

# A Case Study of Pediatric Diarrhea at Murchison District Hospital in Port Shepstone, KwaZulu-Natal, South Africa

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## **1. Abstract**

This study investigates pediatric diarrhea in children under 5 years old at Murchison District Hospital in Port Shepstone, South Africa. Hospital Child Pip data was used to determine the number of admissions to the hospital for pediatric diarrhea and its mortality rate. Characteristics of deceased patients including age, malnutrition, and HIV status, were then synthesized with information on patients' access to clean water and improved sanitation obtained through 20 interviews of mothers of patients as well as caregivers' infant feeding practices and hygiene practices, such as handwashing with soap. Treatment and prevention of diarrhea was also explored. Murchison's management of diarrhea compared positively to national guidelines. Ultimately, the data showed that South African's lack of knowledge about pediatric diarrhea directly contributes to its incidence and mortality rate. Education was concluded as the key solution. National scale and local scale recommendations were given on how to make such education practical through improving access to facilities, increase the number of educators by increasing existing incentives for health professionals, assess patients' understanding of home assessment and treatment of diarrhea and dehydration, and provide them with reference materials that they can review.

## **2. Introduction**

## 2.1. A Brief Global History of Pediatric Diarrhea

In 1958, the World Health Organization (WHO) recognized diarrheal disease as “a major health problem”.<sup>1</sup> The pathways of transmission from feces or contaminated water to flies and animals to food contamination were studied; conditions that exacerbate diarrheal cases, such as malnutrition, and preventative measures, such as good hygiene, were also investigated and largely understood.<sup>2</sup> In addition, mortality was known to “often be prevented by simple rehydration therapy.”<sup>3</sup> Furthermore, even those populations commonly ignored, such as children, were included in the study. Reducing mortality in children was explicitly acknowledged as a priority insofar as “a practical programme cannot be completed without consideration of methods for the prevention of death in those children.”<sup>4</sup>

However, almost fifty years later 1.7 million children under five years old still die each year globally from complications caused by diarrhea, translating to a death every nineteen seconds.<sup>5</sup> In addition, the demographics of child mortality remain extremely skewed; “diarrhea is a major killer in developing countries,” while in the developed world “it is usually no more than an irritant.”<sup>6</sup> Resources remain rarely and perhaps unfairly allocated to help reduce child mortality due to diarrheal complications; instead, they fund research and treatment for diseases, such as tuberculosis, which actually kill fewer people annually.<sup>7</sup> Moreover, remedying complications caused by diarrhea, such as dehydration, include simple, inexpensive treatments, such as oral

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<sup>1</sup> Verhoestraete, L. J.; Puffer, R. P. *Bull. Wld. Hlth. Org.* **1958**, *19*, 23-51.

<sup>2</sup> *Ibid.*

<sup>3</sup> *Ibid.*

<sup>4</sup> *Ibid.*

<sup>5</sup> “Water, Sanitation and Hygiene Facts.” World Health Organization. 2004.

< [http://www.who.int/water\\_sanitation\\_health/publications/facts2004/en/index.html](http://www.who.int/water_sanitation_health/publications/facts2004/en/index.html)>.

<sup>6</sup> Horn, R.; Perry, A.; Robinson, S. “A Simple Solution.” *Time Magazine*. 16 Oct. 2006. <[www.timemagazine.com](http://www.timemagazine.com)>.

<sup>7</sup> *Ibid.*

rehydration therapy (ORT). According to Dr. David Sack of the International Centre for Diarrheal Disease Research in Dhaka, Bangladesh, “to save a life of a person with diarrhea is probably the cheapest health intervention you can think of.”<sup>8</sup>

## 2.2. *A Brief Synopsis of Pediatric Diarrhea in South Africa and KwaZulu-Natal*

In South Africa in 2004, preventable intestinal infectious diseases were the leading underlying natural causes of death for children between the ages of one and four.<sup>9</sup> Inadequate sanitation, inability to access clean water, and insufficient personal hygiene are responsible for an estimated 88% of pediatric diarrhea, while human feces remain “the primary source of diarrheal pathogens.”<sup>10,11</sup> Prüss *et. al.* estimated that providing basic sanitation and introducing an improved water supply would decrease diarrheal disease rates of participants by 37.5%.<sup>12</sup> The South African government, international entities, and community leaders have made great strides in improving facilities and increasing access to improved water and sanitation.<sup>13</sup> The South African Government has developed health-related Millennium Development Goals. By 2015, the government hopes to reduce the under five mortality by two-thirds from 1990, and “half the proportion of people with sustainable access to safe drinking water.”<sup>14</sup> In South Africa, 98% of the urban population now has access to improved water sources, but only 84% have access to

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<sup>8</sup> *Ibid.*

<sup>9</sup> Statistics South Africa. Mortality and causes of death in South Africa, 2003 and 2004: Findings from death notification. Statistical release P0309.3 Pretoria: Statistics of South Africa; 2006. <<http://www.statssa.gov.za>>.

<sup>10</sup> “Water, Sanitation and Hygiene Facts.” World Health Organization. 2004. <[http://www.who.int/water\\_sanitation\\_health/publications/facts2004/en/index.html](http://www.who.int/water_sanitation_health/publications/facts2004/en/index.html)>.

<sup>11</sup> South African Health Review 2006. Health Systems Trust. “Chapter 11: Key Childhood Health Promotion and Disease Prevention Programmes.” 191-193.

<sup>12</sup> Prüss, A.; Kay, D.; Fewtrell, L.; Bartram, J. *Environ. Health Prospect.* **2002**, *110*, 537-542.

<sup>13</sup> Knight, S., M.D. SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007. 8:30 - 11:00 A.M.

<sup>14</sup> South Africa Millennium Development Goals Country Report 2005. <<http://www.doh.gov.za/docs/reports/2005/mdgd/>>.

improved sanitation.<sup>15</sup> However, conditions are worse in rural areas, where only 73% have access to improved water sources and 44% have access to improved sanitation.<sup>16</sup> Moreover, studies indicate that the incidence of diarrhea in children under five is increasing.<sup>17</sup> In KwaZulu-Natal (KZN), the province consistently with the highest incidence since 2001, diarrhea affected 487 of every 1000 persons in 2005, almost tripling the incidence of 2000 and doubling the 244.2 incidence of 2004.<sup>18</sup>

### 2.3. *Overview of Murchison District Hospital*

This case study examines pediatric diarrhea at Murchison District Hospital, located in KZN in Port Shepstone. A 1994 study of Murchison concluded that gastroenteritis and malnutrition diseases were among the “chief causes of admission” for rural, African children under twelve.<sup>19</sup> The catchment area of Murchison encompasses 7 clinics and serves approximately 250,000 residents of the Ugu District. The hospital has 321 beds, including 12 cot beds in the infectious disease pediatric ward and 8 shelves not included in the bed count. Murchison has been awarded the status of a “baby friendly” hospital, meaning that it has met WHO and United Nations Children’s Fund (UNICEF) guidelines for creating an environment that supports successful breastfeeding.<sup>20</sup> Moreover, Murchison was awarded the Premier Award for Best District Hospital in South Africa both in 2004 and 2005.<sup>21</sup> Additionally, the hospital has a Voluntary Testing and Counseling program (VCT) and is an anti-retroviral (ARV) roll-out site.

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<sup>15</sup> World Health Organization and United Nations Children’s Fund. Joint Monitoring Programme for Water Supply and Sanitation. Online database. <<http://www.wssinfo.org/en/welcome.html>>.

<sup>16</sup> *Ibid.*

<sup>17</sup> “Health Statistics: Diarrhea Incidence.” *Health Systems Trust*. 30 March 2007. <<http://www.hst.org.za/healthstats/132/data>>.

<sup>18</sup> *Ibid.*

<sup>19</sup> Walker, A. R. P.; Walker, B. F.; Dunn, M. J.; Dunn, S. E. *The Journal of the Royal Society for the Promotion of Health*, **1994**, *144*, 33-38.

<sup>20</sup> “The Baby-Friendly Hospital Initiative.” UNICEF. 30 April 2007. <[http://www.unicef.org/nutrition/index\\_24806.html](http://www.unicef.org/nutrition/index_24806.html)>.

<sup>21</sup> Hardy, B; Interview. Murchison Hospital. 12 April 2007. 8:10-8:20 A.M.

In the general pediatric wards there are 39 beds, 2 incubators, and one phototherapy bed not included in the bed count. Moreover, the pediatric wards have the capacity to board 10 mothers; those facilities are also not included in the bed count.<sup>22</sup> There are twelve beds in the pediatric gastroenteritis ward (Appendix A).<sup>23</sup> Three doctors, including Dr. Silvia Paz, a senior doctor; and two doctors completing their required community service at Murchison, Dr. Trevor Pillay and Dr. Tami Nair, treat patients in the pediatric wards. Approximately 15 at any one time administered care to pediatric ward patients and the ward boasted two HIV/AIDS counselors. Dieticians also see patients daily.

#### *2.4. Objectives of Study*

The specific objectives of this study are to obtain an understanding of the burden of pediatric diarrhea at Murchison and in the Ugu District, including its incidence, prevalence and mortality rate. Possible trends between patients' families are explored, such as their access to adequate facilities, their personal hygienic practices, and their infant-feeding practices. In this way, Murchison District Hospital is contextualized in reference to data from other similar health facilities, and statistics for the entire province and country. In addition, the diagnoses and treatments of pediatric diarrhea with regard to each procedure's cost-benefit ratio for both emergency and non-emergency cases were studied and compared to recommendations of the South African Department of Pediatrics, which are based on WHO and UNICEF recommendations. Moreover, preventative measures are considered, such as education. Economic, social and cultural barriers to these preventatives are also investigated. The study culminates in directly addressing the question of why so many children continue to die from a

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<sup>22</sup> Observation of Murchison Hospital flyer. Pediatric Ward. 16 April 2007. 9:00 A.M.

<sup>23</sup> *Ibid.*

condition that is relatively inexpensive to treat and easily preventable. The investigator gives recommendations for the nation, the province of KwaZulu-Natal, and Murchison District Hospital and assess whether or not they are realistic and practical.

## 2.5. Definitions

### 2.5.1. Population Definitions

For the scope of this study, “child,” and “pediatric,” and other such words will refer to individuals under the age of 5 years old, while “infant” will refer to individuals under 1 year old. Moreover, the investigator will use the words “physician” and “doctor” interchangeably.

### 2.5.2. Diarrheal Definitions

#### 2.5.2.1. Stool Classifications

Soft stool: normal stool, described as resembling “thick porridge.”<sup>24</sup>

Semi-loose stool: slightly watery stool, described as resembling “soup.”<sup>25</sup>

Loose stool: completely liquid stool, described as resembling “water.”<sup>26</sup>

#### 2.5.2.2. Diarrhea Classifications

Acute diarrhea: 4 or more loose stools in a 24-hour period.<sup>27</sup>

Persistent diarrhea: An episode that begins acutely and lasts at least one week.

Chronic diarrhea: An episode that begins acutely and lasts for longer than two weeks.

Nonspecific cases of diarrhea will also be referred to as gastroenteritis.

### 2.5.3. Categorizing Stages of Dehydration

The biological dangers of diarrhea are dehydration and metabolic deficiencies that commonly occur if treatment is not sought quickly. Correctly assessing the severity of dehydration is

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<sup>24</sup> Paz, S. Interview. 28 April 2007. 11:00 A.M.-12:00 P.M.

<sup>25</sup> *Ibid.*

<sup>26</sup> *Ibid.*

<sup>27</sup> *Standard Treatment Guidelines and Essential Drugs List 2006*. Pretoria: The National Department of Health, 2006. 23-35.

essential to choosing the most appropriate intervention. The spectrum of dehydration includes conditions from no visible dehydration to shock.

Table I. Medical categorizations for accessing how severely a patient is dehydrated.<sup>28</sup>

<b>Signs of dehydration</b>	<b>Shock</b>	<b>Severe Dehydration</b>	<b>Dehydration</b>	<b>No visible dehydration</b>
<b>As a percent</b>	(one of the signs below)	(two of the signs below) <b>10%&lt;-----→7.5%</b>	(two of the signs below but not severe dehydration) <b>5%</b>	(none of the sign of dehydration)
Level of consciousness	decreased level of consciousness	lethargic or unconscious	restless or irritable	well, alert
Eyes sunken		eyes sunken	eyes sunken	eyes not sunken
Ability to drink		drinks poorly or unable to drink	thirsty, drinks eagerly	drinks normally, not excessive thirst
Skin pinch (turgor)		severe decrease in skin turgor; skin pinch returning in > 2 seconds	moderate decrease in skin turgor; skin pinch returning in < 2 seconds	skin pinch goes back immediately
Capillary filling time	capillary filling time > 3 seconds			
Cardiovascular	decreased BP with rapid thready pulse			

In the least severe category of dehydration, no visible dehydration, the doctor is unable to observe any symptoms of dehydration. Distress or pinched skin returning after less than 2 seconds indicates moderate dehydration. Severe dehydration is yet more dangerous and the patient now appears very dehydrated. The patient becomes lethargic, may drink poorly or has skin that does not return for over 2 seconds when pinched. Shock, the most severe category of dehydration, affects a patient's vital signs, such as blood pressure and consciousness.

<sup>28</sup> Adapted from: *Standard Treatment Guidelines and Essential Drugs List 2006*. Pretoria: The National Department of Health, 2006. 23-35.

### 3. Literature Review

#### 3.1. Infant Feeding Practices

Infant feeding practices have been documented as contributing to an infant's susceptibility to diarrhea. It has been well documented that exclusive breastfeeding (EBF) significantly reduces a child's risk of becoming infected with diarrheal diseases.<sup>29</sup> Moreover, EBF appears to reduce the risk of infection during early post partum (0-6 months) when it would be potentially most dangerous to the child.<sup>30</sup> One study found that at six weeks, when compared to EBF infants, ERF infants were four-fold more likely to have become infected with diarrheal diseases, one and a half fold more likely to have become infected at three months, and 20% more likely to have become infected at six months.<sup>31</sup> Moreover, a pooled-meta analysis conducted by the WHO of studies of breast milk and infant mortality in developing countries that compared to infants who were exclusively breastfed, found that infants who are not breastfed and consume formula milk or other replacement feeding have a 6-fold increased risk of dying within the first 2 months of life, a 4-fold increase between 2-3 months, and a 2.5 fold increase between 4-5 months, mainly due to an increased risk of developing diarrheal diseases or pneumonia.<sup>32</sup> Furthermore, when the Center for Disease Control (CDC) compared children visiting emergency rooms for diarrhea with children admitted for other illnesses, and interviewed parents about their child's health, feeding history, and environment, the CDC found that the most significant risk factor was not

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<sup>29</sup> Nduati, R.; John, G.; Mbori-Ngacha, D.; Richardson, B.; Overbaugh, J.; Mwatha, A. *et. al. JAMA*. **2000**, 283. 1167-1174. <<http://jama.ama-assn.org/cgi/content/abstract/283/9/1167>>.

