

Emergency Health Management and Student Hygiene at a South African University

Kudzai Ashley Tagwira, Michelle Marle Marais, Tracy Anne Ludwig, Rutendo Precious Chidziva, Mavis Nyaradzo Munodawafa, Wendy M. Wrench, and Roman Tandlich

Abstract—Risk of infectious disease outbreaks is related to the hygiene among the population. To assess the actual risks and modify the relevant emergency procedures if necessary, a hygiene survey was conducted among undergraduate students on the Rhodes University campus. Soap was available to 10.5% and only 26.8% of the study participants followed proper hygiene in relation to food consumption. This combination increases the risk of infectious disease outbreaks at the campus. Around 83.6% were willing to wash their hands if soap was provided. Procurement and availability of soap in undergraduate residences on campus should be improved, as the total cost is estimated at only 2000 USD per annum. Awareness campaigns about food-related hygiene and the need for regular hand-washing with soap should be run among Rhodes University students. If successful, rates of respiratory and hygiene-related diseases will be decreased and emergency health management simplified.

Keywords—Awareness, Food hygiene, Infectious disease spread, Undergraduate students.

I. INTRODUCTION

SECTION 13 of the Rhodes University Emergency Management Plan (RUEMP) outlines the emergency management response to an infectious disease outbreak on the Rhodes University (RU) campus (see Part I for details) [1]. The Rhodes University Healthcare Centre (RUHC) has the following functions in this context (see section 13.1.2) [1]: to implement infectious disease control policies, to conduct awareness campaigns about the risks and transmission mechanisms, to procure and maintain reserves of the necessary protective supplies, to drive efforts of containing an outbreak, to inform the Regional and State Health Authorities and the Settlers' Hospital if an outbreak has occurred. They must further isolate the infected patient and oversee the treatment until the infectivity of such a patient has dropped to zero; and to provide updates about the extent of the given outbreak to the Dean of Students (see section 13.1.2) [1]. The

Management Team of RU takes charge of maintaining continuity of university's operations and devising a campus-wide infectious disease response plan [1].

The response team needs to be named for an infectious disease outbreak and a clear accountability mechanism put in place (see section 13.2) [1]. Coordination mechanisms have to be developed between the RU emergency responders and the local office of the South African Department of Health (see section 13.2) [1]. By 2011, the RUHC put in place a policy for medical emergencies [2]. This policy defined the emergency and non-emergency medical cases; and provided guidelines for prioritizing patients accordingly [2]. In the case of an outbreak, this policy and the treatment guidelines for infectious diseases as defined by the South African National Department of Health are adhered to by the RUHC staff [2], [3]. The accountability is covered by the primary treatment being in the hands of the RUHC nursing staff, while the information dissemination/RU response being supervised by the Dean of Students. The list of the first responders can be found on the RU website together with the dates until which the certification of the particular person is valid [4]. Other relevant resources for the safety are also available on the university's website [4].

The South African Department of Health runs the Disease Reporting System which requires the local authorities and institutions such as RU to report outbreaks from 33 infectious diseases such as measles [5]. Two outbreaks from this causative agent have occurred at the RU campus between 2010 and 2011. The RU establishment has fulfilled its legal [5] and internal emergency management obligations [1]. Infected patients were placed in isolation in the RUHC facilities and the updates were provided to the RU community by the Dean of Students through the dedicated e-mail list [1]. A working relationship is in place to treat more serious cases in the Settlers' Hospital in Grahamstown and a private hospital in Port Elizabeth [2]. Thus disease containment/response to infectious diseases is currently not a problem at the RU campus. However, a long-term emergency health management strategy which is campus-wide will only become sustainable if the policy is centred more on preventive measures and the elimination of risk factors. This in turn will only become feasible once baseline data on the critical factors controlling spread of infectious disease at the RU campus are available. Such information is lacking at the moment.

Hygiene is defined as "conditions and practices that help to maintain health and prevent the spread of diseases" [6]. Good

Kudzai Ashley Tagwira, Michelle Marle Marais, Tracy Anne Ludwig, Rutendo Precious Chidziva, Mavis Nyaradzo Munodawafa, Wendy M. Wrench are with the Division of Pharmacy Practice, Faculty of Pharmacy, Rhodes University, P.O. Box 94, Grahamstown 6140, South Africa (Tel 00-27-46-603-8395, Fax 00-27-46-603-7506, e-mails: Shelleymarais@gmail.com, Mukwazhe@gmail.com, Nmnyarie@gmail.com, Crazy.ludwig99@gmail.com, Ruttpresh@gmail.com and w.wrench@ru.ac.za).

