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Incidence of CAUTI in a new integrated ICU/HD in Singapore over 1 year

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Abstract

Hospital-acquired infection worldwide has been associated with significant mortality and morbidity and unfortunately catheter-associated urinary tract infection (CAUTI) is known to be one of the commonest hospital-acquired infections.

A retrospective study was done to determine the incidence of CAUTI in the Intensive Care Unit/High Dependency (ICU/HD) in Ng Teng Fong General Hospital (NTFGH) since it was opened from 1 July 2015 to 31 July 2016. NTFGH Intensive Care Unit is an integrated ICU/HD unit that manages a combination of surgical, medical, trauma and cardiac patients. The inclusion criteria were patients catheterized and with urinary tract infections diagnosed in ICU/HD and also diagnosed with UTI within 48 hours of discharge from ICU/HD. The data was retrieved from hospital electronic database. The types of organisms and their resistant pattern to antibiotics were analysed.

A total of 3159 patients were admitted to the ICU/HD during this period. One hundred eighteen patients were diagnosed with urinary tract infections in general and out of this group 69 patients were noted to have CAUTI based on CDC criteria. The commonest organisms related to CAUTI were Escherichia coli and Klebsiella pneumoniae. These two organisms showed a similar pattern of establishing resistance to all the first line antibiotics used and they were ampicillin, amoxicillin-clavulanic acid and cephalosporins. Though the usage of quinolones, sulfamethoxazole-trimethoprim and gentamicin were low, these organisms have also established resistance to these 3 antibiotics. Enterococcus fecalis was the next commonest organism and was often associated with the presentation of diarrhea. Other organisms including Pseudomonas, Proteus, Enterobacter, Morganella, Citrobacter, Burkholderia and Staphylococcus were sporadically reported.

The common risk factors for developing CAUTI noted were surgical elderly male patients with diabetes and a history of obstructive UTI.

A committee involving a team from ICU has been set to review the current indwelling urinary catheter bundle and rectify the problems and implement new measures to reduce the incidence of CAUTI.

Key words: CAUTI, hospital-acquired infection, bacteria, antibiotic resistance.

Introduction

Catheter-associated urinary tract infection (CAUTI) accounts for 20 to 30% of hospital-ac-quired infections (1) and studies done have shown that is more common in the ICU than elsewhere in the hospitals. Previous cohort studies have also demonstrated that such as gender, age, primary medical diagnosis and duration of catheters as risk factors for developing CAUTI.

Ng Teng Fong General Hospital is a newly built hospital in the western part of Singapore and it was officially opened in July 2015. The hospital facilities were opened in stages over the subsequent few months and more acute patients were subsequently referred to the hospital. The demographic of the surrounding neighborhood was generally middle class families with a high population of elderly patients with underlying medical conditions and social problems.

In our hospital, we have established an indwelling catheter bundle to reduce the incidence of CAUTI in the whole hospital. We have done this retrospective study to determine the incidence of CAUTI in the unit and also to review the risk factors involved in our cohort of patients that had developed CAUTI over the last year.

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Methods

At the time of this study, the CDC criteria was adopted and used to establish the diagnosis of CAUTI. This was taken into consideration that in most of the time the Intensive Care Unit/High Dependency (ICU/HD) patients might be on sedation and on the ventilators or non-invasive devices and not be in a state to complain about dysuria. There were also possible other confounding factors such as shock, fever and hypotension related to other concurrent infection or other medical conditions such as cardiogenic shock and inflammatory response which might alter the mental state and also presented with similar clinical signs and symptoms.

This was a retrospective study and the list of patients with urinary tract infections was retrieved from the hospital electronic data base and each patient was reviewed thoroughly to determine if the cause was related to CAUTI. Once the diagnosis was established, the duration of catheter in situ and other relevant medical data were retrieved. The types of bacteria in the UTI cultures were analysed and the antibiotic resistance and the time frame of the presentation was also noted. This was compared to the time frame of similar bacterial presentation in the general ward of the hospital done by the infection control nurses. The data was subsequently tabulated and analysed.