<sup>30</sup> Rollins, N. "Infant feeding practices to prevent HIV transmission." *SIT Public Health Lecture Series*. 29 March 2007. 1:00-3:30 A.M.

<sup>31</sup> Nduati, R.; John, G.; Mbori-Ngacha, D.; Richardson, B.; Overbaugh, J.; Mwatha, A. *et. al. JAMA*. **2000**, 283. 1167-1174. <<http://jama.ama-assn.org/cgi/content/abstract/283/9/1167>>.

<sup>32</sup> Doherty, T.; Chopra, M. "Chapter 13: HIV and Infant Feeding." *South African Health Review 2006*. Durban: Health Systems Trust, 2006. <[www.hst.org.za](http://www.hst.org.za)>.

breastfeeding.<sup>33</sup> In fact, children who had suffered from diarrhea were 50-fold more likely to be non-breastfed than other children.<sup>34</sup> These statistics appear to suggest that breast milk protects children from becoming infected with diarrheal diseases.<sup>35</sup>

### 3.2. *Malnutrition and HIV*

Moreover, infants who are ERF often do not receive necessary nutrients and suffer from malnutrition.<sup>36</sup> One of the most common co-morbidities of diarrhea is malnutrition.<sup>37, 38</sup> Diarrhea exacerbates malnutrition by lowering the absorption of nutrients into the blood stream and malnutrition weakens the immune system and increases the severity of the diarrhea.<sup>39</sup> HIV completes the vicious triangle of co-morbidity by increasing a child's nutritional requirements.<sup>40</sup> Moreover, a child whose immune is compromised as the result of HIV becomes more susceptible to bacteria and viruses that cause diarrhea.<sup>41</sup>

### 3.3. *Transmission Pathways*

According to Winblad *et. al.*, “the most important pathways for the transmission of diseases from feces are hands, flies, water, soil as well as food that have been contaminated by any of the first four factors.”<sup>42</sup> Accordingly, risk factors that have been documented as most typically associated with transmission of diarrhea, including storage of drinking water, having an

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<sup>33</sup> Rollins, N. “Infant feeding practices to prevent HIV transmission.” *SIT Public Health Lecture Series*. 29 March 2007. 1:00-3:30 A.M.

<sup>34</sup> *Ibid.*

<sup>35</sup> *Ibid.*

<sup>36</sup> Doherty, T.; Chopra, M. “Chapter 13: HIV and Infant Feeding.” *South African Health Review 2006*. Durban: Health Systems Trust, 2006. <[www.hst.org.za](http://www.hst.org.za)>.

<sup>37</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

<sup>38</sup> *Standard Treatment Guidelines and Essential Drugs List 2006*. Pretoria: The National Department of Health, 2006. 23-35.

<sup>39</sup> *Ibid.*

<sup>40</sup> Knight, S.; SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007. 8:30 -11:00 A.M.

<sup>41</sup> *Ibid.*

<sup>42</sup> Winblad, U.; Simpson-Herbert, M. “Sanitizing human Excreta.” *Ecological Sanitation*. Stockholm Institute: Stockholm, 2004. 10-11.

overflowing latrine, having standing water in close proximity to a household, and caregivers not washing their hands after using the toilet.<sup>43</sup> Studies indicate that unsafe water and inadequate sanitation along with insufficient hygiene accounts for 88% of documented cases of diarrheal disease.<sup>44</sup> For example, in a study conducted by the World Health Organization, Prüss *et. al.* estimated that providing basic sanitation and introducing an improved water supply decreased diarrheal disease rates of participants by 37.5%.<sup>45</sup> In addition, studies have shown that hand washing with soap can reduce the incidence of diarrheal diseases by 42-47%.<sup>46</sup>

### 3.4. Incidence and Mortality Rate

Studies of diarrhea in South African health facilities have examined the incidence and mortality rate of pediatric diarrhea in their respective facilities. These studies include those conducted at Witbank Regional Hospital, located in the province of Mpumalanga, and at Ndwedwe Community Health Center, a small clinic that serves a deep rural area located in the iLembe District in KwaZulu-Natal (KZN) in 2006.<sup>47</sup> The Witbank study investigates the mortality rate of pediatric diarrhea from January to June 2006.<sup>48</sup> The study executed at Ndwedwe concentrates on the incidence of diarrhea and related cases of dehydration.<sup>49</sup> Together they provide a basis for comparison of relative incidence and mortality rates of pediatric diarrhea.

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<sup>43</sup> Rollins, N. "Infant feeding practices to prevent HIV transmission." *SIT Public Health Lecture Series*. 29 March 2007. 1:00-3:30 A.M.

<sup>44</sup> Water, Sanitation and Hygiene Facts." World Health Organization. 2004. <[http://www.who.int/water\\_sanitation\\_health/publications/facts2004/en/index.html](http://www.who.int/water_sanitation_health/publications/facts2004/en/index.html)>.

<sup>45</sup> Prüss, A.; Kay, D.; Fewtrell, L.; Bartram, J. "Estimating the Burden of Disease from Water, Sanitation, and Hygiene at a Global Level." *110*, May 2002.

<sup>46</sup> *Lancet Infectious Diseases* 2003, 3, 275-281.

<sup>47</sup> Statistics South Africa. Mortality and causes of death in South Africa, 2003 and 2004: Findings from death notification. Statistical release P0309.3 Pretoria: Statistics of South Africa; 2006. <<http://www.statssa.gov.za>>.

<sup>48</sup> Janse van Rensburg, S. "Child PIP in Witbank Hospital." Lecture: Kemptonpark. 26 Oct 2005.

<sup>49</sup> Ocheltree, K.; "Treatment of Pediatric Diarrhea at the Ndwedwe Community Health Center and Among Several Caregivers." Durban: SIT Public Health, 2006.

### 3.5. *The Current Study*

A 1994 study of Murchison concluded that gastroenteritis and malnutrition diseases were among the “chief causes of admission” for rural, African children under twelve.<sup>50</sup> This study will examine the current admission, incidence, and mortality rate of pediatric diarrhea at Murchison District Hospital, located in the Ugu District in Port Shepstone in KZN. It will also investigate possible explanations for these statistics using gathered information on patients and their caregivers. This data will include factors documented to contribute to or protect a child from becoming infected, including infant feeding practices, malnutrition, HIV, access to clean water and improved sanitation, and handwashing practices.

## 4. Methodologies

### 4.1. *Data Collection*

To adequately explore and examine pediatric diarrhea, one must make numerous observations and consult a variety of sources to appropriately contextualize the collected data. At Murchison Hospital, the investigator served as an observer and sometimes as an IsiZulu translator. Approximately ten cases of pediatric diarrhea per diem for approximately two weeks were observed. These case observations included the patient screening, processing, assessment, diagnosis, and treatment. The possible causes, diagnostic procedures, and treatment of pediatric diarrhea were studied through observation of specific cases and subsequent inquiries posited to the respective doctors and nurses. Any deviations from WHO, UNICEF, or KwaZulu-Natal (KZN) recommended diagnostic procedures and treatments were noted and explored further in hopes of better understanding.

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<sup>50</sup> Walker, A. R. P.; Walker, B. F.; Dunn, M. J.; Dunn, S. E. *The Journal of the Royal Society for the Promotion of Health*, **1994**, *144*, 33-38.

The investigator also consulted hospital records about the prevalence, incidence, mortality rates, and possible prevention of pediatric diarrhea, as well as nutrition in KZN and in the local community and region. Doctors' estimations of and qualitative attitudes toward these indicators were then compared to the actual figures. Data obtained at Murchison Hospital was framed in relation to data on Ndwedwe Community Health Center (CHC), Witbank Hospital, the province of KZN, and the entirety of South Africa. Data on these additional locations was obtained from secondary sources, such as literature and experts outside of the hospital. The investigator used these sources to examine consistencies and discrepancies and seek out possible explanations for them. Moreover, physicians' patient recommendations concerning breastfeeding and opinions about the advantages and disadvantages of a "baby friendly" hospital were recorded. Results were examined when considering whether "baby friendly" messages contribute to the reduction of diarrheal incidence.

Twenty mothers of patients were subsequently interviewed as to their access to facilities and practiced behaviors. If necessary, the investigator kindly asked a nurse to translate for him. The investigator asked about the mothers' access to safe water and sanitation as well as their hand washing practices. Parents' or guardians' infant feeding practices, access to water, available toilets, hand washing facilities, and hygienic practices were also examined. This data was compiled against the backdrop of secondary source statistics on prevention and causation. In addition, the investigator noted the age and race of the parent or guardian and examined the data for trends to confirm or reject stereotypical trends, such as that the mothers of children who suffer from persistent diarrhea are mostly teenage African women.

Doctors on-call and nurses were interviewed about preventing pediatric diarrhea. The investigator also observed pediatric diarrhea that becomes elevated to a state of emergency. Two doctors were shadowed when they were on-call for two separate 24-hour shifts, respectively. The doctors were subsequently asked about diarrheal treatment, as well as how and why preventable and controllable conditions escalate to emergency conditions. The investigator inquired if there could be any preventative measures to reduce the number of life threatening cases of pediatric diarrhea and child mortality. The investigator also asked whether the doctors had noted any observable trends of patients. Additionally, two nurses, Sister Malimba and Sister Mjojeli were asked about preventative education. Informal interviews were conducted with two nurses. Inquires were made about their ability to administer all doctor recommendations. Moreover, possible economic, social, and economic barriers to prevention and treatment were addressed.

The investigator accompanied Dr. Nair on her weekly visit to Izolenbene Clinic, located in Murchison's catchment area, which refers patients to Murchison when necessary. The investigator was given a short tour. Also, patient screening, processing, assessment, and diagnosis were observed. When a nurse was not immediately available for assistance in translating, the investigator made himself available for simple translations from IsiZulu to English for Dr. Nair. In the short interims between patients, the investigator was able to ask Dr. Nair questions.

While obtaining data, difficulties arose. Certain excursions, such as that to Izolenbene Clinic, yielded no opportunities for observation of diarrheal cases or interviews. Also, certain parties

were unavailable during the investigator's abbreviated study. For example, community health workers (CWCs) were unable to be reached for queries. Moreover, some parents and guardians preferred to not answer certain questions. More problematic was that parties may have incorrectly perceived that the investigator desired a certain response and may have shaped their answers to fit that mold or completely changed or fabricated their answers. Standardizing those present during interviews remained difficult and potentially problematic. For example, having medical professionals present during interviews with parents of patients may affect the parents' answers. Additionally, having one's professional superior present during an interview may cause the interviewed party to censor certain responses or shape them so as to satisfy or not to offend that superior. Furthermore, some parties would not consent to being interviewed.

#### *4.2. Precautions and Ethical Concerns*

Research becomes more than invalid when ethical concerns, such as privacy, confidentiality, anonymity, and integrity are ignored or neglected. It becomes a detriment to the academic community and can damage individuals, organizations, and communities. For these reasons, the investigator took extreme precautions to protect and maintain informants' physical, psychological, and social safety through careful consideration of the spectrum of potential repercussions for every situation and action. "Informants" for this study are defined as individuals who provide information to the investigator, whether or not via inquiry by the investigator and whether or not that information is subsequently included in the final report. While foreseen informants included doctors, nurses, and parents of patients, unforeseen interviews and unexpected informants were anticipated.

Obtaining consent from informants prior to a consultation was essential for maintaining their desires about the subsequent availability of the information that he or she provides. The investigator only consulted informants who gave the investigator permission to interview them. The investigator then further probed the extent of permission explicitly, inquiring whether the informant's name, age, profession, race, or other defining characteristics could be cited. Moreover, the investigator inquired whether the general public could have access to the informant's information. The investigator completely respected the wishes of every informant, such as confidentiality or anonymity, regardless of pressure from third parties.

Different levels of interview formality require different considerations. For formal, scheduled interviews, informants were asked to sign a consent form, which detailed the objectives of the project. During the interview, the investigator obtained further consent to reproduce any potentially controversial statement immediately after the statement was spoken. The investigator reserved the right to cancel an interview if and when he suspected that the informants did not fully understand the study or could not provide consent, regardless of whether the informant had signed the consent form. If an interview could not be cancelled without harming the relationships with those present, then the investigator shortened the interview and subsequently properly discarded any collected data.

Interviews were conducted one-on-one when possible. If the investigator judged the informant to be unduly influenced by other parties present, the investigator reserved the right to end the interview and properly discard any collected data. If informants volunteered information before the investigator could obtain consent, the investigator obtained consent after each statement that

the investigator desired to reproduce. Throughout interviews or informal conversations, the investigator made himself completely available to all informants so as to better establish relationships of trust. Such relationships promote honest discussions and better communication of information and data.

Data is an extension of the informant and as such should be carefully considered and protected. Rough data, or data that was collected on site, was stored in a small, pocket-sized notebook. This data was then analyzed and considered for its usability, including the extent of permission given and the applicability of the data. Data that needed to be properly discarded was then crossed-out, removed from the notebook, torn into multiple pieces, and discarded in multiple trash receptacles in different locations in a timely manner. This notebook was not shared with others, and upon completion of the study was properly discarded as well.

Data for which permission was given to publicly reproduce it and which also assists the investigator in the study of pediatric diarrhea was recorded in an Independent Study Project Journal (ISP journal). Data was then reconsidered and that which may have harmed the integrity of the informant, individuals, the community, or Murchison District Hospital were properly discarded. For example, data in which an informant criticizes a superior may potentially harm both his or her professional reputation and personal feelings and was discarded properly. Although not discarded, the ISP journal will only be made available to others when the investigator deems it necessary and appropriate. In these ways, the investigator will ensure that proper ethics are maintained and informant's safety protected.

