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Periodic Surveillance of Systemic Infection Antibiogram a Necessity – A Retrospective and Prospective Study

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A B S T R A C T

Periodic monitoring and surveillance of hospital antibiogram is mandatory because making an Antibiogram is the first step before framing Hospital Antibiotic policy. In this study, during the reference period (Retrospective -January 2013-December 2014 & Prospective period-January 2015-December 2015) a periodic surveillance of Anatomic site wise stratified antibiogram for blood, wound/soft tissue, respiratory and urine samples was done as per CLSI guidelines. Prevalent rates of Multi Drug resistant (MDR) pathogens-ESBL Enterobactericiae, MRSA, MDR Gram negative Non fermenters were reported. Prevalent Blood stream Pathogens were *Klebsiella* (17.2%) & CONS (27.2%), Wound pathogens Pseudomonas (25.3%) & *Staphylococcus aureus* (26.4%), Respiratory tract Pathogens Klebsiella (36.1%) & *Pseudomonas* (22.4%) and Urinary tract Pathogens E.coli (45%), & *Klebsiella* (17%). *Klebsiella* had improved susceptibility for Respiratory & Blood stream infection when compared to UTI. Pseudomonas showed improved susceptibility profile for both wound and respiratory infection. Drug resistance increased for E.coli during the reference period. *Staphylococcus* was reported with increasing susceptibility profile when compared with *Enterococci*. Though there was increasing trend in sensitivity percentage for most of the antibiotics during the prospective period when compared to retrospective period a narrow spectrum of sensitivity was observed for commonly used antibiotics.

Introduction

In the era of increasing Antimicrobial resistance due to Antimicrobial misuse and reduced emphasis on antibiotic development by pharmaceutical manufacturers. There has been a major international effort to tackle global challenge of Antimicrobial resistance and our national center for disease control has published National treatment guidelines and Antimicrobial policy for antibiotic use in Infectious disease (http://www.ncdc.gov.in/writereaddata/linkimages/AMR_guideline7001495889.pdf). Antibiotic policy is one of the mandatory requirements for accreditation and making an Antibiogram is the first step before framing Antibiotic policy (http://www.ncdc.gov.in/writereaddata/linkimages/AMR_guideline7001495889.pdf;

Hospital antibiogram, 2010; Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America, 2007). Planning an empiric Antibiotic policy in a hospital utilizes subgroup specific Antibiogram analysis. Standard guidelines for constructing antibiogram are given by organizations like CLSI, IDSA, CDC and WHO (Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America, 2007; Analysis and presentation of cumulative antibiograms, 2007; Specification for a Hospital Cumulative Antibiogram, 2013)**.** They also endorse and recommend the use of appropriate empiric antibiotic therapy based on local microbiological results and their Local Antibiogram. Also most convenient and widely used available measure of a hospital's proportion of resistant organism is hospital cumulative Antibiogram. The need for reliable accurate Antibiogram data is critical to guide appropriate antibiotic selection.

The cumulative hospital Antibiogram is a periodic summary of Antibiotic susceptibility of local bacterial isolates. The objectives of cumulative Antibiogram is to present useful validated information in a consistent way to Clinicians and Policy makers to asses' local susceptibility rates .It also helps in clinician's decision towards selecting appropriate empiric antibiotic therapy and also change in prescribing & infection control practices. It guides in monitoring antimicrobial resistance trends over time with in an Institute (ICU / ward specific, IP vs. Op) and this can make substantial contribution to patient outcome without additional testing (Atul *et al*., 2010; Shanmuga *et al*.,). Aggregates of antibiograms from specific regions would help in monitoring trends across a community & nation (Diane *et al*., 2004). Local Antibiogram data is useful for optimized empirical antibiotics therapy. Antibiograms of pathogens vary markedly between hospitals and between different systemic infection types.

