

# **The Health Implications of Untreated Wastewater and a Treatment Intervention in Rural El Salvador**

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Global Health Capstone Report

Spring 2010

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## **LITERATURE REVIEW:**

The United Nations Development Program set out to “halve the proportion of people without sustainable access to safe drinking-water and basic sanitation” by 2015 as part of Goal 7, Ensure Environmental Sustainability, of the Millennium Development Goals (MDG). A joint monitoring program (JPM) was established by the United Nations between UNICEF and WHO to keep track of the progress of this goal. According to the mid-term report by the JPM, 2.6 billion people lacked access to improved sanitation as of 2008, 72% of which reside in Asia. Another 18% live in Africa and 5% in Latin America and the Caribbean. The report also concluded that at the current rate the world will not make the MDG by 13% and that 2.7 billion people are projected to be without improved sanitation as of 2015. Even if the MDG were met there would still be 1.7 billion people without improved sanitation. ‘Improved Sanitation’ is defined by the JMP as access to a sewer, septic system, a pour-flush latrine, a simple pit latrine or a ventilated pit latrine (WHO, 2010). In many cases the pit latrines may not be sanitary and could still lead to disease (Ahmed, 1994).

Approximately 1.6 million deaths per year are directly attributed to un-safe water supplies, sanitation and hygiene (CSD, 2005). The World Health Organization suggested in their 2002 World Health Report titled “Reducing Risks and Promoting a Healthy Life” that the lack of access to safe water, sanitation and hygiene is the third most significant risk factor for poor health in developing countries. The first was low bodyweight, which can be caused by the lack of safe water and adequate sanitation (WHO, 2002). Diarrhea is the most substantial health issue related to unsafe water and sanitation, which causes the deaths of 1.8 million people every year. 90% of these deaths are in children under five years of age. There are also some efforts in progress to estimate the indirect disease burden through malnutrition. Additionally, people without access to adequate sanitation are 1.6 times more likely to experience diarrheal disease according to the Commission on Sustainable Development (CSD, 2005).

A review of 144 studies focusing on the effects of improved water supplies and sanitation on diarrheal diseases found that on average when improved sanitation was supplied to a

population the morbidity was reduced by 22% (Esrey, 1991). Furthermore a recent study estimated that improved sanitation on average reduces diarrhea morbidity by 32%. The article also claimed that hygiene interventions including hygiene education and promotion of hand washing could reduce diarrhea by up to 45% (Fewtrell, 2005).

## **INTRODUCTION & SCOPE:**

### *Project Background:*

Students at the University of Wisconsin commenced their work in the communities of La Granja and Nuevo Ferrocarril in the Nejapa Municipality of El Salvador in March of 2006. The project began as a wastewater collection intervention to allow the communities access to an existing wastewater treatment plant in the city of Nejapa. The work in the communities has been carried out through collaboration between the UW-Madison chapter of Engineers Without Borders, the Municipality of Nejapa and the Rotary Club International. The collection system in the community of La Granja was completed in March of 2009 and 45% of the households were connected to the system as of December 2009. The construction of a pedestrian bridge began in January 2010 to both carry a pipe for the collection system and to allow for easier transport between communities. The bridge is expected to be completed by May 2010. The implementation of the collection system in Nuevo Ferricarril is targeted to begin in January of 2011 pending receipt of funding.

### *The Communities:*

The communities of La Granja and Nuevo Ferrocarril began as refugee camps in the aftermath of the El Salvadorian Civil War, which lasted for twelve years and ended in 1992. The houses in the communities have since been transformed into permanent homesteads and as a result they lack sanitation infrastructure. Today the two communities combined have about 2,500 residents. Until the onset of this project there was no centralized wastewater collection system, which resulted in raw sewage being discarded to the streets. This behavior poses significant health risks to community members and it is expected that construction of a wastewater

collection system would alleviate many of the adverse health effects. However the effect of the intervention has not yet been definitively determined due to the unavailability of sufficient health records.

*Capstone Project Scope:*

The goal of this project was to network with health workers and administrators in the communities and to gain insight into the interworking of both the public and private health care systems. Additionally it was my objective to obtain health data about the communities to better understand the impact of the wastewater collection system put into place.