## 5. Findings and Analysis

### 5.1. Morbidity and Mortality Burden of Pediatric Diarrhea at Murchison

#### 5.1.1. Admissions

Table II. Monthly tabulation of those admitted to pediatric gastroenteritis (GE) ward for 15 months from January 2006 to March 2007.<sup>51</sup>

Month	GE Admissions
January 2006	38
February	53
March	45
April	43
May	77
June	71
July	29
August	18
September	21
October	29
November	23
December	29
January 2007	41
February	53
March	41
Total	611
Monthly Average	41

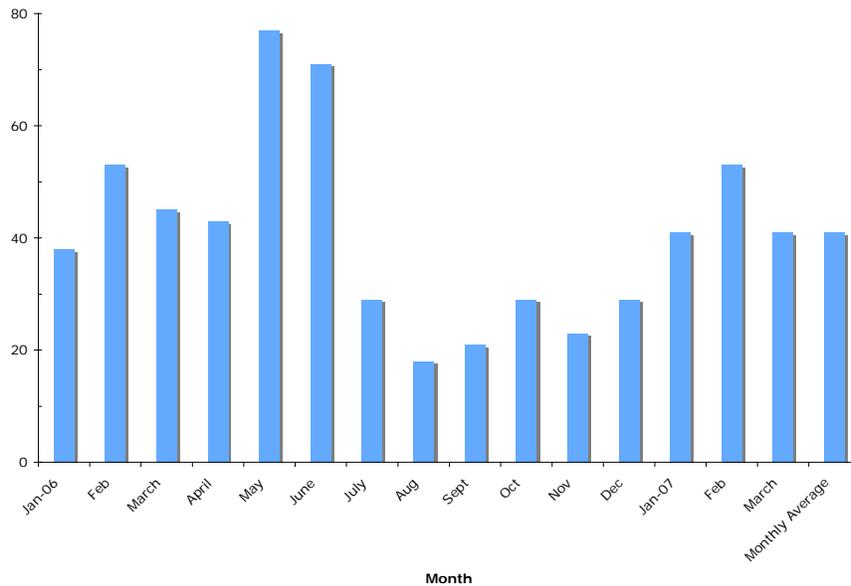


Figure 1. Monthly tabulation of those admitted to pediatric gastroenteritis (GE) ward for 15 months from January 2006 to March 2007.<sup>52</sup>

<sup>51</sup> Murchison Hospital Pediatric Wards Admission Book. 16 April 2007. 9:00 A.M.-11:00 A.M.

At Murchison District Hospital, data on pediatric admissions during 2006 and 2007 revealed that 488 of every 1833 children admitted (26.62%) suffered from gastroenteritis.<sup>53</sup> The most admissions for gastroenteritis occurred during February 2006 (77 admissions) and the fewest admissions for gastroenteritis was during August 2006 (18 admissions), creating a large spectrum of two admission per day in February to about one admission every other day in August (Table II, Figure 1). Between months then, the number of admissions seems largely inconsistent. The number of admissions for February 2006 was more than the sum of admission for July, August, and September 2006. In this way, there appears to be a trend in incidence with more cases occurring during the late summer and early spring, especially between February and June (Table II, Figure 1). This is consistent with physicians' estimates that gastroenteritis accounts for between 25 and 30% of pediatric admissions and provides evidence for doctors' claims that pediatric diarrhea is "seasonal."<sup>54</sup>

Unfortunately, data for Murchison District Hospital remains rather difficult to compare to data for the entire province. In KZN, the province consistently with the highest incidence since 2001, diarrhea affected 487 of every 1000 children (48.70%) in 2005, almost tripling the incidence of 2000 and doubling the 244.2 (24.42%) incidence of 2004.<sup>55</sup> Unfortunately, the large discrepancies in these incidences do not lead to any one particular conclusion. Hospital records from 2004 remained inaccessible to the investigator. From the onset then, one must attempt to compare data from two different time periods and therefore, potentially two different populations. Beyond this complication and the possibility of inaccurate reporting, however, the

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<sup>52</sup> *Ibid.*

<sup>53</sup> *Ibid.*

<sup>54</sup> Paz, S.; Nair, T.; Pillay, T. Interview. 13 April 2007. 10:00 A.M.-10:10 A.M.

<sup>55</sup> Walker, A. R. P.; Walker, B. F.; Dunn, M. J.; Dunn, S. E. *The Journal of the Royal Society for the Promotion of Health*, **1994**, *144*, 33-38.

data still cannot provide more than the means for the simple numerical comparison that the province overall appears to have a higher incidence than the catchment area of Murchison District Hospital (Table II, Figure 1). Furthermore, the difference may not be accurate. One cannot even be certain whether this discrepancy is real without knowing the months during which the province data was collected. The KZN data may be skewed if it was only collected during the pinnacle of gastroenteritis “season” or “off-season.”

One of the most significant dangers of diarrhea is dehydration. Dr. Paz estimates that approximately 1 in 3 pediatric diarrhea patients (204 patients, 33.33%) arrive at Murchison in shock.<sup>56</sup> Additionally, the investigator estimated that at about 25% of patient had moderate to severe dehydration.<sup>57</sup> A similar study conducted at Ndwedwe Community Health Center (CHC), a smaller clinic located in KwaZulu-Natal (KZN), in 2006 found a much lower incidence of dehydration among patients suffering from diarrhea, citing that “in one month, there are generally only two to three cases of children suffering from diarrhea with some dehydration and maybe one case of diarrhea with severe dehydration.”<sup>58</sup>

Admittedly, the populations served by these two health facilities differ greatly. Ndwedwe CHC is a small clinic that serves a deep rural area, while Murchison Hospital is a larger district hospital located in a semi-rural area that serves clinics, such as Ndwedwe CHC. Therefore, it becomes difficult to compare data on severity of illness when one was built to treat severe illness and one was meant to refer patients to the former. Although, patients are supposed to be referred

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<sup>56</sup> Paz, S. Interview. 28 April 2007. 11:00 A.M.-12:00 P.M.

<sup>57</sup> Observation. Murchison Hospital Pediatric Gastroenteritis Ward. April 12-April 26.

<sup>58</sup> Ocheltree, K.; “Treatment of Pediatric Diarrhea at the Ndwedwe Community Health Center and Among Several Caregivers.” Durban: SIT Public Health, 2006. 18-19.

to a hospital from a clinic, many bypass the clinic and go to the hospital, especially in emergency cases. However, the difference in environments may equate to Ndwedwe being less accessible than Murchison Hospital in which case Ndwedwe would likely have a lower incidence of severe cases of dehydration for pediatric gastroenteritis patients, because more would perish at home.

### 5.1.2. Number of Deaths and Mortality Rate

Table III. Deaths and mortality rates of children with diarrhea as an underlying cause from September 2006 to March 2007 recorded monthly, including a monthly average.<sup>59</sup>

Month	Admissions	Transfers/Referrals	Deaths	Mortality Rate	
				Per 1000 admissions	Percentage
September 2006	21	0	1	48	4.76
October	29	1	4	143	14.29
November	23	1	3	136	13.64
December	29	0	4	138	13.79
January 2007	41	2	7	180	17.95
February	53	3	10	200	20.00
March	41	2	9	231	23.08
Total	237	9	38	–	16.67
Monthly Average	34	1	5	167	4.76

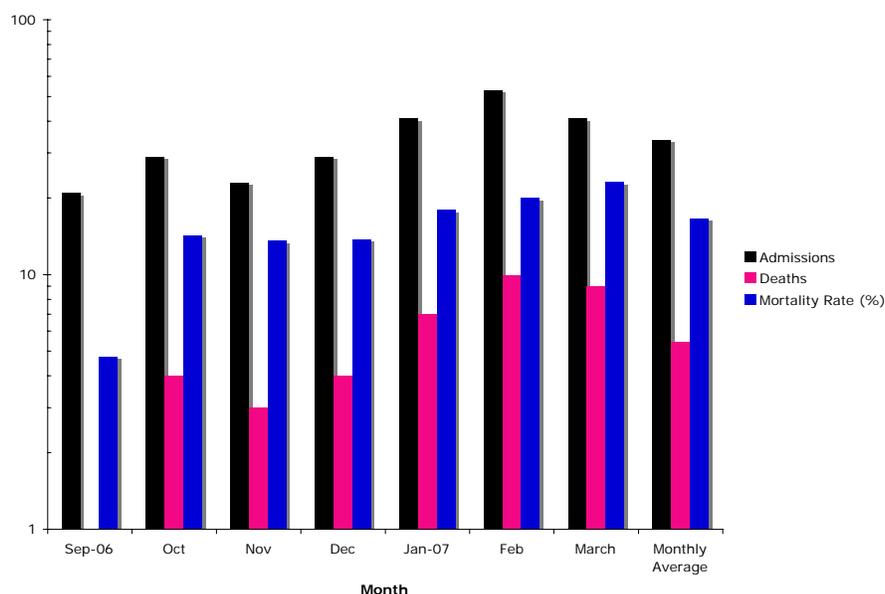


Figure 2. Deaths and mortality rates of children with diarrhea as an underlying cause from September 2006 to March 2007 recorded monthly, including a monthly average (LOG scale).

<sup>59</sup> Murchison Hospital Pediatric Wards Admission Book. 16 April 2007. 9:00 A.M.-11:00 A.M.

Between September 2006 and March 2007 there were 237 admissions to the pediatric gastroenteritis ward; 9 transfers to other wards or referrals to other hospitals or clinics; and 38 deaths. This translated to a monthly average of 34 admissions, 1 transfer or referral, 5 deaths, and an average mortality rate of 167 for every 1000 admissions (16.7%).<sup>60</sup> This was similar to interviewed physicians' estimates of an average mortality rate of approximately 150 for every 1000 admitted (15.0%).<sup>61</sup> This data can be compared to that from a similar hospital and data for the entire country. Witbank Regional Hospital, located in the province of Mpumalanga, reported a lower mortality rate of 122 for every 1000 admissions (12.2%) from January to June 2005.<sup>62</sup> However, beyond the more obvious discrepancies of time and the respective catchment populations, fewer deaths may have occurred at the regional hospital because children died in district hospitals before they could be referred. Although perhaps an exception, as a district-level hospital Murchison appeared to have the capacity to stabilize and treat pediatric diarrhea and dehydration despite their severity, as evidenced by the investigator observing all severely dehydrated patients or patients in shock being treated in Murchison and none being referred to the regional hospital. Across South Africa in 2004, the mortality rate of pediatric diarrhea, which is 230 for every 1000 affected (23.0%), is substantially higher than that of Murchison,<sup>63</sup> although the mortality rate of Murchison's catchment pediatric population could actually be similar or higher, as one does not know how many children perish outside of the hospital, such as at home or at clinics, in addition to deaths within the hospital. Murchison then becomes difficult to contextualize because comparison of its data to that of other health facilities, the province, and the country remains largely problematic.

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<sup>60</sup> *Ibid.*

<sup>61</sup> Paz, S.; Nair, T.; Pillay, T. Interview. 13 April 2007. 10:00 A.M.-10:10 A.M.

<sup>62</sup> Calculated from Janse van Rensburg, S. "Child PIP in Witbank Hospital." Lecture: Kemptonpark. 26 Oct 2005.

<sup>63</sup> Statistics South Africa. Mortality and causes of death in South Africa, 2003 and 2004: Findings from death notification. Statistical release P0309.3 Pretoria: Statistics of South Africa; 2006. <<http://www.statssa.gov.za>>.

## 5.2. Developing General Patient Profiles

Consequently, one must be content to develop and scrutinize patient profiles for possible trends. Additionally, factors that have been shown or are generally acknowledged to affect one's probability of and susceptibility to the viruses and bacteria that cause gastroenteritis were investigated, such as a patient's age, feeding type, nutrition, and HIV status.

### 5.2.1. Maternal Ages

Table IV. Age distribution of interviewed mothers of pediatric diarrhea patients.<sup>64</sup>

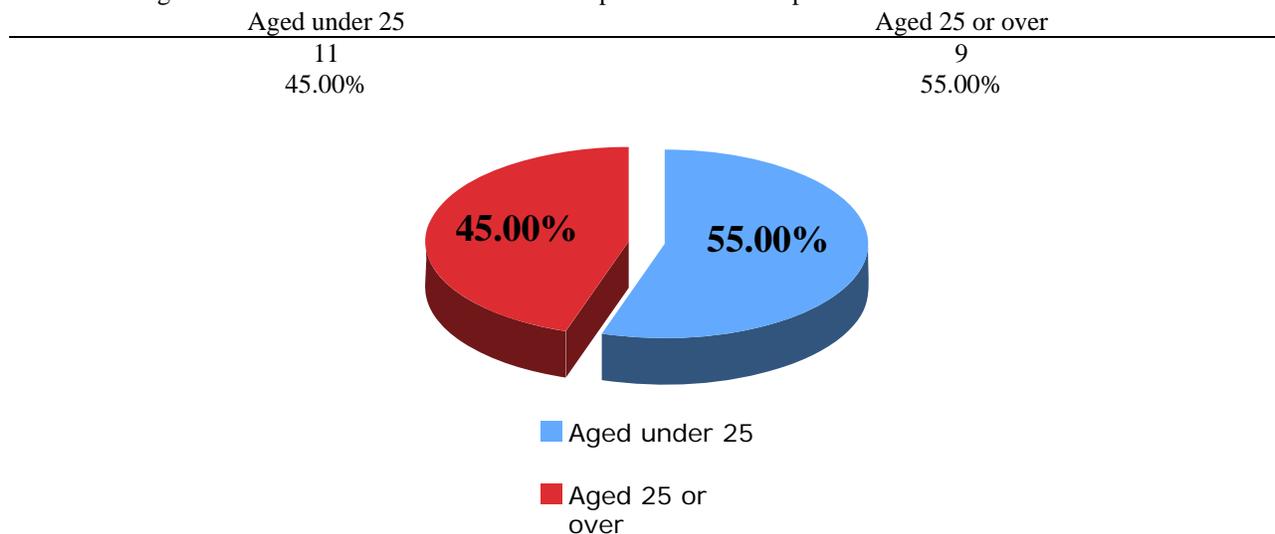


Figure 3. Age distribution of interviewed mothers of pediatric diarrhea patients.

The majority of the twenty mothers interviewed were under 25 years old (11 mothers, 55.00%) (Table IV, Figure 3). The data appears to offer little evidence for the common opinion that because pediatric diarrhea is so preventable, patients must have young, inexperienced mothers. In fact, this data seems to echo Dr. Paz's attitude that "the age of the mother is largely irrelevant as there appears to be no trend with gastroenteritis patients and parental age." However, this

<sup>64</sup> Informant mothers of diarrhea patients. Compiled interviews. 12 April - 26 April 2007.

very small sample size makes extrapolation of this data to larger populations problematic.

Conversely, the ages of patients seem to illustrate a trend.

### 5.2.2. Patient Ages

Table V. Deaths of children with gastroenteritis as an underlying cause categorized by the age groups less than one year old and equal to or greater than one year old.<sup>65</sup>

Children Aged Under 1 Year	Children Aged 1 Year or Over
29	9
76.32%	23.68%

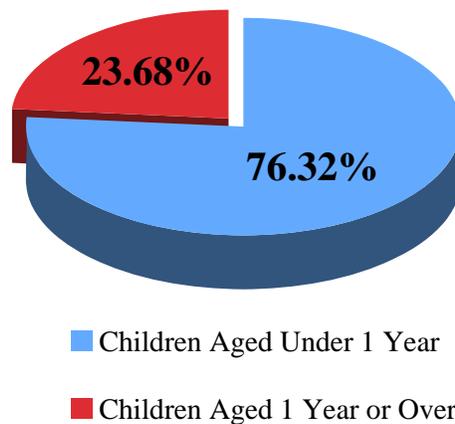


Figure 4. Deaths of children with gastroenteritis as an underlying cause categorized by the age groups less than one year old and equal to or greater than one year old.<sup>66</sup>

The majority of the children who died of gastroenteritis between September 2006 and March 2007 were under 1 year old (29 children, 76.32%) (Table V, Figure 4). This finding was expected as it complements expert findings.<sup>67</sup> Moreover, the data appears to echo the sentiments of those physicians interviewed at Murchison.<sup>68</sup> Dr. Paz and Dr. Pillay agreed with Dr. Nair when she explained that “infants under 1 year of age are biologically more susceptible to the

<sup>65</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

8:00 A.M.-10:00 A.M.