Background

Susceptibility statistics consisting of cumulative and ongoing summary of patterns of antibiotics sensitivity of clinically important bacteria are important for various health care practitioners & Microbiologists. The most common use of hospital antibiogram data is probably for assisting clinicians with empiric therapy for suspected infections.

Our tertiary care hospital has been reporting MDR (Multi drug resistant) pathogens from almost all of clinical samples types from different clinical units. As we are in the process of framing an official Antibiotic policy, retrospective surveillance of our hospital Antibiogram will help in framing our Institute's effective Antibiotic policy and prospective surveillance will strengthen the same. This surveillance study will also help in identifying the prevalent MDR pathogens from specific clinical specimen type at our tertiary care center which will ultimately lead to implementation of Specific Infection control practices in those areas accordingly. Moreover, because there will be hardly any new antibiotics in near future, a better understanding of institutional antibiogram is needed on how to optimize the use of existing antibiotics, either alone or in specific combinations.

The aim and objectives of this study includes;

Retrospective Surveillance (Jan 2013-Dec 2014)of Cumulative Antibiogram to identify the most prevalent pathogens isolated from specific anatomic sites & trends in Antibiotic sensitivity pattern of the same. Prospective Surveillance (Jan 2015-Dec

2015) of Antibiogram for tracking the shift in trends of MDR pathogens and guidance for a necessity to change in prescribing and infection control practices.

Materials and Methods

This study was conducted at a 650 bedded tertiary care hospital. All the pathogens isolated from specific clinical samples (Blood, wound/pus, Respiratory tract specimens (throat swabs, sputum, Endotracheal secretions, etc.) and urine)submitted for culture/sensitivity to central Microbiology Lab during the Retrospective period (January 2013-December 2014) and Prospective period (January 2015-December 2015) was analyzed. In this study the bacterial profile of Blood stream infections, wound infections, Respiratory tract infections and Urinary tract infections reported. Also the trending antibiogram of the most frequently isolated pathogen of the above mentioned infection syndrome during the mentioned study period was recorded and analyzed. The identification of bacterial isolates and antibiotic susceptibility interpretation for drugs tested against most frequently isolated pathogens is reported according to CLSI guidelines. The cumulative antibiogram was constructed for pathogens isolated from the above mentioned infection syndrome in accordance with the CLSI guidelines. The antibiogram was manually constructed and we included first isolate per patient and excluded duplicate isolates. Trending of Drug resistance /multi drug resistance was recorded forthe prevalent pathogen for the mentioned infection syndrome.

The antibiotic discs that were used to identify the susceptibility pattern of the bacterial pathogens and their concentrations included penicillin (10 mcg), amikacin (30 mcg), ceftazidime (70 mcg), ceftriaxone (30 mcg), cefoxitin (10 mcg), ciprofloxacin (5 mcg), clindamycin (2 mcg), erythromycin (10 mcg), gentamicin (10 mcg), imipenem (10 mcg), linezolid (30 mcg), piperacillin/tazobactum(Pip-Taz)combination (100/10 mcg), and vancomycin (30 mcg).

Results and Discussion

Antibiotic susceptibility of pathogen can vary markedly between different hospital location and between different clinical specimens. In this study we aim in highlighting the bacterial profile of Blood stream, wound/soft tissue, respiratory tract and Urinary tract infections and cumulative antibiogram of three most prevalent pathogens isolated from each of the above mentioned infection syndrome. Also we have compared the trending susceptibility pattern of the most prevalent isolated pathogen from clinical specimens.

In Table-1 we have enumerated the bacterial profile of Blood stream Pathogens. The most prevalent gram negative being *Klebsiella & Other Nonfermenting Gram Negative Bacilli (NFGNB)* and gram positive *CONS*.