Roman Tandlich is with the Environmental Health and Biotechnology Research Group, Division of Pharmaceutical Chemistry, Faculty of Pharmacy, P.O. Box 94, Rhodes University, Grahamstown 6140, South Africa (tel. 00-27-46-603-8825, fax 00-27-46-603-7506, e-mail: r.tandlich@ru.ac.za).

hygiene depends on the reliable drinking water supply, adequate and operational sanitation infrastructure; and the satisfactory hygiene knowledge among the population [7], [8]. Hand-washing with soap is an essential hygiene practice which reduces the risk of diarrhoeal disease outbreaks by 42 - 47% [9]; and that of pneumonia by 50% [10]. This practice limits contamination of household surfaces with the influenza virus [11] and lowers the risk of disease transmission from close personal contact or contact with the contaminated inanimate objects [12]. It has been reported that 60% of South Africans do not wash their hands properly after using the toilet [13]. If this holds for the RU campus, then the risk of an infectious disease outbreak would be high due to the drinking water supply problems [14]. To ascertain the actual risk level and modify the RUEMP if necessary, a hygiene survey was conducted among undergraduate students on the RU campus. Such data is essential for a successful prevention of the infectious disease outbreaks and management of public health emergencies in a relatively and geographically isolated campus. The results are presented in this article.

II. MATERIALS AND METHODS

A. Data Collection and Evaluation

To obtain data on the hygiene habits and relevant knowledge among the RU students living in the on-campus residences, a fifteen-minute questionnaire was administered to the second-year undergraduate students enrolled in the Bachelor of Pharmacy degree (designated as B. Pharm. degree in further text; see Appendix I). The questions were separated into the following sections: personal information (gender, ethnicity, nationality and age group - section 1); percentage of the students residing in the on-campus student accommodation and the availability of soap there (section 2); the students' hygiene habits in relations to food (section 3); general hygiene habits of individual students (section 4); the students' knowledge about hygiene and spread of disease (section 5); and finally students impressions about the hygiene and hygiene awareness at Rhodes University campus (section 6). The ethnic background classification, language and other features of the data-collection tool were based on the official data collection guidelines used by Statistics South Africa [15].

The students' responses in section 1 sub-divided into five subsections and were recorded as numbers of students categorising themselves as belonging into between 2 and 8 categories. For the data evaluation, numbers of students who were recorded as belonging into a given category and a particular subsection were converted into the response rates (*RR*) as defined in (1).

$$RR = 100 \times \frac{N(\text{given group})}{N(\text{total})} \quad (1)$$

In (1), $N(\text{given group})$ is the number of students who classify themselves as belonging into the particular category (dimensionless). At the same time, $N(\text{total})$ is the total number

of students who took part in the study and returned questionnaires with filled out data (dimensionless). The coefficient of 100 converts the *RR* values calculated in (1) into percentages. At the same time, the particular *RR* value for a given category represents the proportion of the total student number taking part in the study that fall into that particular category and the subsection in question.

In section 2, the responses were recorded in the form of yes or no answers; and the names of residences that the students stayed in at the RU campus. In the case of yes/no answers, data evaluation was performed in the same way as for section 1 and the respective *RR* values were calculated using (1). In section 3, the responses were recorded as "Always, Sometimes, Never"; or alternatively as "Never, Rarely, Sometimes, Often, Always" (see Appendix I for details). The *RR* values were again calculated for a given subsection and category according to (1). The modified Likert scale was used to collect and evaluate data in section 4 (see Appendix I for details). The students were requested to express their answers/perceptions using the following options [16]: rating 1 - not essential; rating 2 - not essential, but not insignificant; rating 3 - indifferent standing; rating 4 - not essential, but potentially significant and rating 5 - essential. The *RR* values were calculated for each of the grades on the Likert scale using (1).

Data capturing and evaluation in section 5 were analogous to section 1 and 2; with the exception that the students were requested to write down names of diseases they associated with poor hygiene in subsection 5.2. The correct identification of the diseases was evaluated by the names and the *RR* values calculated according to (1). Finally, the student responses were captured in section 6 as the yes/no answers, types of awareness examples and similar to section 5. The same applies to data evaluation for section 6. As it can be seen from the structure of the questionnaire, the answers collected provide the baseline information about the frequency of the hand-washing with soap among the undergraduate students living on and off the RU campus. At the same time, the spread of disease will be linked to the availability of soap on campus and the particular every-day activities such as food consumption and inter-personal contact. Ethnic and cultural background, along with the first language and gender of the respondents, will also be taken into account.

B. Questionnaire Administration

Six students were recruited for the pilot phase of the study where the preliminary format of the questionnaire was administered. The students' responses were then used to clarify the wording of the questionnaire, with only one change made in section 6. No students who answered questions in the pilot phase were interviewed for the actual data collection to avoid introduction of any statistical bias during data collection. For the actual data collection, a new set of 70 different students was recruited randomly from among the B. Pharm. second-year class. Applicants had to read an invitation letter (see Appendix II) and sign a consent form (see Appendix III) before questionnaire administration took place.

Ethical approval for the research and all the forms in Appendices I-III was obtained from the RU's Faculty of Pharmacy Ethics Committee. Statistical records from the RUHC were consulted to establish the type and prevalence of infectious diseases at Rhodes University. The ethical approval mentioned above covered the access to this data and strict confidentiality was adhered to as no student names were recorded.

