

## Nosocomial Infection at the Tamale Teaching Hospital from 2017 To 2020

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### INTRODUCTION

Historically, staphylococci, pseudomonads, and *Escherichia coli* have been the nosocomial infection trioka; nosocomial pneumonia, surgical wound infections, and vascular access-related bacteremia have caused the most illness and death in hospitalized patients; and intensive care units have been the epicenters of antibiotic resistance. Acquired antimicrobial resistance is the major problem, and vancomycin-resistant *Staphylococcus aureus* is the pathogen of greatest concern. The shift to outpatient care is leaving the most vulnerable patients in hospitals. Aging of our population and increasingly aggressive medical and surgical interventions, including implanted foreign bodies, organ transplantations, and xenotransplantation, create a cohort of particularly susceptible persons especially in developed countries. Renovation of aging hospitals increases risk of airborne fungal and other infections. To prevent and control these emerging nosocomial infections, we need to increase national surveillance, “risk adjust” infection rates so that inter hospital comparisons are valid, develop more noninvasive infection resistant devices, and work with health-care workers on better implementation of existing control measures such as hand washing.

### BACKGROUND

Nosocomial infections, also known as hospital-acquired infections, are newly acquired infections that are contracted within a hospital environment. Transmission usually occurs via healthcare workers, patients, hospital equipment, or interventional procedures. The most common sites of infection are the bloodstream, lungs, urinary tract, and surgical wounds. Though any bacteria may cause a nosocomial infection, there is an increasing incidence of multidrug-resistant (MDR)

pathogens causing hospital-acquired infections. This rise can be explained by indiscriminate use of antibiotics and lacking hygiene measures, especially among medical staff. Commonly seen multidrug-resistant pathogens include methicillin-resistant *Staphylococcus aureus* (MRSA), extended-spectrum beta-lactamase-producing bacteria (ESBL), and vancomycin-resistant enterococci (VRE). The choice of antibiotic for treating infections with these pathogens is based on the individual resistance profile and often requires additional strict isolation methods for the patient.

According to Weinstein (1998), the contribution of antibiotic resistance to excessive death rates in hospitals is difficult to evaluate, often depending on whether studies are population-based or case-control, but evidence is mounting that antimicrobial resistance contributes to nosocomial deaths. While bacterial resistance is clearly the major threat, viral and fungal resistance could become important because of the small number of therapeutic options for these pathogens. Herpes viruses with acquired resistance to acyclovir and ganciclovir have emerged as problems, particularly in HIV-infected patients. Pathogens with intrinsic resistance often have lower pathogenicity and have disproportionately affected immunocompromised patients. For example, *Candida* spp. with intrinsic resistance to azole antifungal agents (e.g., *C. krusei*) and to amphotericin B (e.g., *C. lusitanae*) have emerged as problem pathogens in oncology units. While we are facing the era of opportunists, including fungi, viruses, and parasites in immunocompromised patients, the one we fear most is the post antibiotic era. The first nosocomial inkling is MRSA with reduced susceptibility to vancomycin (7). Beyond the post antibiotic era lies the era of xenogenic infections as organs,

transplanted from nonhuman primates, bring with them a variety of potential zoonotic pathogens. Nevertheless, traditional respiratory pathogens may yet prove to be our greatest challenge; for example, a major shift in strain type (8) could result in devastating pandemic community and nosocomial influenza A outbreaks.

### RESEARCH PROBLEM

Of late there has been increase in microbial infections in almost all departments at TTH. Most strongly hit the surgical department whereby we have post-surgical wound healing so difficult because of nosocomial infection and bacterial colonies in the wound. Some of these microbes tend to have symbiotic resistance and cause extended effect of bitter lactamase to susceptible bacteria causing resistance to antibiotics.

Internal medicine: In the internal medicine department, infectious diseases such as pneumonia, bronchitis, gastroenteritis and septic ulcers fail to heal because of lack of response to antibiotics this could be traced back to the phenomena of extended bitalactamase by bacteria such as morrasellacataris, clebsila, psycococcus are listed as the floral collected from the respiratory tract of patients.