An indwelling catheter bundle was established as early as 2011 when the team of doctors and nurses from this hospital was working in the old premises of Alexandra hospital. This was used to guide the care of patients with urinary tract catheters and the predominant aim was to prevent CAUTI. This bundle is still currently in used. The bundle has been incorporated into the hospital electronic entry system as compare to the paper entry approach when it was first started in the old premises. We hope to review the compliance to the bundle in the new electronic system in the future.

A team of ICU doctors and nurses from the ICU/HD and infection control department are involved in the routine audit of CAUTI and measures are taken to maintain the compliance of the indwelling catheter bundle and also to reduce the incidence of CAUTI to the lowest rate as possible.

Results

A total of 3159 patients were admitted during this period into the ICU/HD with a total of 7461 catheter days. One hundred eighteen patients were diagnosed with urinary tract infections in general and out of this group of patients, 69 of them were noted to have CAUTI based on CDC criteria with a total of 408 catheter days (**Figures 1-2**). The total number of days in ICU/HD over this period for all patients was 5628 and the number of patients infected with CAUTI was 445.

The incident of ICU/HD CAUTI was 2%, CAUTI rate was 0.012 per 1000 days and the device utilization ratio was 1.32 over the studied period.

There were more surgical patients (31) with CAUTI as compared to medical (25) and cardiac (13) and there were 41 males as compare to 28 females in our cohort. The male patients tended to have a higher incidence of diabetes, hypertension and ischaemic heart diseases for the same age group as compared to the female patients. The mortality of these patients was also predominantly the males. Ninety percent of the patients had the catheters for less than 10 days and those that needed a catheter for more 14 days usually had a failed trial of off catheter. These catheters were placed most of the time in Emergency Department (ED) 58%, ICU 17% and general ward 25%. These findings were suggestive that chronic underlying medical diseases, site of insertion may also be contributing factors to the development of CAUTI.

The 2 predominant organisms in our cohort of patients were Escherichia coli and Enterococcus fecalis and followed by Klebsiella pneumoniae. We noticed a graduate increase in the pattern of resistance to the commonly used antibiotics in our hospital and they were ampicillin, amoxicillin-clavulanic acid and cephalosporins such as ceftriaxone, ceftazidime and cefepime. Despite the fact that quinolones like ciprofloxacins, sulfamethoxazole-trimethoprim and gentamicin were rarely used, these organisms had also developed resistant patterns to these antibiotics. Enteroccocus fecalis were found unfortunately to be associated with concurrent diarrhea in these patients. New measures had been taken so far to minimize catheters contamination when the patients are having diarrhea and hopefully this will help to reduce this contributing factor. Other sporadic presentations of organisms such as Pseudomonas, Enterobacter, Citrobacter, Morganella, Staphylococcus and Proteus could have colonized the patients during their previous admissions to other hospitals for similar or related underlying medical conditions (**Figures 3-8**).

Discussions

CAUTI (1) remains as one of the commonest hospital-acquired infections in the ICU and just like any other hospital-acquired infections is a burden on the healthcare system and contributes to an increase in length of stay in hospitals and may con-

tribute to unwarranted ICU/HD admissions. This may contribute to an increase in medical cost and financial burden on the patients and their family members. (2-5)

The incidence of CAUTI in our ICU is relatively low as compare to that quoted in other studies (0.012 vs 4.7 per 1000 days) in Southeast Asia (2) and also in other studies done in Singapore (2% vs 13.7%). (6) This could be partially attributed to the fact that we are still a relatively new set up and that we have yet to open to full capacity for the ICU.

The study on the point prevalence of bacterial infections in a few Singapore restructure hospitals in 2015 also demonstrated that Escherichia and Klebsiella in 2015 contributed more than 20.6% of the hospital-acquired infection, which unfortunately could have been preventable. This study is conducted national wide and the full study is yet to be published at the time of this report. Our study also concurred that these are the major organisms that played a significant role in CAUTI too in our ICU/HD and accounted for 50% of the positive cultures. The resistance patterns exhibited by these 2 common organisms have also demonstrated similar profile to the hospital antibiogram for the months of January 2016 to June 2016 too.

