrhea can be prevented?	Yes..... No..... Don't know.....	1 2 98	→80 →80
79	How do you think diarrhea can be prevented?			

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
	<i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			
80	What do you think causes diarrhoea? <i>(encourage by asking if there is anything else until there is nothing else mentioned)</i>			

RUBBISH DISPOSAL

No.	Question	Tick/circle the code or fill in the answer	Code	Go to
81	Where do you keep (store) your garbage until you get rid of it?	In a covered dustbin In an uncovered dustbin Get rid of it immediately Other.....	1 2 3	
82	How do you get rid of/dispose of your stored garbage? <i>(you can tick more than one)</i>	Removed by local municipality Removed by community members..... Taken to communal refuse dump/communal container..... Throw it in my own refuse dump/pit..... Throw it in the garden..... Burned..... Buried..... Recycled..... Other, specify.....	1 3 5 6 7 8 9 10	

MOVE ON TO THE OBSERVATION SECTION.

Before MOVING ON, verify the entire questionnaire to confirm that all questions have been answered.

15 APPENDIX 4: SOUTH AFRICAN HAND HYGIENE OBSERVATION SHEET

WATER RESEARCH COMMISSION

HAND HYGIENE IMPROVEMENT OBSERVATION

I WOULD LIKE TO RE-EMPHASISE THE FOLLOWING:

- You can say anything you want as long as that is truly how you feel.
- There are no right or wrong answers, only your ideas and opinions.
- Be assured that I will NOT tell anyone what you say in the interview. All information will be confidential.

NB try not to tick question in front of the householder. Observe and tick when you move to next section of observation.

SANITATION

No	Question	Tick/circle the code or fill in the answer	Code	Go to
a	Ask: Do you have access to a toilet at home?	Yes..... No.....	1 2	→r
b.	Ask: How many toilets are there in your home? (insert number)	NUMBER Don't know.....	98	
c.	Ask: How long have you had the/these toilet/s? (insert number of months or years)	Number MONTHS or Number YEARS Don't know.....	98	
d.	Ask Do you share the toilet/s with other households?	Yes..... No.....	1 2	→f
e.	Ask: How many other households share your toilet/s? (insert number)	NUMBER Don't know.....	98	
f.	Ask: How many people share (use) this toilet/s (including children)? (insert number)	NUMBER Don't know.....	98	
g	Ask: Is/are the toilet/s cleaned?	Yes..... No.....	1 2	→i
h	Ask: When was/were the toilet/s last cleaned?	Today..... Yesterday..... Less than a week ago..... More than a week ago..... Don't remember Other (specify).....	1 2 3 4 5	
i.	Ask: May I see the toilet facility? (if there is more than one toilet, ask to see the toilet which is most often used)	Yes..... No.....	1 2	→s
No	Question/Observation	Tick/circle the code or fill in the answer	Code	Go to
j	Where is the toilet facility located?	Inside or attached to house..... Elsewhere in the yard..... Outside premises..... Other (specify).....	1 2 3	→m
k.	How far is the toilet facility from the house?	Less than 20 metres (less than 20 big steps)... More than 20 metres (more than 20 big steps) Don't know.....	1 2 98	
l	Are there obstacles in the route (path) to the toilet (are there signs of regular use)?	Dense vegetation covering the route to the toilet..... Major crevices or potholes in the route to the toilet..... Papers and rubbish in the route to the toilet.. Route is clear.....	1 2 3 4	

No	Question	Tick/circle the code or fill in the answer	Code	Go to
		Route is well worn showing signs of regular use.....	5	
		Cannot assess.....	6	
		Other observation.....		
m.	Is it easy to enter the toilet?	Entrance is clear/door not locked.....	1	
		Entrance is obstructed (blocked).....	2	
		Facility is locked.....	3	
		No door.....	4	
		Can't determine.....	5	
n.	What kind of toilet facility does this household use? (tick ONLY one for the toilet being investigated) (for flush toilet ask whether the toilet is connect to a septic tank or municipal line)	Flush toilet with municipal connection.....	1	
		Flush toilet with septic tank (on-site disposal)	2	
		Urine diversion toilet.....	3	
		Chemical toilet.....	4	
		Bucket toilet.....	5	
		Pit toilet with ventpipe.....	6	
		Pit toilet without ventpipe.....	7	
o.	Is the facility (toilet/walls/floor) clear of rubbish, dirt and dust?	Yes.....	1	
		No.....	2	
p.	Is there faecal matter present inside the facility on floor or walls (human or animal)?	Yes.....	1	
		No.....	2	
q.	Is there toilet paper or newspaper next to/within arms reach of the toilet	Yes.....	1	→s
		No.....	2	→s
r.	Ask: If you don't have access to your own toilet where do you defecate (go to the toilet)?	In the yard.....	1	
		In the street.....	2	
		Neighbours toilet.....	3	
		Communal/public toilet.....	4	
		Plastic bag.....	5	
		Other (specify).....		