<sup>66</sup> *Ibid.*

<sup>67</sup> Knight, S.; SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007.

8:30 -11:00 A.M.

<sup>68</sup> Paz, S.; Nair, T.; Pillay, T. Interview. 13 April 2007. 10:00 A.M.-10:10 A.M.

bacteria and viruses that cause gastroenteritis because their immune systems are still developing and would have developed few antibodies to help to fight infection.”<sup>69</sup>

### 5.2.3. Malnutrition

Table VI. Malnutrition of children who died of gastroenteritis at Murchison from September 2006 to March 2007 based on mass and symptoms classified as either normal, over weight for age (OWFA), under weight for age (UWFA), kwashiorkor (kwashi), marasmus, or marasmus-kwashiorkor, according to WHO’s Integrated Management of Child Illness Standards (IMCI).<sup>70,71</sup>

Normal	OWFA	UWFA	Kwashi	Marasmus	M/K
5	2	9	1	16	5
13.16%	5.26%	23.68%	2.63%	42.11%	13.16%

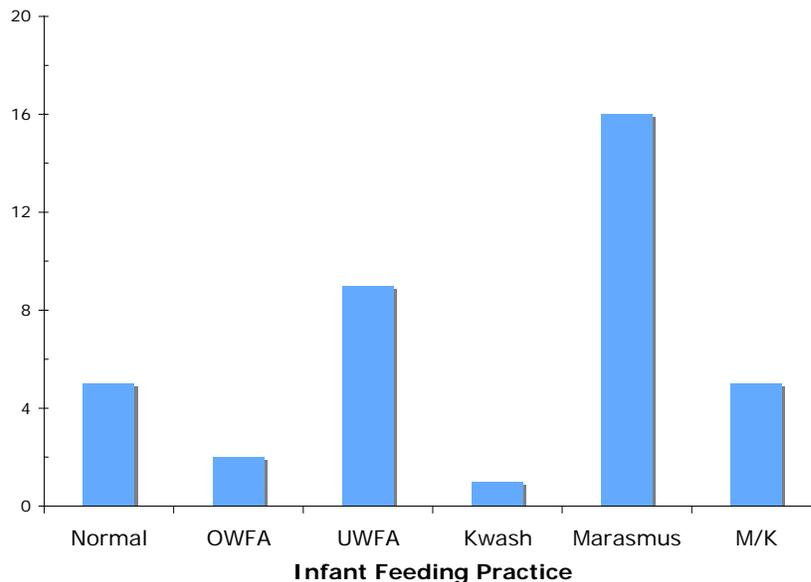


Figure 5. Malnutrition of children who died of gastroenteritis at Murchison from September 2006 to March 2007 based on mass and symptoms classified as either normal, over weight for age (OWFA), under weight for age (UWFA), kwashiorkor (kwashi), marasmus, or marasmus-kwashiorkor, according to WHO’s Integrated Management of Child Illness Standards (IMCI).<sup>72,73</sup>

<sup>69</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

<sup>70</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

<sup>71</sup> “Diarrhoeal Disease: Initial Fluid Management.” Department of Paediatrics. Pietermaritzburg: Province of KwaZulu-Natal Health Services, 8 March 2005.

<sup>72</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

<sup>73</sup> “Diarrhoeal Disease: Initial Fluid Management.” Department of Paediatrics. Pietermaritzburg: Province of KwaZulu-Natal Health Services, 8 March 2005.

One of the most common co-morbidities of diarrhea is malnutrition.<sup>74, 75</sup> Diarrhea exacerbates malnutrition by lowering the absorption of nutrients into the blood stream and malnutrition weakens the immune system and increases the severity of the diarrhea.<sup>76</sup> Most children who died were marasmic (16 children, 42.11%) and the fewest children were kwashiorkor (1 child, 2.63%) (Table VI, Figure 5).<sup>77</sup> Many children were under weight for their age (9 children, 23.68%), as many children were normal as were marasmus-kwashiorkor (5 children each, 13.16%), and fewer children were overweight for their age (2 children, 5.26%) (Table VI, Figure 5).<sup>78</sup> These results were expected, as this data appears to illustrate the vicious cycle between diarrhea and malnutrition.<sup>79</sup>

#### 5.2.4. HIV

Table VII. HIV status of children who died of gastroenteritis at Murchison from September 2006 to March 2007 classified as either exposed, HIV positive, HIV negative, or unknown. Also, tabulation of whether these children received anti-retrovirals (ARVs), excluded those who tested negative.<sup>80</sup>

Exposed	HIV Positive	HIV Negative	Unknown	ARVs Taken	ARVs Not Taken	Unknown
24	6	2	6	2	26	6
63.16%	15.79%	5.26%	15.79%	5.56%	72.22%	16.67%

<sup>74</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

<sup>75</sup> *Standard Treatment Guidelines and Essential Drugs List 2006*. Pretoria: The National Department of Health, 2006. 23-35.

<sup>76</sup> *Ibid.*

<sup>77</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

8:00 A.M-10:00 A.M.

<sup>78</sup> *Ibid.*

<sup>79</sup> Knight, S.; SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007.

8:30 -11:00 A.M.

<sup>80</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

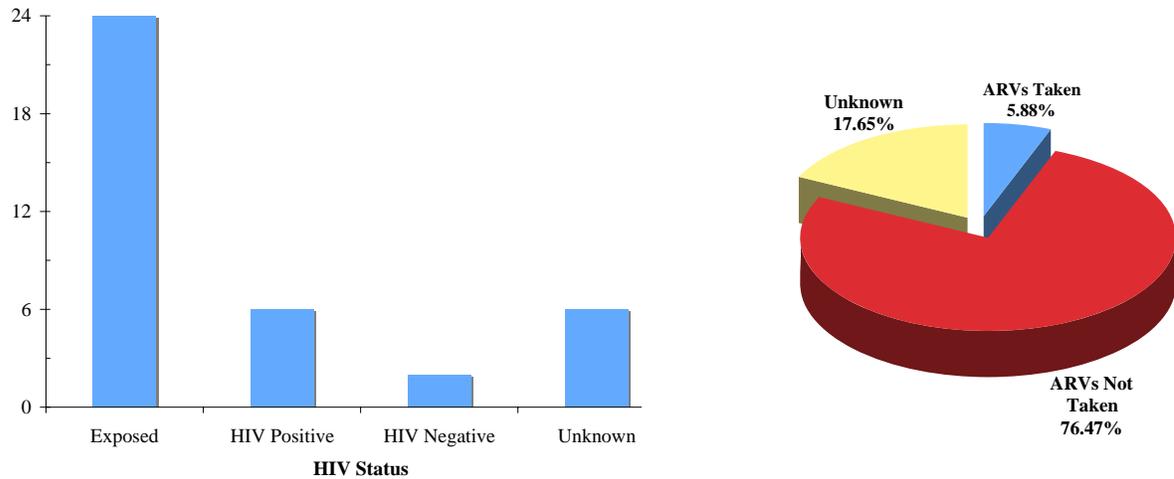


Figure 6. HIV status of children who died of gastroenteritis at Murchison from September 2006 to March 2007 classified as either exposed, HIV positive, HIV negative, or unknown. Also, tabulation of whether these children received anti-retrovirals (ARVs), excluded those who tested negative.<sup>81</sup>

HIV completes the vicious triangle of co-morbidity by increasing a child's nutritional requirements.<sup>82</sup> Moreover, a child whose immune system has been compromised as the result of HIV becomes more susceptible to bacteria and viruses that cause diarrhea. The majority of children were at least exposed to HIV (24 children, 63.16%) and an additional 6 children (15.79%) were HIV positive (Table VII, Figure 6).<sup>83</sup> Only two children had tested negative for HIV (2 children, 5.26%) and the statuses of the remaining children were unknown (6 children, 15.79%) (Table VII, Figure 6).<sup>84</sup> Unfortunately, this data does not illustrate any trends with its small sample size and substantial portion of children with unknown statuses (Table VII, Figure 6).<sup>85</sup> In light of the fact that Murchison is an ARV rollout site, the data was somewhat unsettling. Only 5.56% of children (2 children) who were HIV positive or exposed were receiving anti-retroviral therapy (ART). Studies estimate that 40% of HIV positive children

<sup>81</sup> *Ibid.*

<sup>82</sup> Knight, S.; SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007. 8:30 -11:00 A.M.

<sup>83</sup> Murchison Hospital Child Pip data: September 2006 - March 2007. 26 April 2007.

<sup>84</sup> *Ibid.*

<sup>85</sup> *Ibid.*

under 12 are in need of ART.<sup>86</sup> In 2006, 9.1% of children who qualify are receiving ART in KZN and 12.1% of children who qualify are receiving ART in South Africa.<sup>87</sup> Murchison then seems to administer ARVs relatively rarely to children, although providence and country statistics were for children under 15 years old. Perhaps within this group the percentage of these children who are under 5 in this study was actually less than the data for those under 5 at Murchison. The investigator passes no judgment on the hospital or its staff, nor is professionally qualified to do so. A majority these children may not have had CD4 counts low enough to qualify for ART. Moreover, the parents or guardians may have refused treatment for their children.

### 5.3. *Access to Facilities*

Unfortunately, these statistics come from patients post mortem. In order to make these statistics useful in the prevention of future deaths of children from diarrhea, one must delve deeper and gain awareness of patients' lifestyles and their hygienic environments. Dr. Stephen Knight, an expert on hygiene and sanitation, defines "hygienic environment" as involving both "the facilities to which one has access, as well as the behavior and habits that one practices."<sup>88</sup> A lack of access to certain necessities to health, such as adequate sanitation and clean water, complicates the process of maintaining one's health.

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<sup>86</sup> James, S.; Moodley, V. "Chapter 17: "The Health of Older Children in a School Setting." In: Ijumba, P.; Day, C.; Ntuli, A. editors. *South African Health Review 2006*. Durban: Health Systems Trust, 2004. <<http://www.hst.org.za/publications/423>>.

<sup>87</sup> *Ibid.*

<sup>88</sup> Knight, S.; SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007. 8:30 -11:00 A.M.

### 5.3.1. Access to Toilets

Table VIII. Sanitation access of mothers of gastroenteritis patients, recorded as either “long-drop” toilet, ventilated improved pit latrine (VIP), flush toilet, or none.<sup>89</sup>

Long-drop Toilet	VIP	Flush Toilet	None
16	2	2	0
80.00%	10.00%	10.00%	0.00%

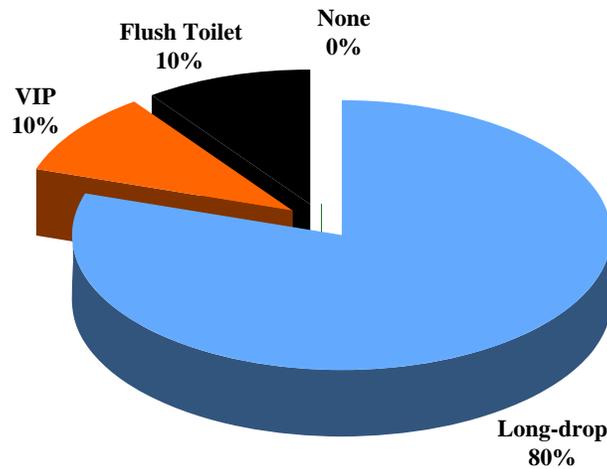


Figure 7. Sanitation access of mothers of gastroenteritis patients, recorded as either “long-drop” toilet, ventilated improved pit latrine (VIP), flush toilet, or none.<sup>90</sup>

Most mothers of pediatric gastroenteritis patients indicated that they have “long-drop” toilets (16 mothers, 80.00%), or toilets in which the waste collected in a hole in the ground (Table VIII, Figure 7).<sup>91</sup> As many had ventilated improved pit latrines (VIP) as had flush toilets (2 mothers each, 10.00%) (Table VIII, Figure 7).<sup>92</sup> Fortunately, all mothers reported having a toilet (Table VIII, Figure 7),<sup>93</sup> although data may be less than accurate, as one might expect the embarrassment of not having a toilet to cause one to be untruthful upon inquiry. The majority of families having “long-drop” toilet was unsurprising, because such toilets have a high probability

<sup>89</sup> Informant mothers of diarrhea patients. Compiled interviews. 12 April - 26 April 2007.

<sup>90</sup> *Ibid.*

<sup>91</sup> *Ibid.*

<sup>92</sup> *Ibid.*

<sup>93</sup> *Ibid.*

of contaminating the user; insects and animals that may come into contact with individuals have direct access to the waste. Nationally, only 44% of South Africa’s rural population has access to improved sanitation.<sup>94</sup> In 2005, 12.5% of households in KZN did not have a toilet.<sup>95</sup> In comparison, the catchment area of Murchison has approximately half as much access to improved sanitation (20%) (Table VIII, Figure 7).<sup>96</sup>

### 5.3.2. Access to Water

Table IX. Mothers’ of gastroenteritis patients access to water, recorded as household tap, community tap, or river.<sup>97</sup>

Household Tap	Community Tap	River
1	10	0
9.09%	90.91%	0.00%

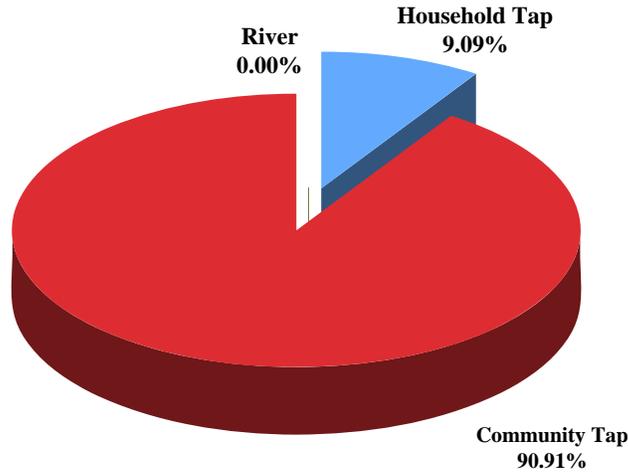


Figure 8. Mothers’ of gastroenteritis patients access to water, recorded as household tap, community tap, or river.<sup>98</sup>

Nearly all of the mothers interviewed obtained their water from a community tap (10 mothers, 90.91%) (Table IX, Figure 8).<sup>99</sup> None of the mothers took water from rivers, and one mother

<sup>94</sup> *Ibid.*

<sup>95</sup> General household survey July 2005. Statistical Release P0318. Pretoria: Statistics South Africa; 2006. <<http://www.statssa.gov.za>>.