Table-2 highlights the Cumulative sensitivity of most prevalent blood stream pathogens for three year study period (Jan 2013 to Dec 2015)

Trending sensitivity pattern of the prevalent blood stream infection pathogen individually for the each study period is shown in Table-3. Last row highlights the Trending drug resistance percentage (ESBL-Extended spectrum beta lactamases) In Table-4 we have enumerated the bacterial profile of Soft tissue/Wound infection. The most prevalent gram negative being *Pseudomonas* followed by *E.coli* and gram positive *Staphylococcus aureus.*

Table-5 highlights the Cumulative sensitivity of most prevalent wound pathogens for three year study period (Jan 2013 to Dec 2015)

Trending sensitivity pattern of the prevalent wound infection pathogen individually for the each study period is shown in Table-6. Last three rows highlights the Drug resistance percentage (ESBL-Extended spectrum beta lactamases, MRSA-Methicillin resistant staphylococcus aureus and MDR % of *Pseudomonas*)

In Table-7 we have enumerated the bacterial profile of Respiratory tract Pathogens. The most prevalent gram negative being *Klebsiella* followed by *Pseudomonas and* gram positive *Staphylococcus aureus.*

Table-8 highlights the Cumulative sensitivity of most prevalent Respiratory tract pathogens for three year study period (Jan 2013 to Dec 2015). Trending sensitivity pattern of the prevalent Respiratory pathogen individually for the each study period is shown in Table-9. Last three rows highlights the Drug resistance percentage (ESBL-Extended spectrum beta lactamases, CR-carbapenam resistance, MRSA-Methicillin resistant staphylococcus aureus and MDR % of *Pseudomonas*)

In Table-10 we have enumerated the bacterial profile of Urinary tract infection. The most prevalent gram negative being *E.coli* followed by *Klebsiella and* gram positive *Enterococci*

Table-11 highlights the Cumulative sensitivity of most prevalent Urinary tract pathogens for three year study period (Jan 2013 to Dec 2015)
Trending sensitivity pattern of the prevalent Uropathogen individually for the each study period is shown in Table-12. Last three rows highlights the Drug resistance percentage (ESBL-Extended spectrum beta lactamases, CR-carbapenam resistance, VRE-Vancomycin resistant Enterococci)

Cumulative hospital Antibiogram, which is an integral part of Antimicrobial stewardship (AMS) was previously, reported hospital wide. Later CLSI has published consensus guide lines recommending stratification of susceptibility data by patient population wise or Anatomic site wise, or location wise. In this study, during the reference period (Retrospective -January 2013-December 2014 & Prospective period-January 2015-December 2015) we have done a periodic surveillance of Anatomic site wise stratified antibiogram with specific reference to blood, wound/soft tissue, respiratory and urine.

Blood stream Infection (Table 1, 2 & Table: 3): For the entire study period the most prevalent gram negatives isolated from blood were *Klebsiella* (17.2%) followed by Other NFGNB (13%) and CONS (27.2%) among gram positives as shown in Table: 1. Imipenem and Colistin sensitivity remained 100% throughout the study period (Table-2 and Table-3)) for both *Klebsiella* & Other Nonfermenting Gram negative bacilli. ESBL *Klebsiella* percentage declined from 100% in 2013 to 45% in 2015as shown in Table: 3 .Vancomycin & Linezolid showed a slight decline in sensitivity for CONS in 2014 but increased to 100% in 2015 (Table-3). The trending sensitivity for *Klebsiella* was increasing for most of the antibiotics except Pipericilin-Tazobactum. But for other NFGNB's though Imipenem, Pip-Taz & Colistin remained 100% susceptible, there was a declining trend seen for other antibiotics. The susceptibility trend for CONS improved for most of the antibiotics as shown in Table-3

In a study by Shilpi *et al.,* (2016) *E.coli* was the predominant blood stream pathogen

(22.4%) followed by *Klebsiella* (19.7%) and CONS (17.4%) was the second common among gram positives following Staphylococcus aureus (18.3%). In that study *Klebsiella* showed 100% sensitivity to colistin but Imipenem sensitivity was 98.2%.In concordance with our study, reports by Sharma *et al*., and Pragnya Paramita Jena *et al.,* (2015) CONS was the prevalent gram positive blood pathogen at 21.5% & 40.5% respectively. But Other NFGNB's (22%) and *Acinetobactor* (14%) were the prevalent gram negatives.