HANDWASHING

No.	Observation	Tick/circle the code or fill in the answer	Code	Go to
s.	Ask: Where do you most often wash your hands at home?	Never wash hands.....	1	→oo
		In or near toilet facility/bathroom.....	2	
		In or near kitchen.....	3	
		Elsewhere on premises.....	4	
		Outside premises.....	5	
		No specific place.....	6	
t.	Ask: Can you show me the place where you most often wash your hands?	Yes.....	1	→oo
		No.....	2	
u.	Is the hand washing place inside or within 2metres of a toilet facility?	Yes.....	1	
		No.....	2	
v.	Is there a handwashing device such as a tap, basin, bucket, sink, plunger and 2litre bottle, tippy tap, etc.	Yes.....	1	→x
		No.....	2	
w.	What type of handwashing device is there?	Tap (connect to municipal water)	1	
		Bucket and wine tap.....	2	
		Pipe and tap.....	3	
		Plunger and 2 litre bottle.....	4	
		Bucket or basin (without a tap attached).....	5	
		Don't know.....	98	
		Other (specify).....		
x.	Is there water in or within arms (easy) reach of the handwashing device (test whether water is flowing or check if the container has water in it)	Yes.....	1	
		No.....	2	
y.	Does the handwashing device allow for unassisted washing and rinsing of both hands, i.e. does not require a 2 nd person to provide water?	Yes.....	1	
		No.....	2	

No.	Observation	Tick/circle the code or fill in the answer	Code	Go to
z.	Is there a cleansing agent (soap, ash, detergent) next to the handwashing device	Yes..... 1 No..... 2		→bb
aa	What type of cleansing agent is next to the handwashing device?	Bar soap..... 1 Detergent (liquid soap and/or sunlight liquid)..... 2 Ash..... 3 None of the above..... 4 Other (<i>specify</i>).....		
bb	Is there something on which to dry hands?	Yes..... 1 No..... 2		→dd
cc	Type of drying material available?	Cloth towel or cloth..... 1 Paper towel..... 2 Hot air drier..... 3 None of the above..... 4 Other (<i>specify</i>)..... 5		→ee →ee →ee
dd	Does the towel or cloth (material and paper) appear clean?	Yes..... 1 No..... 2		

At this point, take the sample of handwashing water.

No.	Observation	Tick/circle the code or fill in the answer	Code	Go to
ee	Ask: will you be willing to show me how you wash your hands?	Yes..... 1 No..... 2		→oo
ff	Is the person wearing any rings on their hands?	Yes..... 1 No..... 2 Cannot see..... 3		
gg	Is the person wearing a watch?	Yes..... 1 No..... 2 Cannot see..... 3		
hh	Does the person have any visible cuts/injuries on their hands?	Yes..... 1 No..... 2 Cannot see..... 3		
ii	Does the person use water?	Yes..... 1 No..... 2		
jj	Does the person use soap or other cleansing materials (ash, soil, plants, etc.)?	Yes..... 1 No..... 2		
kk	Are both hands washed?	Yes..... 1 No..... 2		
ll	Do they rub their hand together at least 3 times?	Yes..... 1 No..... 2		
mm	What does the person use to dry their hands?	Cloth towel or cloth..... 1 Paper towel..... 2 Hot air drier..... 3 Left to dry on their own (air dry)..... 4 On their clothes..... 5 Other (<i>specify</i>).....		
nn	What happens to the hand washing water after the person has washed their hands?	Goes down the drain..... 1 Stays in the bucket or basin..... 2 Spills onto the ground..... 3 Thrown in the yard/garden..... 4 Thrown down the toilet..... 5 Thrown in the street..... 6 Don't know..... 7 Other, <i>specify</i>		

No.	Observation	Tick/circle the code or fill in the answer	Code	Go to

At this point, take the swab of the dominant hand of the interviewee.

DWELLING

No.	Observation	Code	Observation	Code	Observation	Code
oo	What is the main material used for the floor, walls and roof of the main dwelling?					
	Floor		Walls		Roof	
	Earth.....	1	Bricks.....	1	Corrugated iron.....	1
	Concrete.....	2	Cement blocks/concrete.....	2	Wood.....	2
	Tiles.....	3	Corrugated iron.....	3	Thatch.....	3
	Carpets.....	4	Wood.....	4	Plastic.....	4
	Other (<i>specify</i>).....		Plastic.....	5	Cardboard.....	5
			Cardboard.....	6	...	
			Mixture of mud and cement....	7	Asbestos sheets.....	6
			Wattle and daub.....	8	Tiles.....	7
			Mud.....	9	Zinc.....	8
			Asbestos.....	10	...	
			Zinc.....	11	Other (<i>specify</i>).....	
			Other (<i>specify</i>).....			
No.	Observation		Tick/circle the code or fill in the answer		Code	Go to
pp	Is there rubbish lying around the yard?		Yes.....	1		
			No.....	2		

THANK YOU FOR PARTICIPATING IN OUR RESEARCH

Before leaving this household, verify the entire observation to confirm that all questions have been answered.