C. Statistical Analysis

It is assumed in further analysis that hand-washing with soap reduces the prevalence of disease (see Introduction). Sample size and data collected are considered representative of students residing on campus due to the opportunistic nature of this study. Data analysis was aimed at answering the following questions: a) H_0 : The majority of students have soap in their residence vs. H_a : The majority of students do not have soap in their residence; b) H_0 : The provision of soap in residence bathrooms does not affect students' willingness to wash their hands vs. H_a : The provision of soap in residence bathrooms does affect students' willingness to wash their hands; c) H_0 : Gender does not affect students' willingness to wash their hands vs. H_a : Gender affects students' willingness to wash their hands; and d) H_0 : The majority of students are not willing to wash their hands vs. H_a : The majority of students are willing to wash their hands. The z -test was applied to research questions a) and d); and the χ^2 test was used to answer questions b) and c). The level of significance was set to 0.01 and calculations were performed using the Microsoft Excel Software package (Johannesburg, South Africa).

III. RESULTS AND DISCUSSIONS

Out of the 70 recruited study participants, there was a 96% response rate with 16 respondents being men (23.8% of all respondents) and 51 respondents being women (76.2% of all respondents). When the nationality of the respondents was investigated the following distribution was recorded: South African (59.7%), Zimbabwean (31.3%), Namibian (6.0%), Swazi (1.5%) and Kenyan (1.5%). Exactly 41.8% of all respondents were between 17 and 19 years of age, while 53.7% of all respondents were between 20 and 22 years of age and finally 4.5% were aged between 23 and 25. Taking the ethnic background of the respondents into account, 74.6% were Black African, 13.4% were of Asian origin and 6.0% were Coloured. The remaining respondents accounted for 6.0% of all study participants and were either of Indian, White, African-American or had Mixed Ethnic Heritage. With respect to the first language of the respondents, English was the first language for 28.4% of respondents and the rest spoke one of the other official languages of the Southern African Development Community (SADC) region.

The large majority of 98.5% of the B. Pharm. students who participated in the study were from the SADC region. Thus cultural background of the participants' is likely to have limited influence on their hygiene habits and knowledge, i.e. the results of the current study. This is based on the fact that

all of the students came from countries where English is the primary medium of instruction from the secondary level onwards. Such conclusion, in combination with the fact that comprehension of the questionnaire did not pose a significant problem for students in the pilot phase, indicates that the language background of the participants will not influence the study's results. Statistical estimation indicates that the years lost due to infection from hygiene-related conditions increase between 14 and 35 years of age, but remain constant between 15 and 24 years of age [17]. Given the data in the previous paragraph, the conclusions from the current study will not be affected by the age of the respondents. International studies point to the relationship between the individual's ethnic background and their hygiene practices [18]. Therefore the students' ethnic background can be expected to have a profound effect on their hygienic behaviour.

All students who answered the questionnaire lived on campus since the beginning of their B. Pharm. studies at RU and were spread over 30 residences. Thus the RR value in section 2.1 for equal to 100% for "Yes" and the RR value for the "No" answer was equal to 0%. Therefore results of the survey will reflect the hygiene habits and knowledge of undergraduate students living at the RU campus. Seven participants had soap in their residence bathrooms, while 60 participants did not. This indicates that the RR values for the data in section 2.2.3 were equal to 10.5% for "yes" and 89.6% for "No". The percentages of soap availability were equal to 12.5 % for male and 9.8 % for female students.

This will likely decrease the frequency of hand-washing with soap among the undergraduate students on RU campus due to the lack of soap or the need for students to provide it themselves. Hygiene on the RU campus might become compromised, mainly during day time, when getting to lectures and other academic activities is likely to put students under stress and make the use of soap in the above-described conditions less probable. This will in turn lead to poor hygiene which will increase in the probability of the spread of infectious diseases at RU campus, in line with previous studies conducted in the tertiary educational institutions [19]. Such conclusion is supported by the 2010 RUHC statistics which indicated that 69.8 % of the patients treated by the nursing staff exhibited symptoms which resulted from poor hand hygiene practices. Examples of actual diseases include eye infections, respiratory tract infections and gastrointestinal diseases.

Questions in section III investigated the respondents' hand-washing habits before and during food consumption. The answers and the respective RR values are shown in Tables I and II. Only 26.8 % of the study participants followed proper hygiene and wash their hands every time before food consumption. Erkal and Şahin [20] found that food hygiene was the fifth most important hygiene priority among university students in Turkey. Given the RR value for washing hands before meals indicates that the attitude of undergraduate RU students was similar. The significance of this finding is likely to have more profound public health implications at the RU campus due to the common drinking water supply outages

[14]. Up to 92.6 % of them touch their food intermittently or during every meal. This in combination with the low availability of soap the on-campus residences will increase the risk of the infectious disease spread at the RU campus. Hygiene habits in context of food consumption by undergraduate students will have to form an important part of any policy changes and awareness campaigns on the infectious disease risks at RU.