<sup>96</sup> *Ibid.*

<sup>97</sup> Cohen, S.; “Murchison Hospital Maternal Interviews.” Maternity Ward. 12 April – 26 April.

<sup>98</sup> *Ibid.*

<sup>99</sup> *Ibid.*

had running water in her residence (9.90%) (Table IX, Figure 8).<sup>100</sup> Although this data was collected from mothers in Murchison Hospital’s Maternity Ward,<sup>101</sup> it still gives some general indication of mother’s access to water. One cannot extrapolate this sample of eleven mothers to a larger population, but perhaps one could extrapolate the data to eleven mothers of children in the gastroenteritis ward. Although preferable to river water, a community tap requires individuals to transport the water, creating more opportunity for contamination and transmission of the bacteria and viruses that could diarrhea. In South Africa, 73% of the rural population had access to improved water sources in 2002.<sup>102</sup> In 2005, 79.4% of households in KZN had access to piped water.<sup>103</sup> The catchment area of Murchison then has good access to clean water (99%) relative to other rural areas of South Africa (Table IX, Figure 8).<sup>104</sup>

#### 5.4. Maternal Behaviors

Admittedly, even appropriate facilities and resources do not necessary lead to improved health. To improve a hygienic environment, behaviors must accompany resources.<sup>105</sup> The following statistics attempt to assess behaviors generally accepted as important to maintaining one’s health: handwashing and infant feeding practices.

##### 5.4.1. Handwashing with Soap

Table X. Handwashing with soap practices of mothers’ of gastroenteritis patients.

Behavior	Facilities	No Access	Total (%)
Wash	5	-	25.00%
Do not wash	1	14	75.00%

<sup>100</sup> *Ibid.*

<sup>101</sup> *Ibid.*

<sup>102</sup> World Health Organization and United Nations Children’s Fund. Joint Monitoring Programme for Water Supply and Sanitation. Online database. <<http://www.wssinfo.org/en/welcome.html>>.

<sup>103</sup> General household survey July 2005. Statistical Release P0318. Pretoria: Statistics South Africa; 2006. <<http://www.statssa.gov.za>>.

<sup>104</sup> Cohen, S.; “Murchison Hospital Maternal Interviews.” Maternity Ward. 12 April – 26 April.

<sup>105</sup> Knight, S., M.D. SIT South Africa: Public Health Lecture Series. Public Health Seminar. 8 March 2007. 8:30 - 11:00 A.M.

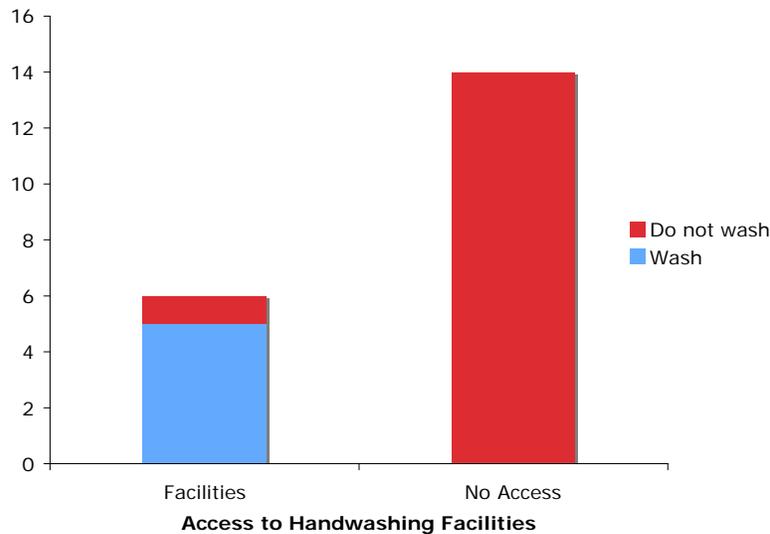


Figure 9. Handwashing with soap practices of mothers' of gastroenteritis patients.

In light of all interviewed mothers having access to theoretically clean water (Table IX, Figure 8), they were asked about their handwashing with soap practices. Handwashing is well documented as a very important practice in preventing diarrhea by reducing the common transmission route of feces or flies to hands and then food.<sup>106,107</sup> The majority of mothers indicated that they did not have handwashing facilities (14 mothers, 70.00%) (Table X, Figure 9).<sup>108</sup> The majority of those who have handwashing facilities use them (5 mothers, 83.33%) (Table X, Figure 9).<sup>109</sup> Admittedly, however, further considerations perhaps shed doubt on the accuracy of this data. Some informants potentially did not understand what was meant by “handwashing facility” and may therefore have answered incorrectly, although it seems unlikely as no one gave mutually exclusive answers, such as indicating a lack of access to a handwashing facility, but washing hands with soap after using the toilet or changing a diaper as a consistent

<sup>106</sup> Winblad, U.; Simpson-Herbert, M. “Sanitizing human Excreta.” *Ecological Sanitation*. Stockholm Institute: Stockholm, 2004. 10-11

<sup>107</sup> *Lancet Infectious Diseases* 2003, 3, 275-281.

<sup>108</sup> Informant mothers of diarrhea patients. Compiled interviews. 12 April - 26 April 2007.

<sup>109</sup> *Ibid.*

behavior. However, informants who have access to handwashing facilities may not have been entirely truthful about their handwashing practices due to the potential embarrassment of admitting that one does not wash his or her hands after using the toilet or changing a diaper. Consequently, the accuracy of the collected data should not be accepted with certainty.

#### 5.4.2. Infant Feeding Practices

Table XI. Maternal infant feeding practices for children who died of gastroenteritis at Murchison from September 2006 to March 2007 classified as either exclusive breast feeding (EBF), exclusive replacement feeding (ERF), mixed feeding, or unknown.

EBF	ERF	Mixed Feeding	Unknown
1	16	6	15
2.63%	42.11%	15.79%	39.47%

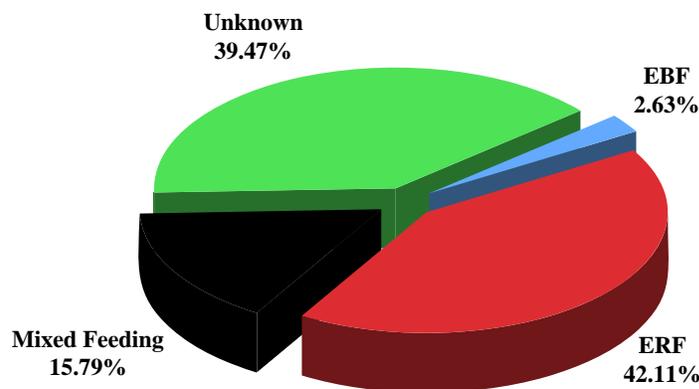


Figure 10. Maternal infant feeding practices for children who died of gastroenteritis at Murchison from September 2006 to March 2007 classified as either exclusive breast feeding (EBF), exclusive replacement feeding (ERF), mixed feeding, or unknown.

No categorical infant feeding practice captured the majority of informants' feeding choices. Most mothers replacement fed their children (16 children, 42.11%) (Table XI, Figure 10) and more mothers mix fed (6 children, 15.97%) than exclusively breast fed (1 child, 2.63%). Again,

this data coincides with previous studies and physician responses at Murchison. Dr. Nair commented, “Most pediatric diarrhea patients whom I see are formula fed.”<sup>110</sup>

### 5.5. *Management of Diarrheal Disease*

The South African Department of Pediatrics’ guidelines for management of diarrheal disease is a version of Integrated Management of Childhood Illness (IMCI), guidelines created by the UNICEF. Developed in 1992 to improve primary health care for children, IMCI is a “strategy for reducing the mortality and morbidity associated with the major causes of childhood illness.”<sup>111</sup> IMCI also addresses appropriate treatments for the most common life-threatening illnesses in children, including diarrhea.<sup>112</sup> Observed physicians strictly followed these guidelines when treating patients.<sup>113</sup>

#### 5.5.1. South African Department of Pediatrics’ Recommended Management of Diarrhea

Step 1: Quickly assess the patient’s severity of dehydration (Table I).

Step 2: Determine intake using the 4 R’s to proper fluid management: Resuscitation, Rehydration, Retain, and Replace.<sup>114</sup>

##### 5.5.1.1. *Resuscitation (If the patient is in shock)*

Shock is not the same as dehydration as it refers to depleted intravascular volume as opposed to extravascular volume.

- Give 20 mL/kg IV bolus immediately: Modified Ringers Lactate (MRL) or Normal Saline
- Review after the bolus
- If still shocked, repeat bolus of 20 mL/kg
- Thereafter, use 5-10 mL/kg boluses until there are signs of intravascular volume replenishment (ie. liver becomes palpable)
- Ask for experienced assistance

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<sup>110</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

<sup>111</sup> “IMCI a joint WHO/UNICEF initiative.” WHO and UNICEF. 1 May 2007. <[http://www.who.int/child-adolescent-health/New\\_Publications/IMCI/imci.htm](http://www.who.int/child-adolescent-health/New_Publications/IMCI/imci.htm)>.

<sup>112</sup> *Ibid.*

<sup>113</sup> Observation. Murchison Hospital Pediatric Gastroenteritis Ward. April 12-April 26.

<sup>114</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

**CAUTION: NEVER USE ½ DEROSE DEXTROSE (DD) AS A VOLUME EXPANDER BECAUSE IT CONTAINS GLUCOSE AND WILL CAUSE AN OSMOTIC DIURESIS AND THE PATIENT’S CONDITION WILL NOT IMPROVE.**

*5.5.1.2. Rehydration*

Dehydration refers to depleted extravascular volume. Therefore, even 10% dehydration is not equivalent to shock.

- For 5% dehydration, give 50 mL/kg/24 hours
- For 7.5% dehydration, give 75 mL/kg/24 hours
- For 10% dehydration, give 100 mL/kg/24 hours (do not give more than 100 mL/kg/24hour)
- Give this IN ADDITION to maintenance requirements (see below)

*5.5.1.3. Retain (Maintenance)*

Table XII. Fluid maintenance protocol for dehydrated children.

Age of Child	MRL or Normal Saline Administered (mL / kg/ 24 hours)
Under 1 year	120
1-2 years	100
2-3 years	85
Over 3 years	70

*5.5.1.4. Replacement of Losses*

- Give 5 mL/ kg/ loose stool or case of vomiting

Step 3: Decide what to administer (Water vs. Food)

Table XIII. Types of rehydration and appropriate solutions.

Type of Rehydration	Recommended Solution <sup>115</sup>
IV Resuscitation	Ringers Lactate or normal saline
IV Rehydration	½ DD
IV Retain	½ DD
IV Replacement	½ DD
Oral Rehydration	Oral rehydration solution (home mix, ORS, Soral)
Oral Retain	Breast / Formula

**CAUTION: NEVER USE ½ DEROSE DEXTROSE (½ DD) AS AN ORAL REHYDRATION SOLUTION BECAUSE IT CONTAINS GLUCOSE AND WILL CAUSE AN OSMOTIC DIURESIS AND THE PATIENT’S CONDITION WILL NOT IMPROVE.**

When administering intravenous fluids to a child, especially when replenishment is required, use an electronic flow controller (like an IVAC pump) EVEN IN DISTRICT HOSPITALS.

Children suffering from diarrheal diseases should be assessed ideally every 8 hours.

<sup>115</sup> “Diarrhoeal Disease: Initial Fluid Management.” Department of Paediatrics. Pietermaritzburg: Province of KwaZulu-Natal Health Services, 8 March 2005.

Dr. Nair explained that Ringers Lactate is an intravenous fluid (IV) similar to normal saline, but contains some glucose.<sup>116</sup> Furthermore, IV fluids are necessary for cases of severe dehydration and shock because they deliver fluid directly to the blood stream, without the delay incurred by oral rehydration solutions.<sup>117</sup>

### 5.5.2. Treatment at Home

#### 5.5.2.1. Treatment for Diarrhea<sup>118</sup>

The mother must be made aware of the 3 Rules of Home Treatment:

1. Give Extra Fluid, 2. Continue Feeding, 3. When to Return

1. Give Extra Fluid (as much as the child will take)

- Breastfeed frequently and for longer at each feed
- If the child is exclusively breastfed give sugar-salt solution (SSS) in addition to breastmilk
- If the child is not receiving breastmilk or is not exclusively breastfed, give one of more of the following: food-based fluids such as soft porridge, amasi (maas), SSS or ORS.

To make SSS: 1 liter boiled (or clean) water +  
8 teaspoons sugar +  
½ a teaspoon of salt

To make ORS: 1 liter boiled (or clean) water +  
1 sachet of ORS powder

SSS is the solution to be used at home to *prevent* diarrhea.

ORS is used to *correct* dehydration.

- Mothers should give their children frequent small sips of SSS from a cup at a dosage of 50-100 mL for children under 2 years and 100-200 mL for children over 2 years after each loose stool.
- If child vomits, wait 10 minutes. Then continue, but more slowly.
- Continue giving extra fluid until diarrhea stops.

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<sup>116</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

<sup>117</sup> *Ibid.*

<sup>118</sup> “Integrated Management of Childhood Illness.” *KZN IMCI guideline*. 2002. <www.kznhealth.co.za>. 3 May 2007.

### 5.5.2.2. *Treatment of Dehydration*

Treat for dehydration if your child experiences two of the following:

- Sunken eyes
- Restless or irritable
- Thirsty, drinks easily
- Skin on the stomach returns to normal slowly after being pinched

To treat dehydration, mothers must give 20 mL/kg/hour of ORS to their child during first 4 hours.

If a child does not respond to treatment or his or her condition worsens that child must be referred to a hospital or clinic.

### 5.5.3. *Challenges to Treating Pediatric Diarrhea at Murchison*

#### 5.5.3.1. *Monetary Challenges and Scarcity of Resources*

Although physicians in the pediatric gastroenteritis ward basically follow all protocols, Murchison's budget sometimes forces them to substitute recommended treatments for alternative, cheaper treatments.<sup>119</sup> For example, Murchison does not stock Ringers Lactate and instead doctors administer Serol solution.<sup>120</sup> While the WHO does not specifically endorse Serol as a preferred treatment option, Dr. Nair explained that "Serol basically works as well as Ringers Lactate."<sup>121</sup> Moreover, against the IMCI recommendations, Murchison does not use an IVAC Volumetric Infusion Pumps for every dehydrated child which precisely regulates the flow rate of a patient's IV and instead must share IVAC Volumetric Infusion Pumps with the Maternity Ward.<sup>122</sup> Furthermore, patients would "greatly benefit" from Resomal, an ORS that has been specially formulated with less sodium and more potassium for malnourished children, which the hospital cannot afford.<sup>123</sup>

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<sup>119</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

<sup>120</sup> Observation. Murchison Hospital Pediatric Gastroenteritis Ward. April 12-April 26.