**SITE VISIT & HEALTH SYSTEM ANALYSIS:**

Upon my trip to the communities in January of 2010 I was able to visit several of the clinics in the area, all of which are located in the city of Nejapa. I found that there were three main clinics in the area; one of which was a smaller faith based clinic, one is run by the mayor's office, alcaldia, and the last of which is run by the national government through the Ministry of Health. The clinic run by the Alcaldia was equipped with an ambulance to take people to the hospital in San Salvador if necessary. The clinic run by the ministry of health was by far the busiest and seemed to focus mostly on maternal and child health. They distribute birth control and vaccines in this clinic as well as providing pre-natal care. There are also offices in the building for some health administrators. I was able to meet with a man name Guillermo Castro, who is an Environmental Health Officer. I learned from him that each municipality is broken into several 'cantones' and that the national government collects health data for each canton. In the Municipio de Nejapa there are eight cantones: Aldea las Mercedes, Bonete, Camotepeque, Conacaste, El Salitre, Galera Quemada, San Jerónimo de Los Planes and Tutultepeque. All of the record keeping is done on the basis of canton rather than community. Furthermore the community of Nuevo Ferrocarril is located in the canton of El Salitre and La Granja is part of Galera Quemada. Additionally there is a single health promoter responsible for the record

keeping in each canton. While I was in the communities I had the opportunity to meet with the health promoter responsible for Nuevo Ferrocarril, Irma Concepción Barrera.

The health promoter in the community had an office that she visited every few days. This is where she kept all of her health records and medical supplies. She also went and visited the houses in the community on a regular basis to keep record of their health and to distribute vaccines. All records were taken on paper and then submitted to the ministry of health. Each year the health promoter also keeps records regarding the state of each household and its members. In addition she was charged with the testing of the drinking water for the presence of chlorine residual each time she was in the community. Although the health promoter only had copies of the health record for the 2009, I was able to obtain a copy for analysis and use for the purpose of this study. For this reason this report will focus on the health of the community of Nuevo Ferrocarril, which has not yet received the sanitation intervention, and will act as a pre-assessment of the community's health.

## DATA ANALYSIS:

### *Community Population:*

The community of Nuevo Ferrocarril is made up of 195 households and has a population of 860. It is home to 73% of the population of the Canton of El Salitre, 53% of which are female. The population statistics for the community may be see in Table 1.

**Table 1:** Community Population Statistics (2009)

The crude birth rate of the canton was 16.2 births per 1,000 people in 2009. The crude birth rate of Nuevo Ferrocarril alone was 17.4 per 1,000. Also the death rate of the canton was 2.6 deaths per 1,000 in 2009. All of the deaths occurred after the age of 50. These rates are low in comparison to the national rates (birth rate, 25.31; death rate, 5.47). In addition the national

	Households	0-4 yrs	5-9 yrs	10-19 yrs	20-59 yrs	> 60 yrs	Male	Female	Total
<i>El Salitre</i>	278	100	172	309	510	82	560	613	1173
<i>Nuevo Ferrocarril</i>	195	76	127	235	379	43	408	452	860

infant mortality rate for El Salvador was 21.52 per 1,000 live births, where there were no deaths of children under 5 in the community (CIA, 2010). The monthly health data was only taken for the entire canton of El Salitre, however since Nuevo Ferrocarril is the largest community in the Canton the data was assumed to reflect the health of the community. A comparison of health metrics of the Central American countries may be found in Table 2.

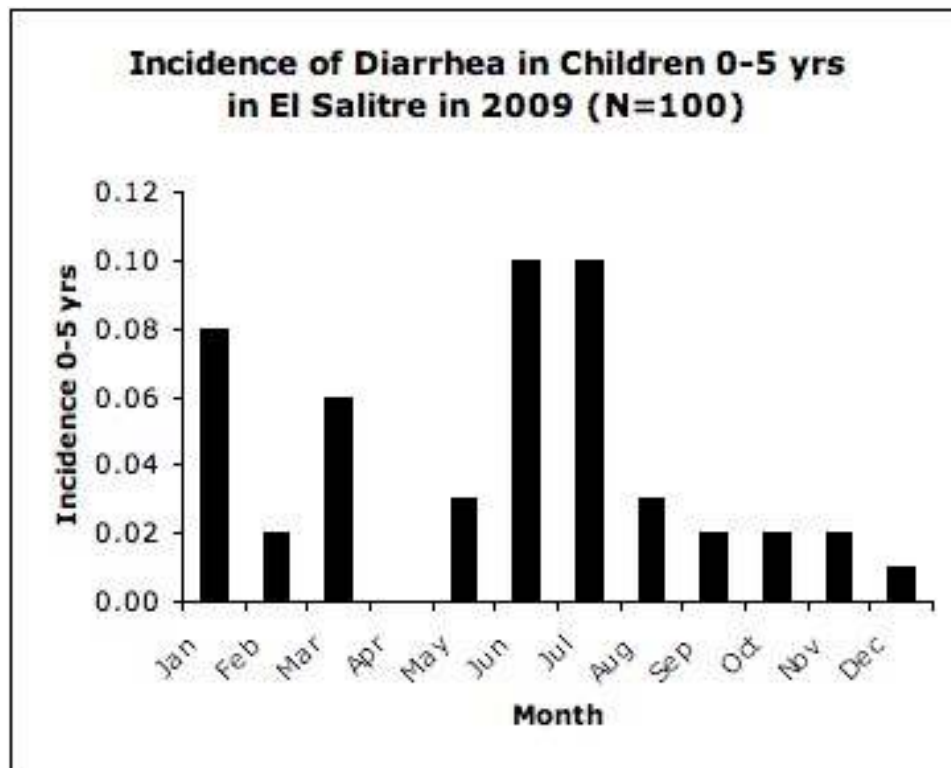
**Table 2:** Health Metrics and Risk Factors (WHOSIS, CIA World Factbook)