In the chest clinic/T.B unit patients confirmed of pulmonary tuberculosis failed to respond to the almightyisoniazide and rifampicin; which was trusted so much by the World Health Organization when it was discovered. The World Health Organization recommended that isoniaziderefamperson could clear the heart in two weeks. Patients do take the medicine for the whole course of six months but yet the signs and symptoms persist and even sputum smell continue to be positive. Research in the chest clinic from 2016-2018 confirmed that patients responded to antikoch after sputum cultures and sensitivity isolated co-infections and appropriate dose of antikoch used to treat them, this discovery prompted the rationale of this research going on now. The clinical research findings of 2016-2018 reveals the fact that coinfections, the effect of antimicrobial resistance against antikoch by micro bacterium (Abdallah Yahaya,2018).

At the paediatric department, a lot of patients had microbial resistance against bacteria. Case studies revealed the fact that icolli which was usually responding to septrin had resistance against antibiotics for a long time until cuture

sensitivity showed that that specie could still respond to septrin but at attacking those, this confirms that some microbes and some antibiotics are intermediary, meaning resistant at continuing dosage but susceptible at attacking those.

In the department of obstetrics and gynaecology, nosocomial infections and co-infections have impacted on the results of induced vaginal delivery cecaerian infections. Minimal management of septic infections of all categories have been so difficult because of co-infections and beta lactamase bacterial. Nosocomial and co-infections grossly are the effects of contamination and microbial infections at the TTH obstetrics and gynaecology departments. Regular fumigation and disinfection has never been enough to stop this nosocomial infection and TTH wards, also universal precaution have never been applied or even known by some staff until the appearance of the CORONA virus pandemic.

### RESEARCH QUESTIONS

The following research questions shall be addressed by the study;

- Which nosocomial infections are emerging at Tamale Teaching Hospital (TTH)?
- Who is at risk of nosocomial infections at TTH?
- What causes nosocomial infections at TTH?
- How are nosocomial infections prevented and controlled at TTH?

### OBJECTIVES

- The main objective of this study is to determine the nosocomial infections emerging at TTH.
- To determine the prevalence of various microbial colonies emerging as nosocomial infections at TTH.
- To determine how nosocomial infections are controlled and prevented at TTH.
- To determine who is at risk of nosocomial infections at TTH.
- To determine the causes of emerging nosocomial infections at TTH.

### LITERATURE REVIEW

#### Nosocomial Infections

Nosocomial infections also referred to as healthcare-associated infections (HAI), are infections acquired during the process of receiving health care that was not present during

the time of admission. They may occur in different areas of healthcare delivery, such as in hospitals, long-term care facilities and ambulatory settings and may also appear after discharge (Sikora and Zahra, 2020).

HAI is the most common adverse event in health care that affects patients' safety. They contribute to significant morbidity, mortality and financial burden on patients, families and healthcare systems. The emergence of multi-drug resistant organisms is another complication seen with HAI. HAI affects 3.2% of all hospitalized patients in the United States, 6.5% in the European Union/ European Economic Area and worldwide prevalence is likely much higher (Magill et al, 2018)

### Types of Nosocomial Infections

Responsible pathogens originate from a variety of different sources and are represented by different sources and are represented by different types of HAI. The center for disease control and prevention broadly categorizes the types of HAI as follows:

- Central line-associated bloodstream infections (CLABSI)
- Catheter-associated urinary tract infections (CAUTI)
- Surgical site infections (SSI)
- Ventilator-associated pneumonia (VAP)

Source: Sikora and Zahra, 2020

### Causative Organism

Pathogens responsible for nosocomial infections include bacteria, viruses and fungi. Specific microorganisms have unique characteristics that favor particular types of infection in susceptible hosts. The prevalence of infections caused by particular microorganisms varies depending on the healthcare facility location, healthcare setting and patient population. Overall bacteria are the most common pathogens, followed by fungi and viruses (Sikora and Zahra, 2020).