TABLE I
THE ASSESSMENT RESULTS OF THE STUDENTS' HAND-WASHING HABITS
BEFORE FOOD CONSUMPTION (RESPONSES FROM SECTION 3.1 OF THE
QUESTIONNAIRE IN APPENDIX I)

<i>RR</i> (Always) ¹ %	<i>RR</i> (Sometimes) ¹ %	<i>RR</i> (Never) ¹ %
26.8	64.2	9

TABLE II
THE ASSESSMENT RESULTS OF THE STUDENTS' HAND-WASHING HABITS
DURING FOOD CONSUMPTION (RESPONSES FROM SECTION 3.2 OF THE
QUESTIONNAIRE IN APPENDIX I)

<i>RR</i> (Never) %	<i>RR</i> (Rarely) %	<i>RR</i> (Some- times) %	<i>RR</i> (Often) %	<i>RR</i> (Always) %
0	7.5	23.9	46.3	22.4

Data in subsection 4.1 revealed that 73.1 % of the respondents washed their hand with soap after using the toilet or the urinals. An additional 26.8% were doing this on an intermittent basis and no students stated that they do not wash their hands ever after using the toilet facilities. In a study performed at the University of Colorado, the installation of hand sanitizers in bathrooms and dining halls was found to reduce the overall rate of disease outbreaks on campus by 20%, while the incidence of upper respiratory illnesses dropped by between 14.8% and 39.9% [21]. Given the low understanding of the food-related hygiene (see previous paragraph for details), the RU emergency management staff should focus on providing sanitary wipes and/or the hand sanitizer dispensers in the residence dining halls. This step should also be combined by running a relevant awareness campaign during meal times.

Table III shows the results on the students' general knowledge about hand-washing as outlined in section 4.4 of the questionnaire (see Appendix I). One hundred percent of all study participants thought it was not essential, but significant or essential to wash one's hands after using a toilet. The *RR* value of 67.2% was recorded for the essential role of hand-washing before eating. An additional 23.9% of all respondents considered this activity not essential, but significant. Therefore a total of 91.1 % responded with a rating of 4 or 5 when asked about the significance of the hand-washing before eating.

These results suggest that a contradiction exists between the students hygiene habits during food consumption and their relevant knowledge (see Tables I and II for details). The diffusion-of-innovation theory states that if people can become aware of the same knowledge at different times, then this can lead to them starting to exhibit a particular behaviour at different times [22]. In the context of the hygiene knowledge at the RU campus, this means different respondents who took

part in the current study probably did not acquire their hygiene knowledge in relation to eating at the same time during their lives. This in turn provides an explanation for the observed discrepancy between the students' understanding that hand-washing before eating is important and actually performing the task while consuming food.

TABLE III
ASSESSMENT OF THE STUDENTS' GENERAL HAND-WASHING KNOWLEDGE

	1* (%)	2* (%)	3* (%)	4* (%)	5* (%)
After using the toilet	0	0	0	7.5	92.5
Before eating	1.5	0	7.5	23.9	67.2
After contact with sick people	0	0	3.0	7.5	89.6

*A scale of responses with 1 being 'not necessary' and 5 being 'essential'

The *RR* values measured for the last question in Table III indicate that 89.6 % of respondents thought that hand-washing had an essential effect on the spread of disease, as this habit should be performed after contact with sick people. At the same time, 97.1% answered this question with a rating of 4 or 5. Thus the RU undergraduate students understand that hand-washing can be used to prevent the spread of infectious diseases. As such increased availability of soap on campus is likely to improve use by students and the efficiency of hand-washing in the containment of infectious diseases will be increased as well. Awareness and other relevant campaigns are therefore likely to be successful. It is worrying that 1.5% of the students did not feel that hand-washing is not necessary before eating and 6% did not think that hand-washing affects the spread of disease. These observations might heighten the probability of an outbreak if the infectious dose for an infection is very low such as with brucellosis [23].

Around 90% of the respondents felt that hand-washing with soap affects the spread of disease (see section 5.1 in Appendix I). The students listed the following diseases as being associated with poor hygiene as required in section 5.2: cholera, colds and flu, diarrhoea, rash, tuberculosis, coughs, gastrointestinal illness, infections due to *Helicobacter* spp., *Escherichia coli* and tapeworms, scabies, typhoid, "jock itch", fungal infection, vomiting, bilharzias, skin infections, bacterial infection, worms and sexually transmitted diseases. The *RR* rates were as follows: 29.8% of students could not name any disease linked to poor hygiene, 35.8% of participants could name two or more diseases; and only 11.9% of participants named three or more relevant illnesses. Thirty four participants (50.7%) correctly stated that cholera is spread by lack of hand-washing, while 23 participants (34.3%) knew that transmission of diarrhoeal and respiratory diseases is related to low frequency of hand-washing. A single participant linked poor hand-washing practices to the spread of typhoid. These *RR* values suggest that gaps exist in the hygiene-related disease awareness among the RU students.