<b>Country, Region or Community:</b>	<b>Population</b>	<b>Birth Rate (births/1000 population)</b>	<b>Death Rate (deaths/1000 population)</b>	<b>% Access to Improved Sanitation</b>	<b>% Access to Improved Drinking Water</b>
<i>Nuevo Ferrocarril</i>	860	17.40	2.60	100	100
<i>El Salitre</i>	1173	16.20	0.00	99	94
<i>El Salvador</i>	7185218	25.31	5.47	86	84
<i>Central America</i>	42068038	24.45	5.03	72	89

*Diarrhea and Malnutrition:*

The incidence of diarrhea in children under 5 years old in El Salitre is on average 4.3%, however the data shows fluctuation throughout the year. In the height of the rainy season the incidence was 10%, however it was only 2% in the months of September through November (Figure 1). This leads me to believe that the spike in diarrhea cases is due to the increased amount of water flowing through the streets. It may then stand that if the grey water is redirected from the streets during this season, the incidence of diarrhea would decrease below the baseline level. However since the community is so small, detecting the effect on diarrheal diseases of the grey water may not be possible. It is known that diarrhea affects nutrition through reduction in dietary intake and intestinal nutrient adsorption. Also malnutrition can aggravate diarrhea because it weakens the immune system, which can lead to further infection (Brown, 2003).

Since malnutrition and diarrhea are linked in this manner, we may be able to get better understanding of the impact of sanitation on health through malnutrition. Approximately 30% of the children under 5 years old in the communities were considered malnourished in 2009, which is slightly higher than the national average in 2007 of 24.6. It is possible that diarrheal diseases due to lack of sanitation is amplifying the malnutrition of the children in the community, even though the percentage of families with 'improved sanitation' is much higher than the national average.



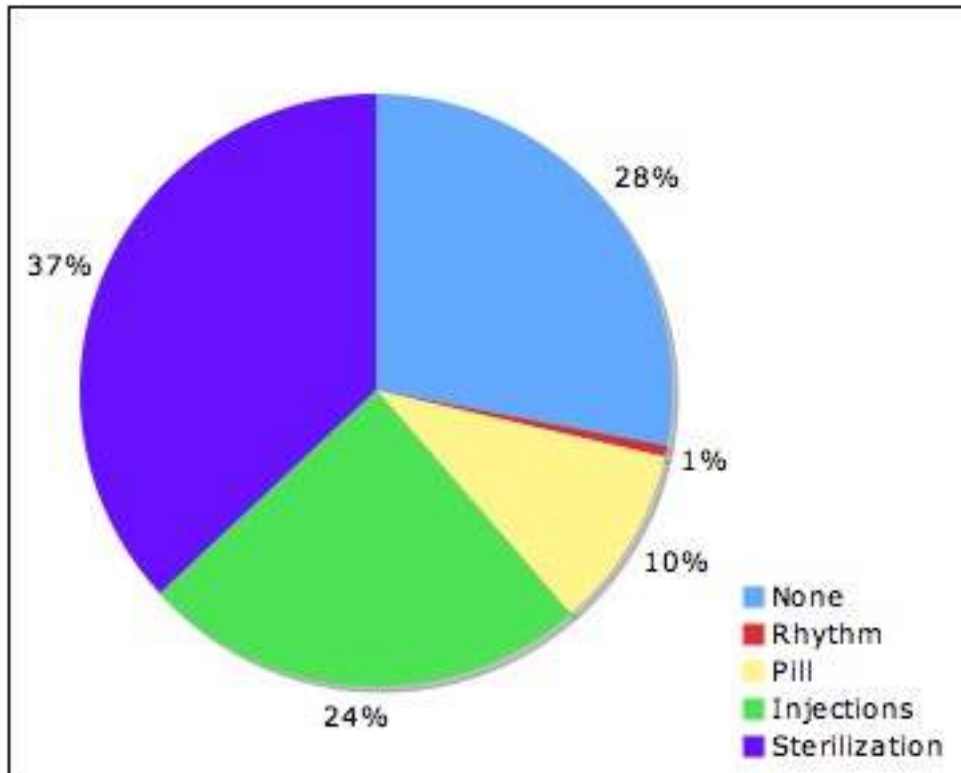
**Figure 1:** Incidence of diarrhea in El Salitre in 2009