### Routes of Transmission

Pathogens associated with healthcare-associated infection (HAI) may have different routes of transmission. The most common route of transmission is through contact, whereby the organisms are

transmitted by direct or indirect contact. Common microorganisms that may be transmitted through contact are multidrug-resistant bacteria (such as MRSA, ESBL-producing Gram-negative organisms, VRE), *C. difficile* and rotavirus. Droplet transmission may occur when microorganisms are transmitted from the respiratory tract by large droplets (greater than 5 microns) and travel less than 3 feet. Examples of infectious pathogens that are transmitted via the droplet route include influenza, *Bordetella pertussis* and *Neisseria meningitidis*. Airborne transmission involves the transmission of organisms from the respiratory tract by small droplets (less than 5 microns) that travel long distances. Chickenpox virus, tuberculosis, measles and the novel SARS-COV-2 virus may be transmitted through the airborne route (Ferioli et al, 2020).

### Complications

Complications of healthcare-associated infection are broad and depend on the type of infection, the severity of illness and implicated pathogen. The list of complications of each type of HAI can be extensive, below a few of the more common complications of each HAI are listed.

Complications of Hospital Acquired Pneumonia (HAP)/Ventilator Associated Pneumonia (VAP) include respiratory failure, empyema, parapneumonic effusions and sepsis.

Complications of Central Line-Associated Blood Stream Infection (CLABSI) include suppurative thrombophlebitis, endocarditis, septic arthritis, osteomyelitis, abscess and sepsis.

Complications of Catheter-Associated Urinary Tract Infection (CAUTI) include upper urinary tract involvement and sepsis (Sikora and Zahra, 2020).

### Prevention

Hand hygiene is the most important aspect of infection control and prevention of healthcare-associated infection. Pathogenic microorganisms that are transiently on the healthcare worker are readily removed with

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routine hand hygiene and limit risk of transmission to the patient. Hand hygiene also prevents colonization and infection in the worker and the contamination of the environment. The World Health Organization has identified moments in which hand hygiene should always be practiced:

- Before touching a patient
- Before any clean or aseptic procedure
- After exposure to body fluids
- After touching a patient
- After touching patient surroundings

Source: (Mathai et al, 2010).

Alcohol-based hand sanitizers are preferred over soap and water washing except when hands are visibly soiled, contact with body fluids after using the toilet, or there is exposure to spore-forming pathogens such as *C. difficile* (Mathai et al, 2010).

Studies have shown that complying to hand hygiene recommendations reduces the pathogen load, prevents transmission of HAI (Pittet et al, 2006).

Standard precautions should be practiced to protect healthcare workers. This includes the use of personal protective equipment such as gloves, gowns, masks and eye protection to protect from blood and body fluids. Transmission based precautions should be used to prevent airborne,

droplet and contact transmission. A fit-tested N-95 respirator should be worn and patient placement in an isolated negative pressure room to prevent airborne transmission. Surgical masks and physical distancing are precautions to prevent droplet transmission. Patient placement in a single room and healthcare worker gown and gloves are worn to avoid contact transmission of MDRO and *C. difficile*. Aseptic techniques should be practiced for invasive procedures and surgery.

## METHODOLOGY

Cross sectional, quantitative approach of data collection

Retrospective analysis of records of patients in the clinic and records or results of sputum culture and sensitivity of the bacteriological department of the laboratory at TTH.