The acquisition of new resistance to the commonly used antibiotics by the bacteria is of great concern as it would imply that the patients may require stronger carbapenems coverage when they turn septic. This is a vicious cycle as it will inevitably result in more resistant strands of organisms.

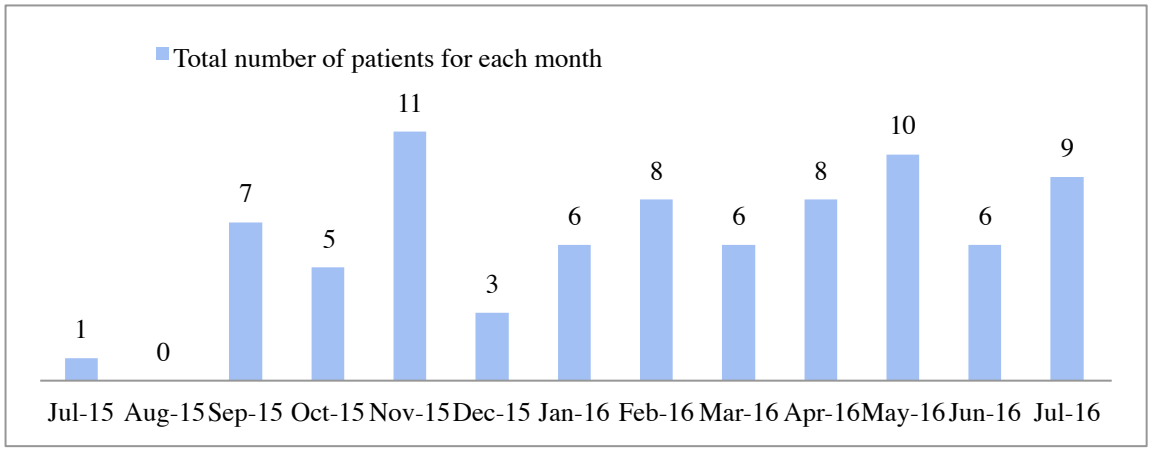
Majority of our patients are above the age of 50 years and are associated with underlying chronic medical conditions such as diabetes, ischaemic heart diseases, congestive cardiac failure and chronic renal diseases. These patients with underlying chronic diseases predisposed to the need for indwelling catheters when they become critically ill. Those patients with a compromised immune status are at increased risk of developing hospital-acquired infections. (1)

We also noted that majority of the catheters were inserted in the emergency department and we are looking into possibility of increase surveillance and supervision of catheter insertion in the respective places.

Ng Teng Fong General Hospital (NTFGH) is still a relatively new hospital and the patient load in the ICU has been slowly increasing over time. The urinary catheter bundle in the ICU appears to keep our CAUTI rate below the reported rates in other institutions and we hope to maintain the standard and if not to lower it further.

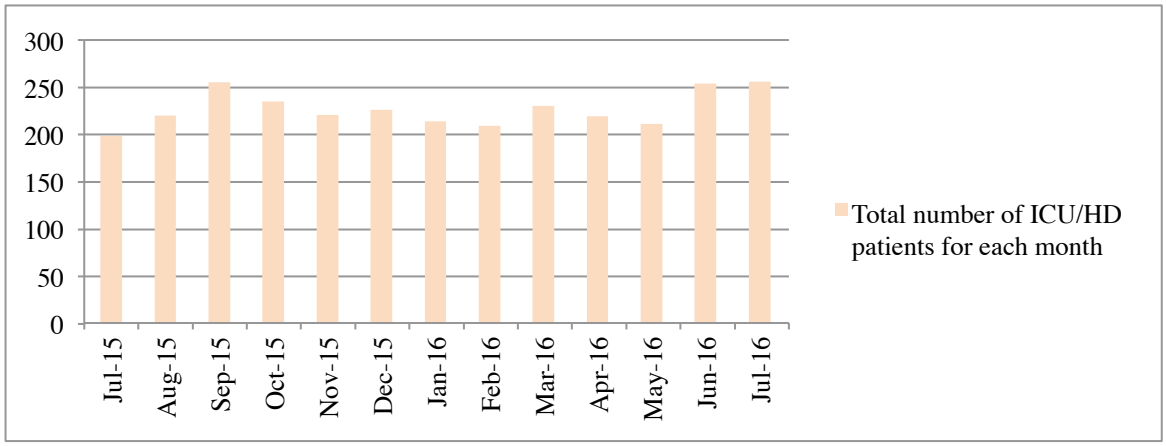
We are still maintaining an active surveillance of CAUTI in our ICU. We have implemented new measures to clean the catheters when the patients have diarrhea and we will review our CAUTI rate in subsequent studies.