<sup>121</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

<sup>122</sup> Paz, S. Interview. 28 April 2007. 11:00 A.M.-12:00 P.M.

<sup>123</sup> *Ibid.*

Beyond monetary challenges, Murchison lacks resources in other sectors as well. For example, the hospital operates on a rather small staff. As Dr. Bill Hardy, Senior Medical Officer at Murchison, plainly articulated, “We often run very thin on the ground.”<sup>124</sup> A major consequence of this shortage is a decrease in the ratio of the medical professionals to patients. Although a doctor was never observed to neglecting a patient, a minimal staff seemed to equate less time being spent on each patient. As a result, doctors delegated more tasks to nurses in order to see every patient. Nurses likely become increasingly busy and previously simple tasks, such as educating parents about diarrhea prevention and treatments that can be prepared at home become more difficult and rushed. A nurse may even become so busy that he or she cannot maintain the prescribed treatment schedule and a patient may not receive a dose of medication.<sup>125</sup>

#### *5.5.3.2. Social and Cultural Barriers to Treatment*

##### *5.5.3.2.1. Language Barriers*

The language barriers between doctors and patients did not appear to affect the quality of care received by the patient. Instead, the language barrier merely altered the logistics of the communication between the doctor and a patient. Although doctors in the pediatric wards could use IsiZulu to acquire a patient’s history, they often could not communicate diagnoses, treatment procedures, or understand parental questions, in which case a nurse was called and asked to act as a translator between the two parties. Although the quality of care was not directly affected, the additional time required for such translation may have taken away some of the doctors’ attention from subsequent patients.

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<sup>124</sup> Hardy, B; Interview. Murchison Hospital. 12 April 2007. 8:10-8:20 A.M.

<sup>125</sup> Observation. Murchison Hospital Pediatric Gastroenteritis Ward. April 12-April 26.

#### 5.5.3.3.2. *Traditional Healers*

As of 2004, there were 200,000 traditional healers practicing in South Africa.<sup>126</sup> The South African Health Ministry underlined their influence on medicine by estimating that 70% of South Africans visit a traditional healer prior to consulting a doctor.<sup>127</sup> As such, traditional healers can potentially serve as a barrier to treatment if they prescribe the wrong remedies for a patient. While many traditional healers are aware of the appropriate treatment for diarrhea, some continue to treat diarrhea with an enema, which exacerbates diarrhea and causes the patient to become still more dehydrated. In this instance, the traditional healer not only served to delay proper treatment for the child, but also directly worsened the child's condition.<sup>128</sup> The investigator observed one such patient, who arrived at Murchison in shock, nearly dead.<sup>129</sup> Luckily, the child eventually was stabilized. Traditional healers handle much of the health burden of South Africa and should not be criticized, but rather better integrated into the medical system so that they can teach biomedicine and doctors can teach them strategies, such as how to properly treat diarrhea.

## 6. Conclusion

### 6.1. *NOTE TO THE READER*

These recommendations should be understood in the appropriate context. The investigator is an undergraduate student from a different country. His brief four-month stay in South Africa does not make him an expert on the South African context, nor does his educational background allow

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<sup>126</sup> "Healers licensed in South Africa." *BBC News*. 9 September 2004. 2 May 2007. <<http://news.bbc.co.uk/2/hi/africa/3640270.stm>>.

<sup>127</sup> *Ibid.*

<sup>128</sup> Paz, S. Interview. 28 April 2007. 11:00 A.M.-12:00 P.M.

<sup>129</sup> Observation. Murchison Hospital Pediatric Gastroenteritis Ward. April 12-April 26.

him to claim any level of medical expertise. Similarly, his extremely brief two week observation of Murchison District Hospital did not begin to afford him a complete view of the hospital or a chance to discover or fully understand the challenges it faces. Therefore, even his best efforts may result in impractical recommendations because of social or cultural customs or complications of which he is unaware. His recommendations may upset some delicate balance that the investigator did not comprehend or perhaps could not comprehend as a foreigner. For these reasons, the author's recommendations should be approached with extreme caution and fully scrutinized before implemented, if at all.

## 6.2. National Recommendations for Improving Health Care of Murchison

### 6.2.1. Millennium Development Goals

In hopes of improving health care in South Africa, the government has adopted and supports the health-related Millennium Development Goals (MDGs) created by the United Nations Development Programme in 2000. Goals that address malnutrition, access to water and sanitation, and child mortality all indirectly address pediatric diarrhea. The South African government strives to reduce child malnutrition by at least one-third between 1990 and 2015.<sup>130</sup> During this period it also hopes to halve the proportion of people without sustainable access to safe drinking water and reduce the number of household without access to hygienic sanitation facilities.<sup>131</sup> Furthermore, the government hopes to reduce the under-five mortality rate by two-thirds.<sup>132</sup> However, interviewed physicians remain skeptical as to whether the goals will be realized punctually.<sup>133</sup> Dr. Nair explained, "Our government rarely finishes projects on time,

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<sup>130</sup> United Nations. "United Nations Millennium Declaration." Resolution adopted by the General Assembly Fifty-fifth session Agenda item 60 (b). A/RES/55/2; 2000. <<http://www.un.org/millennium>>.

<sup>131</sup> *Ibid.*

<sup>132</sup> *Ibid.*

<sup>133</sup> Paz, S.; Nair, T.; Pillay, T. Interview. 13 April 2007. 10:00 A.M.-10:10 A.M.

although it does usually finish the project so perhaps it is only a matter of time.”<sup>134</sup> Dr. Paz echoed Dr. Nair sentiments, exclaiming, “While they will not complete the project on time, I believe these goals can be realized eventually.”<sup>135</sup>

### 6.2.2. Education

These physicians have good reason to be skeptical. Although the government recognizes the ultimate goal of prevention, its understanding of the problem remains incomplete and, consequently, so does its set of proposed solutions. Improving people’s access to proper facilities, such as improve sanitation, is only remedying one tier of the problem. The overall problem is that people are not practicing health habits or making health choices for themselves or others. The solution is singular: education.

#### 6.2.2.1. Retaining Health Professionals

Effectively educating a population about health is a complex process requiring five components: potential for practical application, an instructor, the actual information, assessment, and review. First, the learner must be able to practically apply the acquired information. Just as it would be impractical to teach an entire community that lacked an operating room how to perform brain surgery, teaching an individual the importance hygiene is useless if he or she lacks access to clean water and improved sanitation. Although the population that Murchison serves has better access to clean water than other South Africans on average (Table VIII, Figure 8), the government should not stop increasing South African’s access to clean water until everyone enjoys access. Moreover, while all informants reported having a toilet, Murchison’s catchment area desperately needs better access to improved sanitation (Table VII, Figure 7). The government must allocate additional funds to increasing people’s access to these facilities.

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<sup>134</sup> *Ibid.*

<sup>135</sup> *Ibid.*

Once people have access to proper facilities, proper education becomes practical. However, this nature of learning is rarely effective without an educator. Unfortunately, many health professionals trained in South Africa are migrating to other countries and those who remain prefer to practice medicine in more urban areas, creating a significant maldistribution of health professionals between rural and urban settings. Although not considered a “deep rural” area, Murchison too demonstrates the need for additional health professionals who could serve as educators.<sup>136,137</sup> Currently, the government provides two financial incentives to health professions: a Rural Allowance, which benefits all health professionals in designated rural health facilities, and a Scarce Skills Allowance, which benefits certain categories of health profession, regardless of where they practice. However, a 2004 study by the Centre for Rural Health reported that for only 28% of surveyed health professionals did the allowances cause them to change their career plans for the following year and 27% were undecided.<sup>138</sup> In light of these results, the government should either allocate additional funds to improve incentives for doctors to work in South Africa or formulate a different method. Regardless of how the government might change physician incentives or its approach, it should spend more money on trying to keep doctors in South Africa, especially in rural areas.

#### 6.2.2.2. *Community Health Workers*

For true prevention to occur, people must be educated before they arrive at a hospital. For this reason, the government funds community appointed Community Health Workers (CHWs), whose jobs are to provide health education to local families, such as information on the benefits of hand washing. Shown to be a “success” in a 1991 study, the government continues to allocate

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<sup>136</sup> Hardy, B; Interview. Murchison Hospital. 12 April 2007. 8:10-8:20 A.M.

<sup>137</sup> Observation. Murchison Hospital Pediatric Gastroenteritis Ward. April 12-April 26.

<sup>138</sup> Reid, S. “Monitoring the effect of the new rural allowance for health professionals.” Durban: Health Systems Trust, 2004.

more resources to fund additional of community health workers (CHWs), hoping to add an additional 8,000 CHWs by 2015 to reach the target of 15,000 active CHWs. Their overall effectiveness seems to largely stem from their connections in communities. One community health worker shared that “it’s normal for a community health worker to know nine out of ten of the families that he visits.”<sup>139</sup> Peter Shandu, a trainer of community health worker facilitators, elaborated that CHWs by nature are probably more affective than nurses or doctors because community health workers, “even know the lifestyle in the area ... [and] when someone at your level comes to talk to you, you will listen better.”<sup>140</sup> In South Africa, CHWs then remain a vital piece to the puzzle of educating people about health and must continue to government funded.

### 6.2.2.3. *Media Campaigns*

The use of media as a vehicle for such education has been well documented and has been highly successful in India.<sup>141</sup> An extensive randomized study conducted in India found that electronic mass media, such as radio, television, and cinema, as well as community-level mass media designed to educate viewer and listeners on the proper preparation and use of sugar-salt solutions (SSS) and oral rehydration solutions (ORS) increases an individual’s awareness and proper use of these treatments.<sup>142</sup> While the South African government does do some media campaigns on home treatments of diarrhea, it should increase its efforts. Dr. Nair recalled hearing government messages about diarrhea on the radio, but explained, “Such messages are quite rare and should be aired regularly.”<sup>143</sup> The government should allocate more funds to such media campaigns.

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<sup>139</sup> Community Health Worker. Primary Health Care Facility. Wangu. 14 March 2007. 4:30-4:45 P.M.

<sup>140</sup> Shandu, P. Trainer of Community Health Worker Facilitators. Wangu. 14 March 2007. 3:00-4:00 P.M.

<sup>141</sup> Rao, K. V.; Mishra, V. K.; Retherford, R. D. “Knowledge and Use of Oral Rehydration Therapy for Childhood Diarrhoea in India: Effects of Exposure to Mass Media.” *National Family Health Survey Subject Reports*. 1998.

<sup>142</sup> *Ibid.*

<sup>143</sup> Nair, T.; Interview. 18 April 2007. 1:00 P.M.-2:15 P.M.

### 6.3. *Recommendations for Murchison District Hospital*

The last two requirements for excellent health education are learner assessment and subsequent review. While the quality and frequency of education at Murchison are superb, the investigator observed many patients being discharged and then soon after readmitted for diarrhea and dehydration. Admittedly, for some children diarrhea may be difficult to prevent, because they lack proper access to improved sanitation and clean water. However, the WHO treatment guidelines posit that most cases of childhood diarrhea can be treated at home.<sup>144</sup> In these instances, proper education and treatment at home could possibly prevent many admissions and deaths as a result of pediatric diarrhea.

What is puzzling is that parents of patients do receive education about proper home care for pediatric diarrhea. Educational posters about diarrhea clutter the walls of the pediatric ward. Language barriers should not cause problems, because many of these posters are written in both English and IsiZulu. Moreover, doctors and nurses take time with parents or guardians of patients to educate them, ask them if they understand, and allow them an opportunity to ask questions. One can probably assume that if caregivers knew how to treat diarrhea and dehydration at home and why treatment was important to their child's health, they would administer treatment. There are three possible explanations as to why proper treatment does not occur. One possible explanation is that parents or guardians return depend on others and upon their return home are subsequently forced or influenced to not administer the treatment. Unfortunately, Murchison does not have the capacity to alleviate these persons' socioeconomic situations. The only other explanations seem to be that parents or guardians either understand

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<sup>144</sup> *Ibid.*

how to treat diarrhea, but subsequently forget, or that they do not understand the treatment, but say that they do. These concerns might be remedied by what Murchison lacks: a method by which to assess the effectiveness of their parental education on pediatric diarrhea and resources to give caregivers so that they can review or reference the information. CHWs could also benefit from these resources and could distribute them during their home visits.

### *6.3.1. Questionnaire and Information Packet*

Two separate interventions are recommended: a questionnaire and an information packet (Appendices B – I). The investigator recommends that before a patient is discharged from the gastroenteritis ward his or her parents or guardians complete a questionnaire. The purpose of the questionnaire, which would be available in English and IsiZulu versions (Appendix B, C), is to assess whether the parents or guardians truly understand the proper home care for pediatric diarrhea. Upon completion of the questions, a nurse should evaluate the responses and compare them to the model answers that have been provided (Appendix D, E). If the caregiver is illiterate, a nurse should read the questions to the caregiver. If the caregiver answers any questions incorrectly, the nurse should review and fill in the correct answers with the caregiver. The nurse will then give the caregiver the questionnaire to take home to serve as a reminder of how to prevent and treat pediatric diarrhea and dehydration. The hospital should also give the caregiver an information packet that will include information about home treatments for pediatric diarrhea and dehydration, as well as handwashing flyers for the caregiver to periodically review (Appendices F – I). Available in both English and IsiZulu versions, the packet will include instructions for treating children for diarrhea and dehydration at home, as well as instructions for how to prepare the recommended sugar-salt and oral rehydration solutions (Appendix F, G). Additionally, the packet will contain three handwashing flyers that caregivers can display in their

homes to remind them of the importance of handwashing, particularly after using the toilet or changing diapers and before preparing food or eating (Appendix H, I).

## **7. Limitations of Study**

### *7.1 Limitations of Recommendations*

While the government's budget could fund all of the investigator's recommendations, the government would have to substantially reallocate funds from elsewhere in the budget. Unfortunately, it is difficult to argue convincingly that such a reallocation would be justified, even from a utilitarian perspective of do what will be the greatest benefit to the most people. Cutting the budget in another sector could potentially harm others more than people would be helped through the implementation of these recommendations. Moreover, the practical considerations severely constrain these recommendations. Enacting legislation requires a lengthy, time consuming process. By the time any of these recommendations becomes policy, if at all, they will probably be outdated and the situation will have changed and will require different solutions.