Limited knowledge about the infectious disease transmission can originate from a low rate of awareness campaigns about the infectious disease risks which run in a given community [24]. The findings for the RU campus might have a similar cause as the majority of the study participants

answered “None” in section 6.1 with the respective *RR* value of 52.2%. Therefore the majority of the students felt that no awareness campaigns were run on the RU campus about the risks of infectious diseases and their transmission. A sizeable minority of 32 students (the *RR* value = 47.8%) did, however, reply to the same question that some awareness tools were available across campus. If the level of awareness was still perceived as low, then this might have discouraged students from taking action on their own and collect the necessary information about infectious diseases. The frequency of awareness campaigns must be increased at the RU campus as soon as possible.

A more detailed examination of the RUHC statistical data indicated that 24.3% of students treated during 2010 suffered from nasal and tracheal infections. Literature data show a strong link between the rate of viral infections and the levels of hand hygiene [25]. Hendley et al. [26] showed that rhinoviruses, including the influenza and para-influenza viruses, can survive on hands of infected individuals for one to three hours after contact with the respective virions. At the same time, the authors demonstrated that the infection can be spread if the infected individual touches other persons or surfaces with their hands and fingers [26]. If this took place at the RU campus, then the focus of awareness campaigns should be placed on viral diseases which recently occurred at the RU campus, e.g. measles. A more detailed examination of the prevalence of the causative agents in question at the surfaces throughout the RU campus will also be required. Analogical study undertaken on a US university campus showed that a poster awareness campaign on the importance of hand hygiene decreased upper respiratory tract infections among university students significantly [21]. Similar format should be applied to the RU campus.

Data collected in section 6 of the questionnaire was directed at the provision of soap in the RU on-campus residences and its influence on the willingness of the students living there to improve their hygiene. Sixty out of 67 respondents did not have access to soap in their residence bathrooms. This equals to the proportion of 0.895 of all respondents and is statistically significantly higher than 0.500 at 1% level of significance (*Z* statistic value = 6.470, *p*-value = 10^{-9}). At the same time, 56 of all respondents, i.e. 83.6 % of all respondents, were willing to wash their hands if soap was provided in the residence bathrooms. This percentage is again statistically significantly higher than 50% (*Z* statistic value = 6.470, *p*-value = 10^{-9}). Therefore the majority of Rhodes undergraduate students did not have access to soaps in their residence bathrooms, but were willing to wash their hand regularly with soap if this was provided in the residence bathrooms. Gender of the respondents did not have a significant effect on the willingness to wash hands with soap (χ^2 test, 1 % level of significance, *p*-value > 0.100). This is in line with international observations [27].

Regardless of the soap availability in residences, the students would be willing to wash their hands (χ^2 test, 1 % level of significance, *p*-value > 0.200). Thus the soaps should be made available in the residence bathrooms. There are 50

student residences on the RU campus and these are an average 4 stories high with 2.5 bathrooms per residence. The soap requirement for the residence system per annum can be estimated using (2).

$$SR = 12 \times 4 \times R \times NB \quad (2)$$

In (2), *SR* stands for the soap requirement for all of the RU residences (dimensionless), while *R* is the total number of residences on the RU campus (dimensionless). The equation contains the number 12 to represent 12 months of the year and the number 4, i.e. number of soap per single bathroom. Finally, the term of *NB* represents the number of bathrooms in a residence at the RU campus. At the same time, a hand-sanitiser dispenser should be available at each dining hall, i.e. 14 units per campus. Taking these steps would significantly improve the hygiene situation at the Rhodes University Campus at a cost of approximately 2000 USD per annum.

This study had a few of limitations which need to be mentioned. A few of the residences have annexes, which intermittently contain soap. Thus some students might have had access to soap, but this was not reported by the selected respondents whom the questionnaire was administered to. The student sample was skewed towards female participants, but this is a side-effect of the opportunistic nature of the study. The data may have been limited by self-reporting, in which the participants may have indicated that they perform a specific task, such as hand washing, more regularly than they actually do. Regardless of the limitations, the results of this study do indicate that hygiene measures at RU campus must be improved. The hand sanitizer dispensers should also be installed in dining halls and residence bathroom, as they have been shown to decrease the rates of upper respiratory infections by 14.8% and 39.9% in university environments [21]. Awareness campaigns about hygiene should be run among Rhodes University students. These should be focused on food hygiene, the location of the hand sanitisers and the necessity of the regular hand-washing.

IV. CONCLUSIONS

Hand-washing and hygiene connected to food consumption were discovered to be a major problem at the RU campus. These observations are likely to increase the probability of an outbreak if the infectious dose for an infection is very low such as with brucellosis. Up to 89.6 % of all respondents did not have soap in their undergraduate residences, but up to 83.6 % were willing to wash their hands if soap was provided. The RU campus is geographically isolated and the students as staff are medically more vulnerable than the average South African population. Therefore efficient procurement and increased availability of soap; and hand-sanitisers, in undergraduate residences and dining halls at the RU campus could provide an efficient and cost-effective way to improve the public health and emergency management preparedness there. Awareness campaigns about hygiene should be run among Rhodes University students. These should be focused on food hygiene,

ACKNOWLEDGMENT

APPENDIX I

Please make a cross through the box that contains your answer.