Figure 1. Total number of patients with CAUTI



Legend: CAUTI=Catheter-associated urinary tract infection.

Figure 2. Total number of ICU/HD patients from July 2015 - July 2016



Legend: ICU/HD=Intensive Care Unit/High Dependency.

Figure 3. Distribution of age group with CAUTI

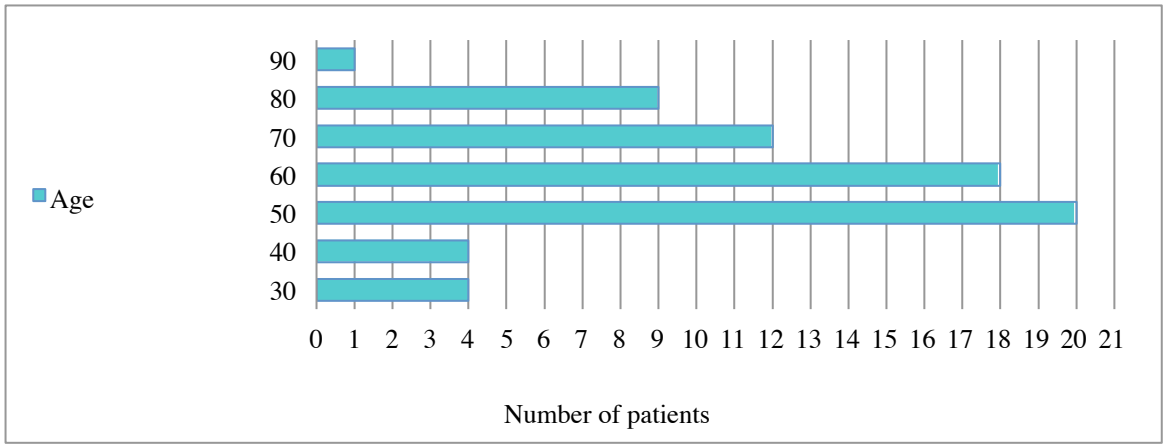


Figure 4. Number of E coli cultures that were sensitive to all antibiotics, resistance to 1, or more than 2 antibiotics

