

Hospital Infection Rate following Sewage Malfunction in a Nigerian Hospital: An Observational Study

^{*1}Mokuolu O. A., ²Sojobi A. and ³Adejumo M.

^{*1}Department of Water Resources and Environmental Engineering,
Faculty of Engineering and Technology, University of Ilorin, Ilorin, Nigeria.
olubunmimokuolu@yahoo.com corresponding author.

²Department of Civil Engineering, Landmark University, Omuaran, Kwara
State, Nigeria. adebayosojobi@gmail.com

³Department of Environmental Health Sciences, Faculty of Public Health,
College of Medicine, University of Ibadan, Ibadan, Nigeria.
Adejumo_mumuni@yahoo.com

Running title: Infection rate during hospital sewage malfunction

Abstract

Patients in healthcare institutions contract nosocomial or Hospital Acquired Infections (HAI) that require extended hospital stays, costs and increased use of antibiotics. Such infections can cause patients great discomfort and adversely impact the overall quality and cost of healthcare. Contaminations into the environment by malfunction engineering infrastructure are a rare consideration in Healthcare facilities, while striving to lower the incidence of HAI by implementing surveillance programs, policies and procedures that aid in breaking the chain of infections. Nosocomial infection can be acquired directly or indirectly. This report is based on the observation on repercussion of sewage malfunction in a Nigerian Hospital where infection rate increased up to 200.2% during sewage malfunction and 246.2% at Neonatal Intensive Care Unit during similar occurrence. There is need for a multi prong approach to Hospital infection control in addition to the popular advocacy on hand hygiene and physical protective equipment.

Keywords

Engineering, facility, infections, Nigeria, sewage, protective, malfunction

1. Introduction

Nosocomial or Hospital Acquired Infections (HAI) occurs in all types of Hospitals and wards worldwide and their consequences on patients and occupational infections among staff in terms of morbidity, mortality, and costs. HAI may be caused by bacteria, viruses, fungi and other parasites. The organisms can be acquired in a multiple of ways; mainly air, surface contact and water (Anjali, 2006). They are a significant burden to patients and public health causing death and increased morbidity in hospitalized patients. These infections mostly occur in intensive care units, acute surgical and orthopaedic wards however there is a paucity of good quality epidemiological data, necessitating a strong need for carefully designed studies to determine the impact of HAI (Beggs *et al.*, 2015; Masnick *et al.*, 2015). HAI may also cause a huge burden financially, the greatest contributors to these costs are the increased stays that such patients require; Hassan *et al.*, 2010 reported up to 3.30 days higher length of stay and a higher portion of costs attributable to Medicare.

HAI may be transmitted by direct contact of the infected person, animal or other reservoir of infection. It may also be transmitted indirectly through air borne or through the bedding, clothing, toys and surgical instruments. Water, food, and biological products may also serve as vehicles for transmission. The highest infection rates are usually among intensive care unit (ICU) patients both adult and paediatric ICU level of occurrence being three times higher than anywhere else in the hospital (Weinstein, 1998). Over time much attention to control the spread of HAI had focused on hand hygiene than on other aspects such as preventing the aerial dissemination of bacteria. However, that there is need for a more pluralistic approach to infection control; one that reflects the complexity of the systems associated with HAI and involves multidisciplinary teams including hospital doctors, infection control nurses, microbiologists, architects, and engineers with expertise in building design and facilities management (Beggs *et al.*, 2015; Kampiatu and Cozean 2015). An outbreak or unusual increase of infection rate should be promptly investigated leading to sustained improvements in patient care and

environmental sanitation (WHO, 2002). This report is based on observation on Hospital Infection rate during sewage malfunction in a Nigerian Hospital.

2. Materials and Methods

This study was carried out as a cross sectional descriptive study at a tertiary healthcare facility (Teaching Hospital) in Nigeria. It is a major Hospital with 600 bed capacity and providing emergency, medical, surgical, radiology, obstetrics/ gynecology and child health services. The hospital also trains medical students. The Hospital has over three thousand employees which include various professionals like Doctors, Nurses, Laboratory Scientists, Pharmacists, Engineers, Physiotherapists and Imaging Scientists. Others are: social workers, Nutritionists, Caterers, Accountants, Administrators etc. Averages of one thousand patients are seen per day.

2.1 Neonatal Intensive Care Unit (NICU)

The Hospital NICU comprises 40 beds for Babies ranging from 1 to 30 days, with all categories of medical and non-medical staff ranging from medical consultants to cleaners. The unit lies on the first floor of a three story building and comprises a large ward for the children, consultant offices, Nurses' rooms, changing room, sleeping rooms for resident Doctors, sleeping room for mothers of patients, and conveniences for all. Sewer and water pipes runs through the roof slab of the unit, managed by the Engineering unit of the Institution as part of the discharge and distribution network respectably.

3. Sewage Treatment

The hospital uses on-site disposal system of sewage treatment. All the liquid waste from the toilet passes through pipes to septic tanks located close to wards and buildings. The effluent from the tank is disposed off through effluent disposal drains called "soak away" usually constructed close to the septic tanks.

4. Observations

The infection control unit keeps record of Hospital infections and rates of infection. Observations were made on repercussion of damaged sewer pipes in 2012 and 2013, infection control unit was contacted for records during this period. Three samples of discharge during the period was assessed under microscopy to confirm the presence of organisms observed.