## RESULTS

768 patients who passed through the chest clinic with pulmonary tuberculosis and other diseases were followed up. Sputum culture and sensitivity were requested, collected and sent to the bacteriology department of our laboratory. The results were collected after 72 hours and analysed. This research continued from 1<sup>st</sup> December, 2017 to 7<sup>th</sup> January 2019. The results were then organized into various columns and recorded as follows;

ISOLATES 1	
1st December, 2017 - 7th January, 2019	
Row Labels	Sum of Count of Isolate 1
Enterobacter spp.	1
Acinetobacterbaumani	1
Acinetobacterspp	1
Candida spp Isolated	28
Citrobacterdiversus	5
Citrobacterspp	22
Coagulase negative Staphylococcus	5
Commensals Only	296
Enterobacter spp.	54
Enterococcus spp	8
Escherichia coli	19
Klebsiellaoxytoca	9
Klebsiella spp	75
Moraxella catarrhalis	145
Morganella morgana	5
Proteus mirabilis	8
Proteus spp	1
Proteus vulgaris	1
Pseudomonas aeruginosa	1
Pseudomonas spp	14
Serratia marcescens	22
Staphylococcus aureus	1
Staphylococcus saprophiticus	29
Staphylococcus viridams	1
Strep viridans	1
Streptococcus pneumoniae	1
Streptococcus spp.	4
Streptococcus viridan	10
<b>Grand Total</b>	<b>768</b>

Fig1

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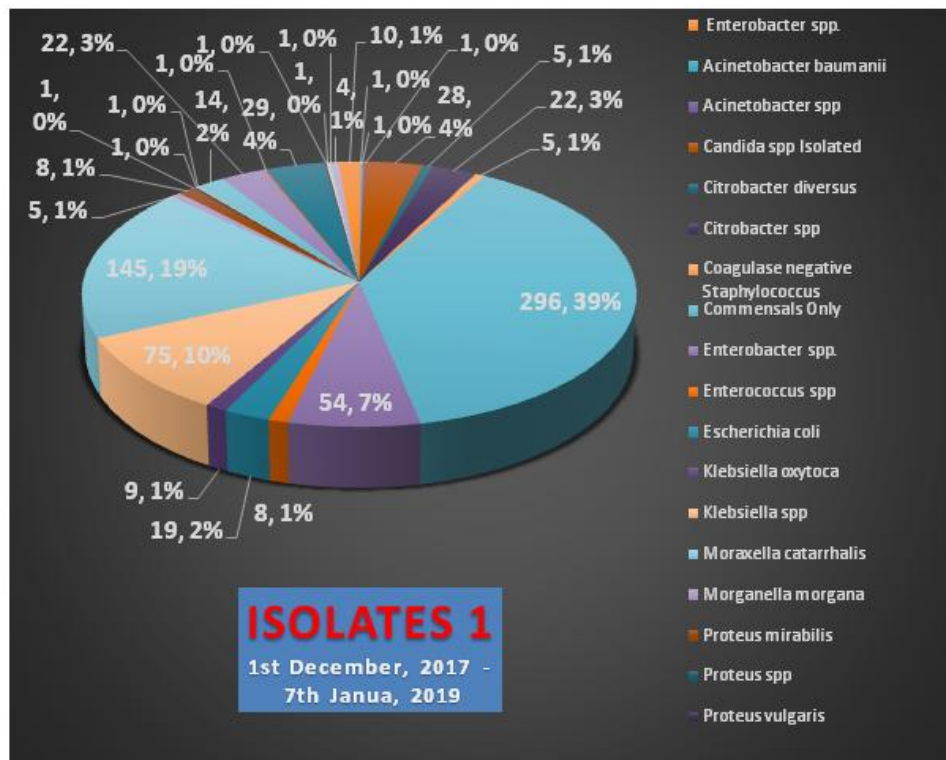