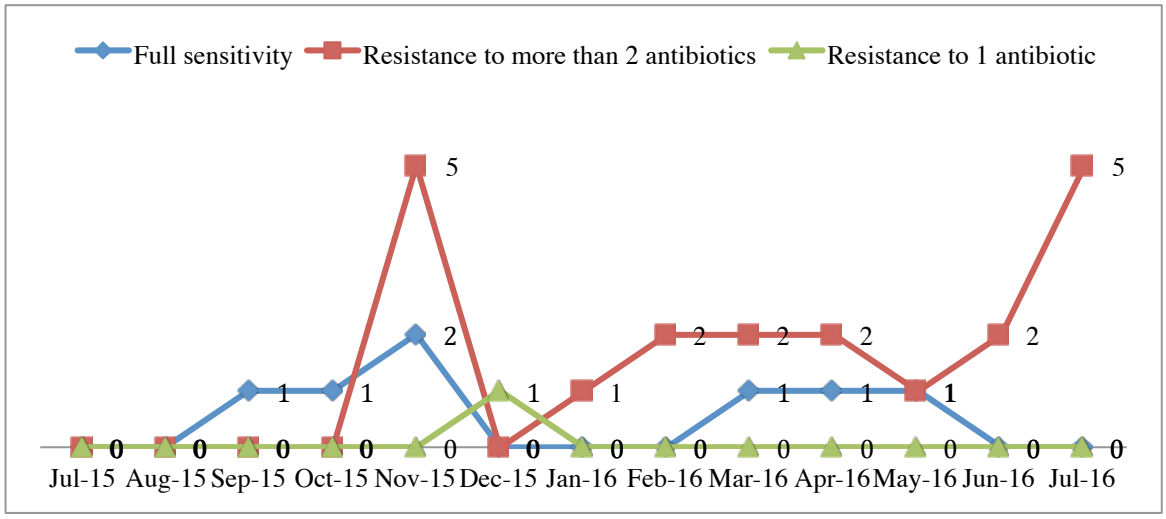


Figure 5. Number of K pneumonia cultures that were sensitive to all antibiotics, resistance to 1, or more than 2 antibiotics

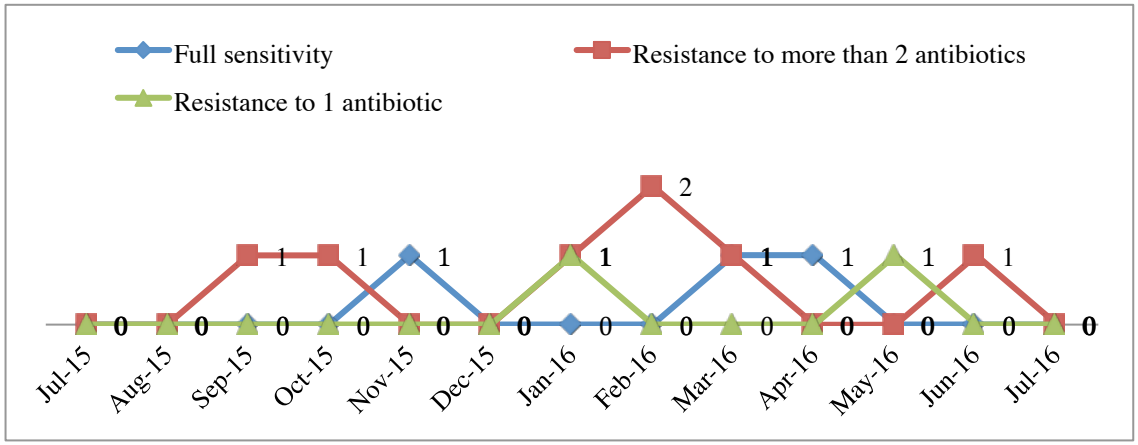


Figure 6. Number of E faecalis cultures that were sensitive to all antibiotics, resistance to 1, or more than 2 antibiotics