### *7.2. Limitations of Murchison Recommendations*

The investigator acknowledges that there are many limitations to all of his recommendations. While filling out the questionnaire, caregivers could guess on the yes or no questions, making it appear as if they comprehend the information, and not receive the subsequent recommended education, if necessary post questionnaire. Also, the nurses and other medical professionals may not always have time to administer the questionnaire and then provide the correct post counseling. Moreover, upon returning home they could misplace the questionnaire or purposely use it for some unintended purpose, such as a fire starter or extra paper for notes. If their baby

subsequently became infected and contracted diarrhea or became dehydrated, the caregiver would not have the information necessary to remind him or her how to properly treat the child.

These recommendations may not be universally applicable throughout the district. Other hospitals may not have as many electronic resources as Murchison to copy and print flyers. In others, health professions may be overworked and too busy to administer the questionnaire. In any case, it seems unlikely that the recommendations, flyers, and final project will be compatible with other hospitals, rendering the recommendations largely useless on a province or national scale.

### 7.3. Limitations of Gathered Data

The biggest limitation of that data is that it does not contribute to one's understanding of the reasons for the discrepancies between data sets from different studies and whether it stems from differences in the populations' access to adequate resources or their personal hygiene.

Moreover, within data sets the sample size was quite small. Consequently, data was too sparse to support any potential for a trend in data or correlation between data. Furthermore, few data sets could be used to extrapolate their proportional characteristics to a larger population. The data also only targeted mothers. While they seem to be the primary care giver in Zulu culture data on their handwashing practices is not very useful if other members of the same family practice alternate behaviors that could easily infect the child. Perhaps more limiting is the lack of confidence in some of the data. Some information most likely got lost within the translations, especially when the data had to be translated twice for every answer, once from English to IsiZulu for a mother and then back from IsiZulu to English for the investigator. Moreover, some mothers may have felt "put on the spot" by the investigator's questions and answered how they

thought the investigator wanted them to answer. Furthermore, some behavioral questions may have made mothers feel embarrassed and caused them to alter untruthfully, such as for the questions.

## **8. Recommendations for Further Study**

A future investigator could continue this research in a number of directions. One could conduct a follow up at Murchison and compare results with this study, looking for consistencies and trends. If this investigator's recommendations have been implemented, a future investigator could assess the efficacy of these interventions. Additionally, one could study pediatric diarrhea in a different type of location, either based on size of facility, such as a clinic or regional hospital, or area type, such as urban, or population type, such as a private hospital. One could also branch out to study a larger age range of children or just concentrate on older children. In addition, one could also choose to concentrate more on a single issue surrounding pediatric diarrhea, such as assessing the connection between HIV and pediatric diarrhea. Moreover, one could also go out with community health workers and study pediatric diarrhea in the field. While these are just a few suggestions, this issue could be furthered studied in countless ways.

## **9. Summary Review of Essential Texts**

Fewtrell, L.; Kaufmann, R. B.; Kay, D.; Enanoria, W.; Haller, L.; Colford, J. M. Jr. *Lancet Infect Dis.* **2005**, *5*, 42-52.

Fewtrell *et. al.* provides a systematic review and meta-analysis of 46 different studies on the effectiveness of specific preventative interventions in reducing the rate of diarrhea by comparing the evidence of the relative effectiveness of interventions to reduce diarrheal illness through improvements in drinking water, sanitation facilities, and hygiene practices in less developed countries. This powerful study will be helpful in quantifying the preventative

effectiveness of specific interventions and their relative effectiveness so as to more accurately explore possible solutions to this health issue.

“Health Statistics: Diarrhea Incidence.” *Health Systems Trust*. 30 March 2007.

<<http://www.hst.org.za/healthstats/132/data>>.

This Health Systems Trust publication details trends in the incidence of pediatric diarrhea for each province and the country as a whole from 1998-2005. Establishing trends of incidence will be helpful in tracking progress made to reduce the incidence of diarrhea as well as promote more informed extrapolations of possible future trends in incidence. These trends can also be compared to trends experienced by the community that is served by Murchison District Hospital.

Horn, R.; Perry, A.; Robinson, S. “A Simple Solution.” *Time Magazine*. 16 Oct. 2006.

<[www.timemagazine.com](http://www.timemagazine.com)>.

Hort *et. al.* highlights the political controversy and expert frustration surrounding pediatric diarrhea as a global health issue. It will also help establish a timeline of scientific discovery by providing a synopsis of the scientific history of pediatric diarrhea, including the first research devoted to it in 1830 through the development and implementation of oral rehydration therapy (ORT).

“Integrated Management of Childhood Illness.” *KZN IMCI guideline*. 2002.

<[www.kznhealth.co.za](http://www.kznhealth.co.za)>. 3 May 2007.

This source gives the IMCI guidelines for accessing and treating a child for diarrhea and dehydration. It was used to help make the information packet for the hospital.

Lenton, R.; Wright, A. M.; Lewis, K. *Health, Dignity, and Development: What Will It Take?* UN Millennium Project. Task Force on Water and Sanitation. London: Earthscan, 2005.

This book focuses on the importance of water and sanitation and the impact of a lack of access to such resources.

Additionally, it discusses constraints to providing universal access to improved water sources and improved sanitation, the probable costs and financing, and the role of technology and infrastructure in providing universal access. This will be helpful as a backdrop against expert opinion so as to better examine possible feasible solutions to reduce the incidence and mortality rate of pediatric diarrhea for the local community served by Murchison District Hospital.

Prüss, A.; Kay, D.; Fewtrell, L.; Bartram, J. *Environ. Health Prospect.* **2002**, *110*, 537-542.  
Prüss *et. al.* reports estimations of the success of preventative measures, including access to basic sanitation and an improved water supply, to reduce the global incidence of pediatric diarrhea. These estimates will help the investigator better consider possible preventative measures to reduce diarrheal disease rates for the local community served by Murchison District Hospital.

Sandora, T. J.; Taveras, E. M.; Shih, M.; Resnick, E. A.; Lee, G. M; Ross-Degnan, D.;  
Goldmann, D. A. *Pediatrics.* **2005**, *116*, 587-594.  
Sandora *et. al.* reports his findings for the first randomized, controlled trial to assess a multifaceted promotional campaign focusing on increasing alcohol-based hand sanitizer use in the home setting. Findings were consistent with similar previous studies, showing a reduction in gastrointestinal viral illnesses and even in common respiratory viral-related illness. These findings will help the investigator better consider possible preventative measures to reduce diarrheal disease rates for the local community served by Murchison District Hospital.

Saloonjee, H.; Bamford, L. *South African Health Review 2006*. “Chapter 11: Key Childhood Health Promotion and Disease Prevention Programmes.” Durban: Health Systems Trust, 191-193. <<http://www.hst.org.za>>.  
The South African Health Review details current statistics on the incidence, prevalence, and mortality rate associated with pediatric diarrhea, including a thorough breakdown of the incidence according to race. In addition, it discusses different preventative measures, such as good nutrition, breastfeeding, and the rotavirus vaccine. This information will assist the investigator in characterizing the disease burden of pediatric diarrhea in South Africa and promote more informed consideration of possible preventative interventions for the local community served by Murchison District Hospital.

South African Millennium Development Goals Country Report 2005.  
<<http://www.doh.gov.za/docs/reports/2005/mdgd/>>.  
The Millennium Development Goals created by the South African Government highlight the national effort to reduce the incidence of pediatric diarrhea. This information will be helpful in citing some of the South African Government’s efforts to combat pediatric diarrhea and in analyzing any progress that is made through comparison to the government’s timeline.

*Standard Treatment Guidelines and Essential Drugs List 2006*. Pretoria: The National Department of Health, 2006. 23-35.

This book contains easy to follow instructions for assessing and treating numerous childhood illnesses, including diarrhea. This information was used for background information on diarrhea, such as definitions of types of stools and general information on diarrhea.

Statistics South Africa. Mortality and causes of death in South Africa, 2003 and 2004: Findings from death notification. Statistical release P0309.3 Pretoria: Statistics of South Africa; 2006. <<http://www.statssa.gov.za>>.

This document reports the leading underlying causes of death for children in 2003 and 2004, citing infectious intestinal diseases as one of the leading causes. Beyond providing recent diarrheal mortality rates, this data will help the investigator quantify the relative significance of this health issue and breakdown stereotypes of the relative mortality rates of more publicized childhood diseases.

The MOST Project. *Guidelines for New Diarrhea Treatment Protocols for Community-Based Healthcare Workers (Not Yet Field Tested)*. 2005. 27 March 2007. <<http://www.mostproject.org>>.

This guide provides information for community health workers (CHWs) on their role in diarrhea management, including how to assess and diagnose a child with diarrhea, when to refer a child to a hospital, home treatments, oral rehydration therapy, and frequently asked questions. This guide will help the investigator better understand the role CHWs and will provide the investigator with baseline guidelines, which he can compare to the actual practices of CHWs. Further learning will be fostered through subsequent inquiries about any discrepancies between the recommendations and the actions of CHWs in the local community served by Murchison District Hospital.

The World Bank Group. *The Handwashing Book: A Guide for Developing a Hygiene Promotion Program to increase Handwashing with Soap*. Washington D.C.: PS Press Services Pvt. Ltd. 2005.

An extensive resource on handwashing, this publication documents how to lay the foundation for a national handwashing program from lessons learned in Senegal, Ghana, and other countries. It includes a section on the consumer and the economics of implementing such a program as well as how to design an appropriate campaign. Moreover, it examines typical barriers to success and poses suggestion on how to avoid or overcome them. This data will promote more informed consideration of possible preventative interventions in the local community served by Murchison District Hospital.

Verhoestraete, L. J.; Puffer, R. P. *Bull. Wld. Hlth. Org.* **1958**, *19*, 23-51.

Verhoestraete *et. al.* is the first international publication recognizing pediatric diarrhea as an international health issue. By detailing the vast knowledge and statistics surrounding diarrhea fifty years ago, it helps establish a baseline for future progress. Beyond providing thorough examination of pathways of transmission, prevention, and treatment, Verhoestraete *et. al.* also explores the possible implementation of practical policies and programs to reduce the incidence and mortality associated with diarrhea, especially pediatric diarrhea, which would be helpful in understanding expert advice on preventative interventions for the local community served by Murchison District Hospital.

Walker, A. R. P.; Walker, B. F.; Dunn, M. J.; Dunn, S. E. *The Journal of the Royal Society for the Promotion of Health*, **1994**, *144*, 33-38.

Walker *et. al.* documents the chief cases of admission to Murchison District Hospital for rural Africans and discovered that gastroenteritis and malnutrition were among the most common reasons for admission of children under twelve. This information will be helpful for comparison to more recent data so as to look for trends in admission to Murchison District Hospital, about which the investigator will consult experts to further his understanding.

“Water, Sanitation and Hygiene Facts.” World Health Organization. 2004.

<[http://www.who.int/water\\_sanitation\\_health/publications/facts2004/en/index.html](http://www.who.int/water_sanitation_health/publications/facts2004/en/index.html)>. This World Health Organization (WHO) publication reports reliable statistics on the incidence of diarrhea in relation to one's access to proper facilities and practice of behavior, such as access to improved sanitation or safe water and handwashing. This data will provide further evidence to better inform the investigator of the studied effectiveness of certain preventative interventions for consideration of current conditions in the community served by Murchison District Hospital.

World Health Organization. *Implementing the New Recommendations on the Clinical Management of Diarrhoea*. Department of Child and Adolescent Health and Development. Geneva: WHO Press, 2006.

This publication details the new recommendations on the clinical management of diarrhea along with how to translate these global recommendations to counties and possible difficulties that countries will encounter. The document as provides the evidence that supports and was used to create these new recommendations. These recommendations will be compared against standard procedures at Murchison District Hospital and the investigator will gain a more complete understanding through inquiring about any discrepancies.

World Health Organization. *Persistent Diarrhea and Breastfeeding*. Division of Child Health and Development. Geneva: WHO Press, 1997.

This document details studies examining the benefits of breastfeeding, its protective effects against acute pediatric diarrhea, and its general nutritional value. It also addresses possible issues that may exacerbate persistent diarrhea or complicate breastfeeding, such as malnutrition and lactose intolerance, respectively.

World Health Organization. *The Treatment of Diarrhea: A Manual for Physicians and Other Senior Health Workers*. Geneva: WHO Press, 2005.

This manual is an extensive resource on diarrhea, including essential concepts, diagnostic procedures, management of acute and persistent diarrhea, complications associated with malnutrition, and the prevention of diarrhea. It also includes numerous appendices, such as microbial causes of diarrhea, oral and intravenous rehydration solutions, and how to use a patient's midarm circumference to detect malnutrition. The diagnostic and treatment procedures described in this manual will be compared against standard procedures at Murchison District Hospital and the investigator will gain a more complete understanding through inquiring about any discrepancies.

World Health Organization and United Nations Children's Fund. Joint Monitoring Programme for Water Supply and Sanitation. Online database.

<<http://www.wssinfo.org/en/welcome.html>>.

This World Health Organization publication reports recent data on the access of urban and rural dwelling South Africans to improved water sources and improved sanitation and contains a useful glossary. This data will help the investigator establish that discrepancies in access to proper facilities between urban and rural populations, which may contribute to discrepancies in the incidence, prevalence, and mortality rate of pediatric diarrhea among these populations.

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## Appendix A



Pediatric Gastroenteritis Ward. Murchison District Hospital. 2007.