Fig 2

Table 1. Results on Nosocomial Infections Emerging at TTH Continues

	Frequency	Percentage
Enterobacterspp	10	1.09
Acinetobacterbaumanii	1	0.11
Acinetobacterspp	1	0.11
Candida sppIsolated	28	3.06
Citrobacterdiversus	5	0.55%
Citrobacterspp	22	2.40%
Coagulase negative Staphylococcus	20	2.19%
Commensals only	296	32.35
Enterobacter spp.	64	6.99
Enterococcus spp	15	1.64
Escherichia coli	20	2.19
Klebsiellaoxytoca	9	0.98
Klebsiellaspp	80	8.74
Moraxella catarrhalis	145	15.85
Morganella morgana	5	0.55
Proteus mirabilis	8	0.87
Proteus spp	15	1.64
Proteus Vulgaris	1	0.11
Pseudomonas aeruginosa	1	0.11
Pseudomonas spp	20	2.19
Serratia marcescens	22	2.40
Staphylococcus aureus	80	8.74
Staphylococcus saprophiticus	30	3.28
Staphylococcus viridams	1	0.11
Strep Viridans	1	0.11
Streptococcus pneumonia	1	0.11
Streptococcus spp.	4	0.44
Streptococcus Viridan	10	1.09
<b>Grand Total</b>	<b>915</b>	<b>100</b>

Source: Bacteriology department of TTH/Chest clinic patients records book 2018-2019

## DISCUSSION OF RESULTS

Analysing the table above, commensals were the highest (296 occupying 32.35%). A total of 915 patients were tested, the table shows the kinds of microbes in the respiratory track of patients in the chest clinic. Some of them was nosocomial others were parasitic and some had bitter lactamase resistance extension. They are all co-infections of the respiratory track of patients at the chest clinic who were different status of pulmonary tuberculosis and other pyogenic pneumonia and bronchitis.

Looking at the table 1 it is clear that the emerging nosocomial infections are not only one group but several different colonies. For example it includes commensals, parasites, symbiotic organisms and even mixed flora. The total number of microbes documented was 915. The bacteria included mostly Gram-positives and Gram-negatives. But the commensals had the highest prevalence occupying 32.5% (tab 1). The next most prevalent group of bacteria was *Moraxella carrtahalis* occupying 15.85%. as documented in my previous research findings, *Moraxella carrtahalis* historically is a commensal in the respiratory tract. Mutation as a result of influence of external factors has converted the niche of *Moraxella carrtahalis* from commensalism to parasitic symbiant in the upper respiratory tract of patients at the chest clinic of TTH (Yahaya A.I, 2018).

The rest of the organisms found in the respiratory tract are mainly gram positives such as *Staphylococcus saprophiticus* 3.28%, streptviridans 0.11%, streptococcus pneumonia 0.11%, streptococcus spp 0.44% and streptococcus viridian 1.09%. the spores of these microorganisms are left suspended in the air of the wards after sneezing or coughing of chest patients. These microbes are in their dormant forms on the dirty floors or hanging on cobwebs in the ceiling of the wards, clinics and other parts of the hospital they get inhaled by innocent patients of the ward in to their lungs or respiratory system. When sputum culture and sensitivity is done, the collected microbes in the respiratory tract are exposed in the smear microscope. Nosocomial infections are most prevalent where protocols for universal precautions are not followed; TTH is not an exception. The wards, clinics and theatres are supposed to be fumigated at least monthly. Apart from the daily cleaning and sanitizing, thorough general cleaning is supposed to be done in the hospital every week or two. These

protocols of universal prevention against nosocomial infection are not followed for some time now and therefore the prevalence of nosocomial infection in TTH.

## CONCLUSION

The emergence of high prevalence of nosocomial infections at TTH is as a result of failure to follow the protocol of universal prevention against nosocomial infections. For instance the World Health Organization has recommended that a health worker should wash or sanitize their hands;

- Before touching a patient
- Before any clean or aseptic procedure
- After exposure to body fluids
- After touching a patient
- After touching patient surroundings

Are these protocols practiced at TTH? No.

## RECOMMENDATIONS

- Protocols for universal precaution must strictly be followed to prevent the spread of nosocomial infeactions.
- Thorough daily cleaning of the hospitals
- Fumigation of the hospital, clinics wards and theatres periodically
- As stated by the World Health Organization precautions should be followed strictly to prevent nosocomial infections.

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