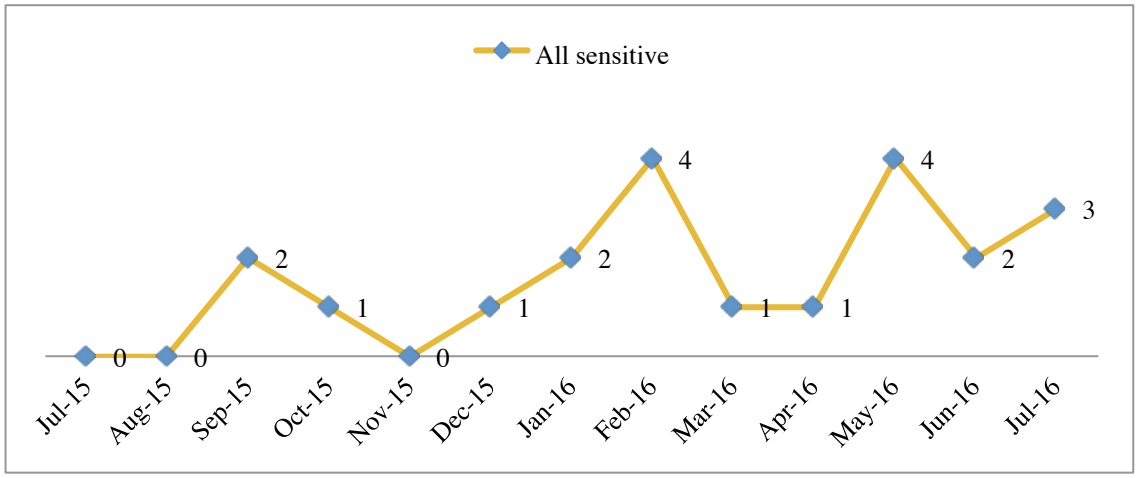


Figure 7. Number of other types of bacteria grown in the urine cultures

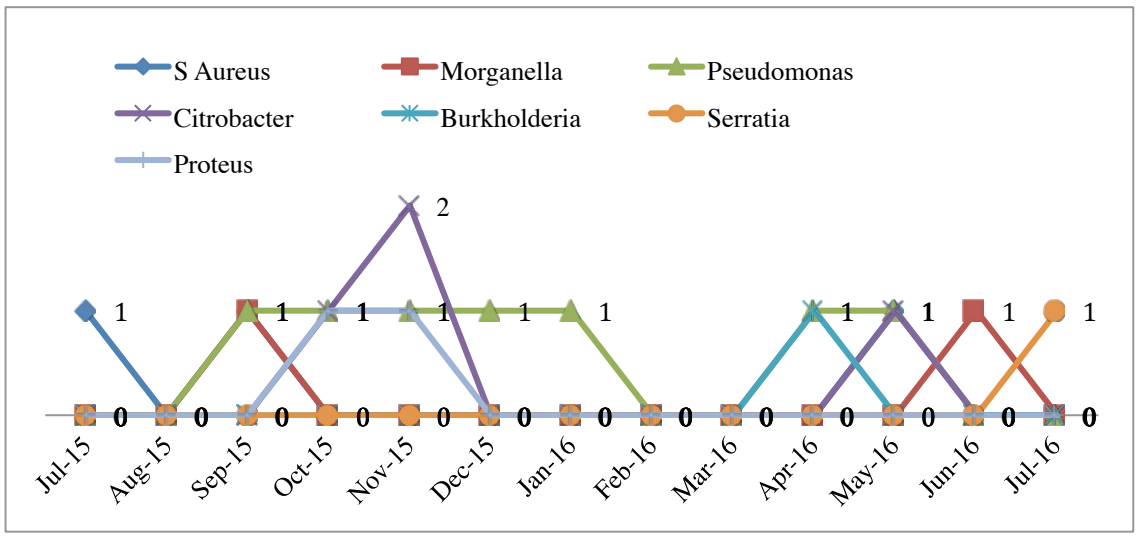
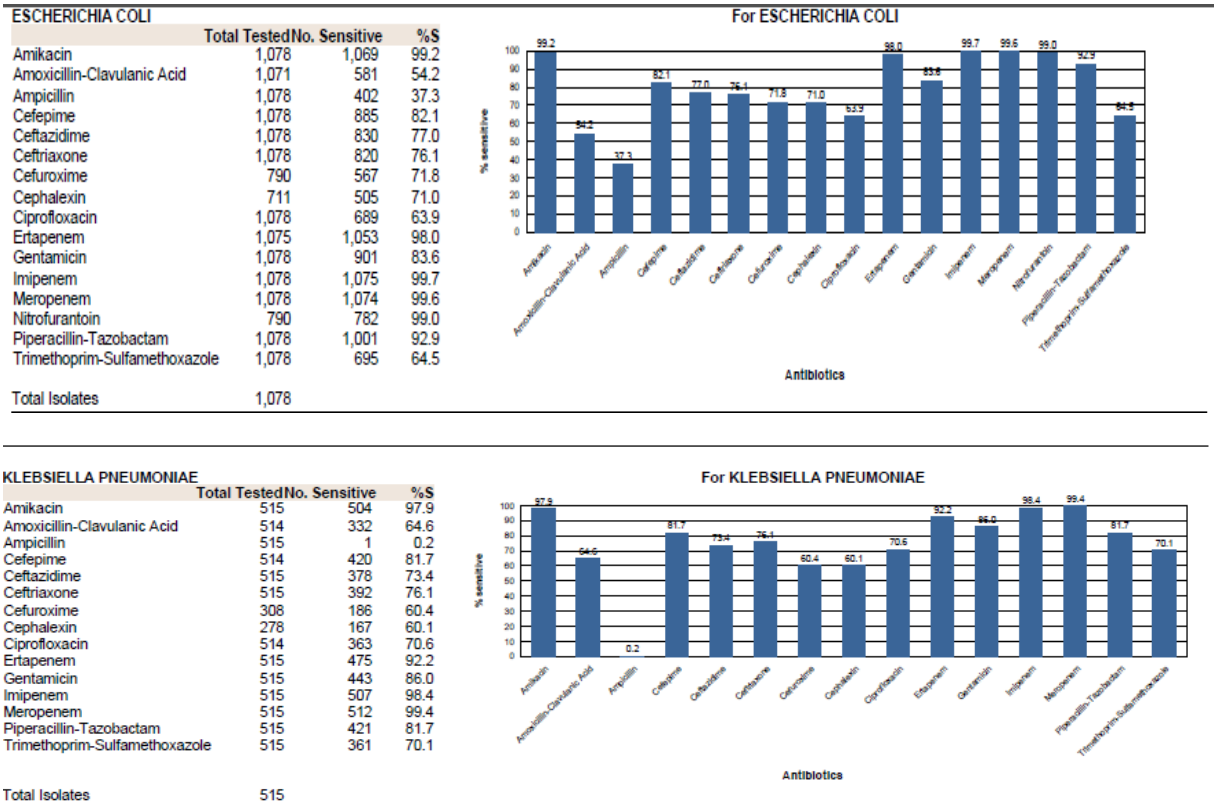