*Family Planning:*

One of the key components of the community data focused around maternal health and family planning. The data showed that 138 women in the community practice family planning (72%). The most common form of birth control used is via injection, which must be administered



every 2-3 months. In addition the health promoter would provide folic acid supplement to pregnant women and women of childbearing age. There was also record of distribution of micronutrients such as Vitamin A and Zinc to mothers after giving birth and to the children. A chart demonstrating the prevalence of various methods of family planning may be found in Figure 2.



**Figure 2:** Types of family planning practiced in Nuevo Ferrocarril (N = 192)

*Household Data:*

The health promoter also evaluates each of the households in the community on a yearly basis. Data is taken about the construction of the homes, water source and disinfection, types of sanitation system, solid waste disposal and the presence of animals. The data shows that in the community of Nuevo Ferrocarril every person has access to drinking water that is delivered to their homes via plumbing and that the water supply is chlorinated. From my discussion with the health promoter I was able to find that the new drinking water system was put into place in 2006, which replaced communal stand pumps. According to her observations there was a rise in childhood diarrhea in the year following the installation of this new system, which she attributed

to the increased amounts of grey water in the streets. In addition, the data showed 190 of the 195 households use pit latrines (97%). The other 5 have indoor flush toilets. According to the World Health Organization, 86% of the population in El Salvador had access to 'improved sanitation' as of 2006. However, as previously discussed, pit latrines qualify as such even though they do not always prevent disease. Furthermore the survey found showed that 98% of the community properly disposed of their solid waste and that only 3 households disposed of their waste in the ravine or in the streets.

### **IMPLICATIONS FOR SANITATION PROJECT:**

The purpose of this project was to use data obtained from a health promoter in the community of Nuevo Ferrocarril to determine the baseline health level for comparison after the implementation of a grey water collection system. From the data we were able to learn that the community has no childhood mortality resulting from lack of sanitation and in fact has a death rate lower than the national average. The community also has a higher rate of access to improved sanitation than El Salvador as a whole, though the vast majority of these people use pit latrines. It is unlikely that the intervention will show decrease in diarrhea cases, as they are already minimal. In addition the size of the population, being under 1,000 people will make a statistically significance difficult to obtain. However it was discovered that 30% of the children are malnourished, which is high compared to the national average (24.6%). It may be that the diarrhea is causing amplification of malnourishment and that this number may drop if infections are abated. Regardless of the quantitative complication, this data does provide tremendous insight about the health and lifestyle of the people in Nuevo Ferrocarril. It is my hope that the EWB students will remain in contact with the health promoter in the community and continue to gather data to strengthen the knowledge of the state of health in Nuevo Ferrocarril.

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## APPENDIX I: CONTACT LIST

<b>Name:</b>	<b>Role:</b>	<b>Contact Information:</b>	<b>Location:</b>
<i>Irma Concepción Barrera</i>	Health Promoter	7994-6466	Nuevo Ferrocarril Office
<i>Guillermo Castro</i>	Environmental Health Officer		Ministry of Health, Nejapa
<i>Esmeralda Vargas</i>	Community Member, Promoter Assistant	7203-5715	Nuevo Ferrocarril

<i>Esmeralda (Rosa) Miranda</i>	Community Member, Promoter Assistant	7276-5499	Nuevo Ferrocarril
<i>Veronica Basquez</i>	Community Member, Promoter Assistant	7826-7184	Nuevo Ferrocarril

**APPENDIX II: RAW DATA**