1.1 Gender	Female	Male							
1.2 Race	African	Coloured	Asian	White	Other (please specify)				
1.3 Age group	17-19	20-22	23-25	Other (Please Specify)					
1.4 Nationality	South African	Zimbabwean	Namibian	Other (Please Specify)					
1.5 What is your home language?	English	Afrikaans	Xhosa	Sotho	Zulu	Shona	Ndebele	Other (Please Specify)	

2.1 Do you live in a Rhodes University residence?	Yes	No
2.2 If yes:		
2.2.1 Which residence?	_____ N/A	
2.2.2 How long have you lived in residence?	_____ years N/A	
2.2.3 Is there soap in your residence bathrooms?	Yes	No N/A

3.1 Do you wash your hands before you eat? Always Sometimes Never

3.2 Do you touch any item of food (e.g. burgers or chips) with your hands while you are eating? Never Rarely Sometimes
Often Always

4.1 Do you wash your hands after using the toilet/urinal? Always Sometimes Never

4.2 Do you use hand sanitizer? Yes No

4.3 If yes, when do you use it? _____ N/A

4.4 How important do you think it is to wash your hands? (1 = Not necessary, 5 = Essential)

4.4.1 After using the toilet/urinal 1 2 3 4 5

4.4.2 Before eating 1 2 3 4 5

4.4.3 After being in contact with sick people 1 2 3 4 5

5.1 Do you think handwashing affects the spread of disease? Yes No

5.2 If yes, which diseases do you think are spread by not washing hands? Write down as many as you know.

Hygiene 4 Health

APPENDIX II

**RHODES UNIVERSITY: FACULTY OF PHARMACY
PARTICIPANT INVITATION LETTER**

Title of project: Personal hygiene and the spread of disease

Date: 04 March 2011

Group members:

Kudzai Tagwira, Michelle Marais, Mavis Munodawafa, Tracy Ludwig, Rutendo Chidziva

Academic Advisors:

Wendy W. Wrench, MPharm

Roman Tandlich, PhD

General project information:

You are kindly invited to participate in the Personal Hygiene and the Spread of disease project. This invitation letter provides detailed information about why we are doing this research. The purpose of this letter is to clearly explain to you all the aspects involved in this activity. **As participation is voluntary, you may withdraw at any point of time, for any reason valid to you.** As you read through, it will guide you so that you make a well informed decision to participate. For clarity on any issues, please ask any one of the group members. On completion of reading and understanding what the activity involves, you are required to sign a consent form that will give us consent to include you as a participant in the project.

This research project has been approved by the Rhodes University's Faculty of Pharmacy Ethics Committee.

Purpose of the project: To establish the personal hygiene habits of Rhodes University students.

Number of participants: 50-70

Procedure of health promotion activity:

An information leaflet (IL) will be handed out that contains information on the benefits of good hygiene practices in curbing the spread of common diseases that are associated with poor hygiene. It also contains information on the current statistics of the diseases that are associated with poor hygiene.

Possible benefits of this health promotion activity:

This research aims to improve awareness and knowledge of the consequences of unhygienic practices. It also aims at improving the behaviour of people with regards to personal hygiene in the interest of good health.

Possible risks of this health promotion activity:

There are no risks associated with this research project.

Privacy and disclosure of information:

No names will be required for this research. A reference number which is quoted in the questionnaires will be used. Signing the consent form gives the facilitators permission to publish the analysed results in a research report, at a poster evening and possibly in academic journals. The data collected will be kept for the duration of the entire project year for a period of 1 year. Thereafter all the data will be destroyed.

Further information:

If you require any further assistance, encounter any problems or wish to enquire further about this health promotion activity, you may contact:

Ms K Tagwira on g09t3977@campus.ru.ac.za or hygiene4health@gmail.com

APPENDIX III

Consent letter for participation in the study

RHODES UNIVERSITY: FACULTY OF PHARMACY CONSENT FORM: PARTICIPANTS

Title of project: Personal Hygiene and the Spread of disease

Group members participating in this research: (Facilitators)

Kudzai Tagwira

Michelle Marais

Mavis Munodawafa

Tracy Ludwig

Rutendo Chidziva

Date: 4 March 2011

Please read Participant invitation letter first. After having carefully read the statements below please provide a tick ✓ next to each of the statements and then proceed to signing the form.

	I have read and fully understand the invitation letter
	The facilitators have noted that my identity and personal details will not be revealed in any published or public form of presentation
	I voluntarily agree to be a participant in this project according to the conditions outlined in the invitation letter