Figure 8. NTFGH antibiogram from January 2016 to June 2016



ESCHERICHIA COLI

	Total Tested	No. Sensitive	%S
Amikacin	1,078	1,069	99.2
Amoxicillin-Clavulanic Acid	1,071	581	54.2
Ampicillin	1,078	402	37.3
Cefepime	1,078	885	82.1
Ceftazidime	1,078	830	77.0
Ceftriaxone	1,078	820	76.1
Cefuroxime	790	567	71.8
Cephalexin	711	505	71.0
Ciprofloxacin	1,078	689	63.9
Ertapenem	1,075	1,053	98.0
Gentamicin	1,078	901	83.6
Imipenem	1,078	1,075	99.7
Meropenem	1,078	1,074	99.6
Nitrofurantoin	790	782	99.0
Piperacillin-Tazobactam	1,078	1,001	92.9
Trimethoprim-Sulfamethoxazole	1,078	695	64.5
Total Isolates	1,078		

KLEBSIELLA PNEUMONIAE

	Total Tested	No. Sensitive	%S
Amikacin	515	504	97.9
Amoxicillin-Clavulanic Acid	514	332	64.6
Ampicillin	515	1	0.2
Cefepime	514	420	81.7
Ceftazidime	515	378	73.4
Ceftriaxone	515	392	76.1
Cefuroxime	308	186	60.4
Cephalexin	278	167	60.1
Ciprofloxacin	514	363	70.6
Ertapenem	515	475	92.2
Gentamicin	515	443	86.0
Imipenem	515	507	98.4
Meropenem	515	512	99.4
Piperacillin-Tazobactam	515	421	81.7
Trimethoprim-Sulfamethoxazole	515	361	70.1
Total Isolates	515		

Legend: NTFGH=Ng Teng Fong General Hospital.

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