### **Pediatric Gastroenteritis Caregiver Education Questionnaire**

1. Kunini lapho kumele uwashe izandla zakho ngensipho?

\_\_\_\_\_

\_\_\_\_\_

2. Kubaluleke ngani ukuhlamba izandla ngensipho?

\_\_\_\_\_

\_\_\_\_\_

3. Uma umntwana wakho enesifo sohudo, kumele umphuzise okunguketshezi okungakanani? Ngaphezu kokujwayelekile\_\_\_\_ Okungaphansi kokujwayelekile\_\_\_\_ isilinganiso esijwayelekile?\_\_\_\_

4. Enziwa kanjani amanzi okumele uwaphuzise umntwana?\_\_\_\_\_

\_\_\_\_\_

5. Kumele umnike amanzi angakani umntwana njalo ngemuva kokuhuda?\_\_\_\_\_

6. Ngabe kumele yini uphuzise umntwana onesifo sohudo umuthi? Jebo\_\_\_\_ Cha\_\_\_\_

7. Ubona kanjani ukuthi umntwana ushodelwa ngamanzi emzimbeni?\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. Yenziwa kanjani i-ORS?\_\_\_\_\_

\_\_\_\_\_

9. Kumele umphuzise i- oral rehydration solution engakanani njalo ngemuva kwehora?\_\_\_\_\_

10. Kunini lapho kumele ubuyele esibhedlela?\_\_\_\_\_

\_\_\_\_\_

(cut here) -----  
-----

## **Pediatric Gastroenteritis Caregiver Education Questionnaire**

1. Kunini lapho kumele uwashe izandla zakho ngensipho?  
\_\_\_\_\_
2. Kubaluleke ngani ukuhlamba izandla ngensipho?  
\_\_\_\_\_
3. Uma umntwana wakho enesifo sohudo, kumele umphuzise okunguketshezi okungakanani?  
Ngaphezu kokujwayelekile\_\_\_\_ Okungaphansi kokujwayelekile\_\_\_\_ isilinganiso  
esijwayelekile?\_\_\_\_
4. Enziwa kanjani amanzi okumele uwaphuzise  
umntwana?\_\_\_\_\_
5. Kumele umnike amanzi angakani umntwana njalo ngemuva  
kokuhuda?\_\_\_\_\_
6. Ngabe kumele yini uphuzise umntwana onesifo sohudo umuthi? Jebo\_\_\_\_ Cha\_\_\_\_
7. Ubona kanjani ukuthi umntwana ushodelwa ngamanzi  
emzimbeni?\_\_\_\_\_

8. Yenziwa kanjani i-  
ORS?\_\_\_\_\_

9. Kumele umphuzise i- oral rehydration solution engakanani njalo ngemuva  
kwehora?\_\_\_\_\_
10. Kunini lapho kumele ubuyele  
esibhedlela?\_\_\_\_\_

## Murchison District Hospital Daily Log

April 12

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Nair in the gastroenteritis ward. On my way to the ward I ran into Dr. Hardy and chatted to him for about 10 minutes about Murchison Hospital. At 10:30, we went to tea with the other doctors and then returned to the ward at 11:00. I then began observing rounds with Dr. Paz in the general pediatric wards. We ate lunch from 1:00 to 1:30 and returned to the pediatric ward to finish up rounds. We finished rounds at 3:00 and went to the Out Patient Dispensary (OPD). We left the hospital at 4:00.

April 13

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Nair in the gastroenteritis ward. At 10:00 Dr. Paz, Dr. Pillay, and Dr. Nair had just finished reviewing a critical case and I got the opportunity to ask them some questions on pediatric diarrhea for a few minutes. At 10:30, we went to tea with the other doctors and then returned to the ward at 11:00. I then began observing rounds with Dr. Pillay in the general pediatric wards. We ate lunch from 1:00 to 1:30 and returned to the pediatric ward to finish up rounds. We finished rounds at 2:30 and went to the Out Patient Dispensary (OPD). I left the hospital at 4:00.

#### April 15

Hours: 16.0

On Sunday, I observed Dr. Nair when she was on first call. The first call doctor does rounds and is the only doctor on campus for the entire hospital, but can call the doctors who are on second and third call for assistance. The doctor sleeps at the hospital and the shift officially lasts from 8:00 A.M. to 8:00 A.M. the next day. I arrived at the hospital at 8:00 A.M. and observed rounds of the entire hospital with Dr. Nair during which we only attended to critical cases. At 1:30 we ate lunch. At 2:00, we continued rounds and finished by 3:00. Then we went to Casualty to attend to a patient who came to the hospital that day. At 6:00 we ate dinner and at 6:30 we returned to Casualty. We finished up by seeing patients by 8:30 and went to hang out in the doctor's recreation room. We were called to Casualty at 11:00.

#### April 16

Hours: 16.0

We were also called at 1:30 A.M., and 4:45 A.M. to attend to patients in Casualty. Among the patients, one child was admitted for diarrhea and dehydration. Another patient had to be sutured for injuries he received during a bottle fight. At 7:00 A.M. we ate breakfast and at 7:20 we began rounds in the Pediatric Gastroenteritis Ward. Dr. Nair went home at 8:00. I continued on rounds with Dr. Paz. We had tea from 11:00 to 11:15 and returned to the pediatric wards. At 1:30 we ate lunch and finished at 2:15. When returns to the pediatric wards and finished at 3:00. I then went to OPD and observed Dr. Paz until I left at 4:00.

#### April 17

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Nair in the gastroenteritis ward. At 10:30, we went to tea with the other doctors and then returned to the ward at 11:00. I then began observing rounds with Dr. Paz in the general pediatric wards. We ate lunch from 1:00 to 1:30 and returned to the pediatric ward to finish up rounds. We finished rounds at 3:15 and went to the Maternity Ward and did rounds in the Nursery. I left the hospital at 4:00.

#### April 18

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Nair in the gastroenteritis ward. At 10:00 I accompanied Dr. Nair to Izolembene Clinic, where I observed her assessing patients, most of whom wanted government grants. We arrived back at the hospital at 1:00 and ate lunch until 2:15. During lunch I interviewed Dr. Nair about the cultural difficulties in treating and preventing pediatric diarrhea. After lunch, we returned to the General Pediatric Ward to finish up rounds. We finished rounds at 3:00 and then went to the OPD. I left the hospital at 4:00.

#### April 19

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Nair in the gastroenteritis ward. At 10:50, we went to tea with the other doctors and then returned to the ward at 11:20. I then began observing rounds with Dr. Nair in the General Pediatric Ward. We ate lunch from 1:15 to 1:45. After lunch I accompanied Dr. Paz to the operating theater, where I saw a skin graft done on a burn victim. We went home at 4 after the surgery.

April 20

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Nair in the gastroenteritis ward. At 10:50, we went to tea with the other doctors and then returned to the ward at 11:20. I then began observing rounds with Dr. Nair in the General Pediatric ward. We ate lunch from 1:15 to 1:45. After lunch we returned to the pediatric ward to finish up rounds. At 2:25 I went to the General Pediatric Ward to compile admission data for Dr. Paz. I left the hospital at 4:00.

April 23

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Pillay in the Pediatric Gastroenteritis Ward. At 10:30, we went to tea with the other doctors and then returned to the ward at 10:50. We then returned to the General Pediatric Ward. We ate lunch from 1:30 to 2:10. After lunch we returned to the Pediatric Ward to finish up rounds. At 3:00 we went to OPD. I left the hospital at 4:00.

April 24

Hours: 7.0

I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Pillay in the Pediatric Gastroenteritis Ward. At 10:45, we went to tea with the other doctors and then returned to the ward at 11:15. We then returned to the General Pediatric Ward. We ate lunch from 1:10 to 1:40. After lunch we returned to the Pediatric Ward to finish up rounds. At 3:15 we went to OPD. I left the hospital at 4:00.

April 25

Hours: 16.0

I went on call with Dr. Pillay. I arrived at the hospital at 8:00 A.M. and began observing rounds with Dr. Pillay in the Pediatric Gastroenteritis Ward. At 10:45, we went to tea with the other doctors and then returned to the ward at 11:15. We then returned to the General Pediatric Ward. We ate lunch from 1:10 to 1:40. After lunch we returned to the pediatric ward to finish up rounds. At 3:15 we went to OPD. From 6:00 until 6:30 we ate dinner and then returned to Casualty. We left casualty at 9:00 to hang out in the doctor's recreation room and play some ping-pong. We were called to Casualty at 11:15.

April 26

Hours: 12.0

We were also called to Casualty at 2:30 A.M., 4:00 A.M., and 5:30 A.M. At 7:00 A.M. we ate breakfast. At 7:30 we went to the Pediatric Gastroenteritis Ward to do rounds. At 8:00 I began compiling Child Pip data for Dr. Paz and entering it on a computer program that I installed. I was also given permission to use that data for this study. I finished at 12:00 and ate lunch. I took the rest of the day off to rest.

April 28

Hours: 1.0

I interviewed Dr. Paz from 11:00 A.M. until 12:00 P.M. about Murchison and the future of pediatric diarrhea.

Total hours: 117.0

## **Pediatric Gastroenteritis Caregiver Education Questionnaire**

### **Answer Key**

11. Kunini lapho kumele uwashe izandla zakho ngensipho?
- Ngemuva kokusebenzisa indlu yangasese
  - Ngemuva kokushintsha inabukeni lomntwana
  - Ngaphambi kokupheka ukudla
  - Ngaphambi kokudla ukudla
12. Kubaluleke ngani ukuhlamba izandla ngensipho? **Ukuhlamba izandla kusiza ukubulala amagciwane angabangela izifo ezifana nesifo sohudo.**
13. Uma umntwana wakho enesifo sohudo, kumele umphuzise okunguketshezi okungakanani? Ngaphezu kokujwayelekile X Okungaphansi kokujwayelekile \_\_\_\_ isilinganiso esijwayelekile? \_\_\_\_
14. Enziwa kanjani amanzi okumele uwaphuzise umntwana?
- **1 litha amanzi abilisiwe +**
  - **8 amathispuni kashukela +**
  - **½ wethispuni likasawoti**
15. Kumele umnike amanzi angakani umntwana njalo ngemuva kokuhuda?
- | Iminyaka                    | Isilinganiso se-SSS            |
|-----------------------------|--------------------------------|
| Ngaphansi kweminyaka engu-2 | Ngaphansi kukahhafu wenkomishi |
| Ngaphezulu kwengu-2         | Ngaphansi kwenkomishi          |
16. Ngabe kumele yini uphuzise umntwana onesifo sohudo umuthi? Yebo \_\_\_\_ Cha X
17. Ubona kanjani ukuthi umntwana ushodelwa ngamanzi emzimbeni?  
**UMA UMNTWANA ENENYE YALEZIZIMPAWU:**
- **Amehlo akhombisa ukushona phakathi**
  - **Ukuhlala inyakaza, ihlala ipaquza**
  - **Ukoma, iphuza amanzi njalo**
  - **Isikhumba esisesiswini sibuyela kwesijwayelekile kancane ngemuva kokusidonsa**
18. Yenziwa kanjani i-ORS?
- **1 litha amanzi abilisiwe(abilisiwe) +**
  - **1 iphakeshana lempushana i-ORS**
19. Kumele umphuzise i- oral rehydration solution engakanani njalo ngemuva kwehora?

**Kumele umphuzise i-ORS engakanani umntwana ngamahora angu-4 okuqala:**

Iminyaka		Izinyanga ezingu4 nangaphansi	Izinyanga ezingu4-kunyaka owodwa	1-2 iminyaka	2 - 5 iminyaka
Isilinganiso (Ketha eyodwa kulezizindlela)	Inkomishi encane	1 ½ izinkomishi	3 izinkomishi	3 ½ izinkomishi	5-5 ½ izinkomishi
	1 litha ibhodlela	Ngaphansi ½ webhodlela	½ webhodlela	1 ibhodlela	1-1 ½ amabhodlela
	2 amalitha ibhodlela	-	-	-	½ webhodlela

Kunini lapho kumele ubuyele esibhedlela? Uma isimo somntwana singakhombisi ukuba ngcono futhi siya ngokuba sibi kunakuqala nemithi ayitholile ingakhombisi ukumsiza kumele abuyele esibhedlela.

## Pediatric Gastroenteritis Caregiver Education Questionnaire Answer Key

20. When should you wash your hands with soap?

- After using the toilet
- After changing nappies
- Before preparing food
- Before eating

21. Why is washing your hands with soap important? Washing your hands with soap kills many of the bacteria and viruses that cause illness and infection, such as diarrhea.

22. If your child has diarrhea, how much fluid should you give the child?

More than usual X Less than usual \_\_\_\_\_ Same amount as usual? \_\_\_\_\_

23. How do you make sugar-salt solution?

- 1 liter boiled (or clean) water +
- 8 teaspoons sugar +
- ½ a teaspoon of salts

24. How much sugar-salt solution should be given after each loose stool?

Age	Amount of SSS
Less than 2 years	Less than ½ cup
Over 2 years	Less than 1 cup

25. Should you ever give an enema or medicine to a child with diarrhea? Yes \_\_\_\_\_ No X

26. How do you know if your child is dehydrated?

**IF CHILD HAS OR IS TWO OF THE FOLLOWING:**

- Sunken eyes

- Restless or irritable
- Thirsty, drinks easily
- Skin on the stomach returns to normal slowly after being pinched

27. How do you make oral rehydration solution (ORS)?

- 1 liter boiled (or clean) water +
- 1 sachet of ORS powder

28. How much oral rehydration solution should be given to a child each hour?

**How much ORS to give child during first 4 hours:**

Age		Up to 4 months	4 months - 1 year	1 - 2 years	2 - 5 years
Amount  (Choose only one measuring method)	Small cup	1 ½ cups	3 cups	3 ½ cups	5-5 ½ cups
	1 liter bottle	Less than ½ bottle	½ bottle	1 bottle	1-1 ½ bottle
	2 liter bottle	-	-	-	½ bottle

When should you return to the hospital? **If the child does not respond to treatment or his or her condition worsens that child must return to the hospital.**

## Pediatric Gastroenteritis Caregiver Education Questionnaire

Please answer the following questions.

29. When should you wash your hands with soap?

\_\_\_\_\_

\_\_\_\_\_

30. Why is washing your hands with soap important?

\_\_\_\_\_

\_\_\_\_\_

31. If your child has diarrhea, how much fluid should you give the child?

More than usual \_\_\_\_\_ Less than usual \_\_\_\_\_ Same amount as usual? \_\_\_\_\_

32. How do you make sugar-salt solution?

\_\_\_\_\_

\_\_\_\_\_

33. How much sugar-salt should be given after each loose stool?

\_\_\_\_\_

34. Should you ever give an enema or medicine to a child with diarrhea? Yes \_\_\_\_\_ No \_\_\_\_\_

35. How do you know if your child is dehydrated?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

36. How do you make oral rehydration solution (ORS)? \_\_\_\_\_

\_\_\_\_\_

37. How much oral rehydration solution should be given to you child each hour?

38. When should you return to the hospital?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(cut here) -----  
-----

## **Pediatric Gastroenteritis Caregiver Education Questionnaire**

**Please answer the following questions.**

1. When should you wash your hands with soap?

\_\_\_\_\_

\_\_\_\_\_

2. Why is washing your hands with soap important?

\_\_\_\_\_

\_\_\_\_\_

3. If your child has diarrhea, how much fluid should you give the child?

More than usual \_\_\_\_\_ Less than usual \_\_\_\_\_ Same amount as usual? \_\_\_\_\_

4. How do you make sugar-salt solution?

\_\_\_\_\_

\_\_\_\_\_

5. How much sugar-salt should be given after each loose stool?

\_\_\_\_\_

6. Should you ever give an enema or medicine to a child with diarrhea? Yes \_\_\_\_\_ No \_\_\_\_\_

7. How do you know if your child is dehydrated?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. How do you make oral rehydration solution (ORS)? \_\_\_\_\_

---

9. How much oral rehydration solution should be given to a child each hour?

10. When should you return to the hospital?

---

## Handwashing with Soap Saves

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!!**



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**Remember to wash your hands with soap:**

- After using the toilet
- After changing nappies
- Before preparing food
- Before eating

**H  
a**



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# Handwashing with Soap Saves Lives!!!

## Handwashing with Soap Saves

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## Handwashing with Soap Saves

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