Printed Name of Project Participant

Signature of Project Participant

Date

Printed Name of Facilitator

Signature of Facilitator

Date

Printed Name of Witness

Signature of Witness

Date

REFERENCES

- [1] Rhodes University Emergency Management Plan (RUEMP). Estates Division, RU, Grahamstown, South Africa, 2011.
- [2] Rhodes University Healthcare Centre (RUHC, 2011). Medical Emergencies. Rhodes University, Grahamstown South Africa.
- [3] South African Medicines Formulary. 8th edition, Health and Medical Publishing Company, Rodenbosch, South Africa, 2008.
- [4] Rhodes University First Aid Responders List. Available at: <http://www.ru.ac.za/safety/firstaid/rufirstaiders/> (website accessed on 11th March 2013).
- [5] South African Department of Health. Disease Notification System. Available at: www.doh.gov.za/show.php?id=2662 (website accessed on 6th March 2013), 2013.
- [6] World Health Organisation. Hygiene. Available at: <http://www.who.int/topics/hygiene/en> (website accessed on cited 29th January 2011), 2011.
- [7] N. Phaswana-Mafuya, N. Shukla. Factors that could motivate people to adopt safe hygienic practices in the Eastern Cape Province, South Africa. *African Health Sciences March*, vol. 5(1), pp. 21-28, 2005.
- [8] I. Van Tonder, J. F. R. Lues, M. M. Theron. The personal and general hygiene practices of food handlers in the delicatessen sections of retail outlets in South Africa. *Journal of Environmental Health*, vol. 70(4), pp. 33-38, 2007.
- [9] V. Curtis, S. Cairncross. Effect of washing hands with soap on diarrhoea risk in the community: A systematic review. *Lancet Infectious Diseases* vol. 3(5), pp. 275-281, 2003.
- [10] S. P. Luby, M. Agboatwalla, D. R. Feikin, J. Painter, W. Billhimer, A. Altaf, R.M. Hoekstra. Effect of handwashing on child health: A randomized controlled trial. *Lancet* vol. 366(9481), pp. 225-233, 2005.
- [11] J. M. Simmerman, P. Suntarattiwong, J. Levy, R. V. Gibbons, C. Cruz, J. Shaman, R. G. Jarman, T. Chotpitayasunondh. Influenza virus contamination of common household surfaces during the 2009 influenza A (H1N1) Pandemic in Bangkok, Thailand: Implications for contact transmission. *Clinical Infectious Diseases* vol. 51(9), pp 1053-1061, , 2010.
- [12] World Health Organisation. WHO Guidelines on Hand Hygiene in Health Care. Available at: http://www.cec.health.nsw.gov.au/_documents/programs/hand-hygiene/who-guidelines.pdf (website accessed on 30th January 2013), 2005.
- [13] Global Hygiene Council. Available at: http://www.lifehealthcare.co.za/Health/Hand_Hygiene.aspx (website accessed last on 7th March 2013), 2009.
- [14] C. D. Luyt, W. J. Muller, R. Tandlich. Low-cost tools for microbial quality assessment of drinking water in South Africa. *HealthMed* vol. 5(6) Supplement 1, pp. 1868-1877, 2011.
- [15] Statistics South Africa. Municipal facts sheet (census 2011 data products). Available at:

- <http://www.statssa.gov.za/Census2011/Products.asp> (website accessed on 14th February 2013), 2012.
- [16] Social Sciences Research Methods. Likert Scaling. Available at: <http://www.socialresearchmethods.net/kb/scallik.php> (website accessed on 4th February 2013), 2006.
- [17] D. Bradshaw, P. Groenewald, R. Laubscher, N. Nannan, B. Nojilana, R. Norman, D. Pieterse, M. Schneider. Initial burden of disease estimates for South Africa, 2000. Burden of Disease Research Unit, Medical Research Council, Cape Town, South Africa, 2003.
- [18] J. L. Anderson, C. A. Warren, E. Perez, R. I. Louis, S. Phillips, J. Wheeler, M. Cole, R. Misra. Gender and ethnic differences in hand hygiene practices among college students. *American Journal of Infection Control* vol. 36(5), pp. 361-368, 2008.
- [19] L.S. Kimel. Handwashing education can decrease illness absenteeism. *The Journal of school nursing: the official publication of the National Association of School Nurses* vol.12(2), pp. 14-16, 18, 1996.
- [20] S. Erkal, H. Şahin. An application on determining hygiene behaviors of university students. *International Journal of Business and Social Science* vol. 2(8), pp. 170-176, 2011.
- [21] C. White, R. Kolble, R. Carlson, N. Lipson. The impact of a health campaign on hand hygiene and upper respiratory illness among college students living in residence halls. *Journal of American College Health* vol. 53(4), pp. 175-181, 2005.
- [22] T. W. Valente, D. V. Schuster. The Public Health Perspective for Communicating Environmental Issues. (Chapter 6, In: New Tools for Environmental Protection: Education, Information and Voluntary Measures, T. Dietz and P. C. Stern, eds.), National Academy Press, Washington, DC, pp. 105-124, 2002.
- [23] Florida State Department of Health. The Florida Lab Link: a biological and chemical preparedness newsletter. Available at: <http://www.doh.state.fl.us/lab/publications/Newsletters/LLV812.pdf> (website accessed on 10th March 2013), 2010.
- [24] S. Samanta, S. Rana, A. Sharma, A. K. Misra, J. Chattopadhyay. Effect of awareness programs by media on the epidemic outbreaks: A mathematical model. *Applied Mathematics and Computation* vol. 219(12), pp. 6965-6977, 2013.
- [25] S. A. Boone, C. P. Gerba. Significance of fomites in the spread of respiratory and enteric viral disease. *Applied and Environmental Microbiology* vol. 73(6), pp. 1687-1696, 2007.
- [26] J. O. Hendley, R. P. Wenzel, J. M. Gwaltney Jr. Transmission of rhinovirus colds by self-inoculation. *New England Journal of Medicine* vol. 288(26), pp. 1361-1364, 1973.
- [27] A. Al Kadi, S. A. Salati. Hand hygiene practices among medical students. *Interdisciplinary Perspectives on Infectious Diseases* art. no. 679129, 2012.