5. Results And Discussion

There were observed leakages in some wards and NICU, with droppings on the floor through the sewage pipes that ran through the ceiling of these wards. The implication of the leakage was assessed by checking the records of the Hospital infection control unit against the period of the leakage with attention focused on the type of organism and incidence of faecal oral infections. The samples of discharge assessed under microscopy confirmed the presence of Escherichia coli in all three samples.

Table 1 shows the number of Hospital Acquired Infections (HAI) from the medical records of patients on admission over six month period when there was leakage in the hospital’s sewage pipes in some wards (January 2013) and after it has been repaired.

Table 1. HAI over a 6 month period						
Infections	2012			2013		
	October	November	December	January	February	March
Staphylococcus aureus	6	8	5	14	9	5
Escherichia coli	0	0	0	2	3	0
Enterococcus faecalis	0	0	0	3	1	0
Total	6	8	5	19	13	5

Hospital infection results from October 2012 to March 2013 are shown in Figure 1.

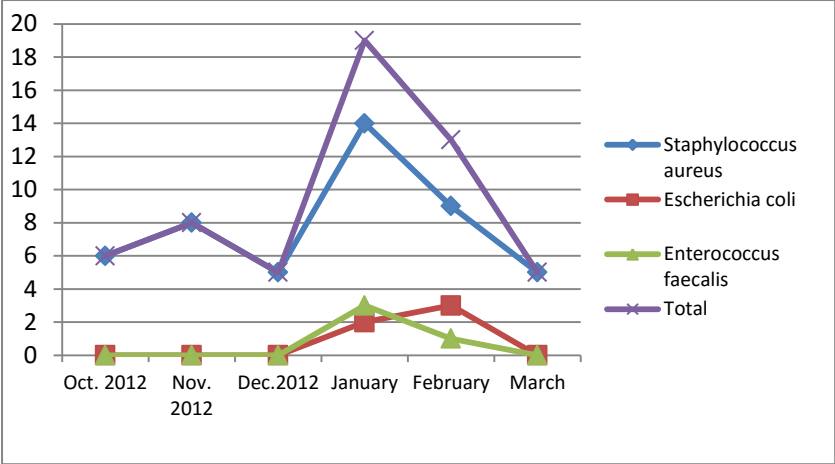


Figure 1: Hospital infection October 2012 to March 2013

Table 2 shows the rate of Infection at the Neonate Intensive Care Unit (NICU) of the hospital from July to December 2012. There was however a leakage in the sewage pipe through NICU in the month of September, while Figure 2 shows clearly the trend of infection rate between NICU July 2012 and December 2012

Table 2: HAI in NICU

Month	Infection Rate
July	2.9%
August	2.3%
September	9.0%
October	2.3%
November	2.4%
December	0.0%

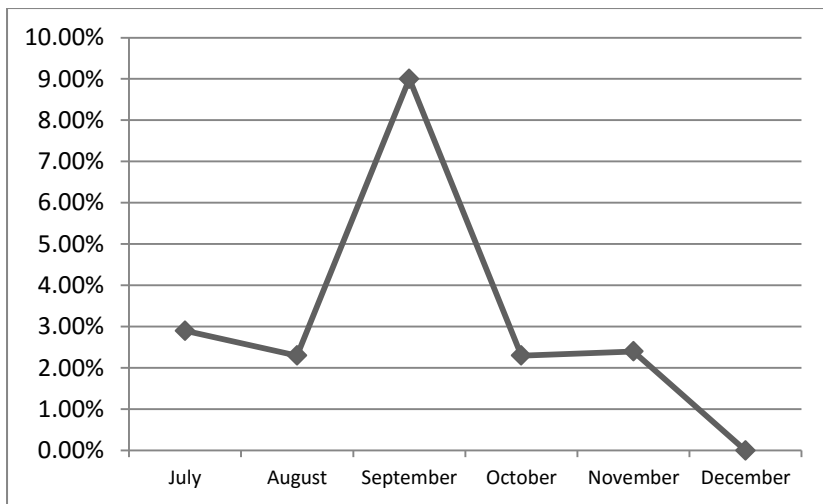


Fig.2: Infection rate in NICU July 2012 to December 2012

According to Minnesota Department of Health, *Staphylococcus aureus* are Bacteria likely to be found in sputum or Urine. *Escherichia coli* (E.coli) are Bacteria found in Human intestines, contacted through stool of faeces of humans mostly by drinking water or eat food that has been contaminated by feces (Web MD). *Enterococcus faecalis* can be found in faecal matter and can be contacted through improper hygiene (livestrong.com).

This study revealed an upsurge in infection at NICU and of the patients on admission at the study Hospital when there were leakages on sewage pipes within the Hospital. According to Weinstein (1998), the highest infection rates are usually among intensive care unit (ICU) patients and three times more among paediatrics ICU patients; this is in line with the observation at NICU among the neonates. Further, Weinstein (1998) found that at least one-third of nosocomial infections are preventable, from the study, the built environment influenced the incidence of infection in the hospital.

A careful consideration of environmental transmission routes in the design and operation of hospital facilities could reduce infection rate.

6. Conclusion

The study showed that infection rate was higher during the time of sewage pipe leakages in the hospital. It is recommended that surveillance and regular maintenance and testing of water/ sewer systems should be conducted by the Engineers and also, Infection control team should participate in the planning for any new or renovation of Hospital construction in order to ensure they meet standards for minimizing possible infections in design and operations.

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