Kudzai Ashley Tagwira is a Zimbabwean student studying a bachelor in pharmacy degree at Rhodes University in Grahamstown South Africa. She did her primary school education at Hillcrest Preparatory School in Mutare Zimbabwe and completed her secondary education at St Dominic's Chishawasha Girls High School in Harare Zimbabwe. In 2008 she worked as a volunteer for Celebration Health a church organisation which was responsible for the setup of cholera treatment camps in the affected towns of Zimbabwe in collaboration with Medecins Sans Frontieres. In 2012 she worked as a volunteer on the Pelopepa health train which gives free health care to rural communities of South Africa. She is also a sub warden at the Rhodes University Health Care Centre and a member of Healthcare Information For All by 2015 initiative (HIFA2015).

Michelle Mara is completed her primary and secondary education (2003) in East London, South Africa. She obtained a Bachelor of Commerce degree in Accounting at Fort Hare University in 2008. In 2009, she commenced her studies in pharmacy through the Faculty of Pharmacy at Rhodes University in Grahamstown, South Africa. Michelle was the Rhodes University Faculty of Pharmacy Student Representative for 2011 and 2012.

Ms Tracy Ludwig was born in Johannesburg, South Africa in 1989. She completed primary (2003) and secondary education (2008) in Windhoek, Namibia. She is currently in her final year of undergraduate study at the Faculty of Pharmacy of Rhodes University in Grahamstown, South Africa and intends doing her internship in a community pharmacy in Windhoek, Namibia in 2013. Her areas of interest are asthma and general pharmaceutical care.

Miss Rutendo Chidziva became a student at Rhodes University, Grahamstown, South Africa in 2009. She did her Primary School education at

Zengeza 4 Primary School, Harare, Zimbabwe. She completed her secondary School at St. Dominic's Chiwashawasha High School, Harare, Zimbabwe in 2007. In 2012 she was a water quality consultant for Galela Amanzi, a student initiative at Rhodes University that provides Rainwater Harvesting Systems to the Grahamstown Community.

Mavis Nyaradzo Munodawafa was born on October 17 1988. She completed her primary education at Chancellor Junior primary school in Mutare, Zimbabwe. She then proceeded to do study at the Nhowe Mission secondary school in Macheke and later transferred to the Dominican Convent High School in Harare. After completion of her 'A' levels, she enrolled at Rhodes University for the Bachelor of pharmacy degree in 2009. She is currently in the final year of her studies and is expected to graduate in early 2013.

Mrs Wendy Wrench joined the Faculty of Pharmacy at Rhodes University in Grahamstown, South Africa in 2003. Prior to this, she worked as a pharmacist in both psychiatric and general hospitals as well as in community pharmacy. She is the co-ordinator of experiential learning programmes (including service-learning programmes) for undergraduate pharmacy students. Other areas of interest are primary health care, health education and promotion, asthma, tuberculosis and HIV&AIDS. Her Master's thesis entitled "Design and Evaluation of Illustrated Information Leaflets as an Educational Tool for Low-literate Asthma Patients", focussed on the design of information leaflets to improve knowledge of asthma, the trigger factors of asthma and the correct technique for use of metered dose inhalers. Wendy is also the Faculty of Pharmacy representative for Community Engagement, the Faculty of Pharmacy staff-student liaison person and a member of the Eastern Cape Provincial and Makana Subdistrict Pharmacy and Therapeutics Committees.

Dr. Roman Tandlich was born in Bratislava, Slovakia in 1975. He completed primary (1989) and secondary education (1993) in the same city. He obtained his Bachelor's and Master of Science degrees from the Slovak University of Technology in Bratislava between 1993-and 1998. The focus of his early work was on environmental contamination from polychlorinated biphenyls. In 1999, Dr. Tandlich commenced his PhD studies in Pharmaceutical Sciences at the North Dakota State University in Fargo, ND, USA. His PhD dissertation, entitled: "Microbial PCB degradation and binding to soil components", was successfully completed with PhD graduation in May 2004. After two postdoctoral fellowships in Israel and South Africa, Dr. Tandlich joined the Faculty of Pharmacy at Rhodes University, South Africa as a Lecturer in Pharmaceutical Chemistry and Biochemistry in 2008. His research interests include wastewater treatment, microbial drinking water quality and sources of contamination during floods and droughts and disaster management implications of wastewater treatment. He has published 42 journal and conference proceeding papers, 6 technical reports and 2 book chapters.