Soft tissue/wound infections (Table 4, 5 & Table: 6): Prevalent gram negative was *Pseudomonas* (25.3%) with improving sensitive percentage for ceftazidime from 58% in 2013 to 70% in 2015. Imipenem sensitivity remained 100% throughout the study period, but colistin& Pip-taz % declined in 2015. MDR % decreased from 41.6% in 2013 to 13.1% in 2015 .*E.coli* second common GNB isolated (14.2%) showed decline in susceptibility profile in 2015 for most of the antibiotics. Carbapenam resistance increased from 0% in 2013 to 11 % in 2015 and ESBL percentage also increased from 89% to 96%. Staphylococcus aureus was prevalent gram positive (26.4%) for which Vancomycin & Linezolid sensitivity improved from 97% in 2013 to 100% in 2015 and MRSA rates halved from40 % in 2013 to 20 % in 2015. Increasing drug resistance was seen in *E.coli*.

Similar results are reported by Sah *et al.,* (2013) and dipender *et a1*., (2012) where in *Staphylococcus* (41% & 33.8%), *Pseudomonas* (11.5% & 20.4%) & *E.coli* (11.5% & 17.4%) are predominant wound pathogens respectively .Similar susceptibility profile was reported for Staphylococcus by Sah *et al.,* but improved sensitivity percentage was seen in study by Dipender etal.

***Respiratory tract infection (Table 7, 8 & Table: 9)*:** Prevalent respiratory gram negative pathogen was *Klebsiella* (36.1%) followed by *Pseudomonas* (22.4%).Imipenem & Pipericillin-Tazobactum remained 100% sensitive for *Klebsiella*. For *Pseudomonas* Imipenam sensitivity improved from 97 % in 2013 to 100% in 2015. Susceptibility profile improved for most antibiotics during the prospective period when compared to retrospective period. MDR percentage for *Pseudomonas* declined from 10.8% to 7.1% and ESBL *Klebsiella* reduced from 89% in 2013 to 36% in 2015. Prevalent Gram positive were Streptococcus (17%) followed by Staphylococcus *aureus* (7.0%).For Staphylococcus Vancomycin & Linezolid remained 100% sensitive and MRSA percentage reduced from 21% in 2013 to 11% in 2015.

Similar reports from studies by Syed *et al.,* (2013), Sarmah *et al.,* (2016), Vijay *et al.,* (2016) & Ashok kumar *et al*., show *Klebsiella, Pseudomonas* & Staphylococcus as Predominant respiratory pathogens. Anvari *et al*., reported *Pseudomonas, Acinetobacter* as prevalent respiratory pathogens. Syed *et al*., Anvari *et al.,* & Vijay *et al.,* reported decreased susceptibility profile for most antibiotics and Sarmah *et al.,* reported a good susceptibility when compared to our study.

Urinary tract infections: The prevalent Gram negative was *E.coli* (45%) followed by *Klebsiella* (17%). Imipenem sensitivity reduced for *E.coli* during the study period (Imipenem 100% in 2013 & 94% in 2015) when compared to *Klebsiella* (89% in 2013 & 100% in 2015). The sensitivity percentage of other antibiotics like ceftazidime, Norfloxacin & Nitrofurantoin for *E.coli* & *Klebsiella* remained same at low percentage. ESBL percentage for both *E.coli* & *Klebsiella* almost remained same throughout

the study period. Enterococci was prevalent gram positive at 13.4% showed improved sensitivity for Gentamicin & Nirofurantoin but declining susceptibility profile for Betalactums, Linezolid and Vancomycin.

Table.1 Bacterial profile of Blood stream Infection

		2013		**2014**		**2015**		**TOTAL**	
Total Number of Samples received		498		631		1208		2337	
	organisms	NO	%	NO	%	NO	%	NO	%
	Klebsiella	34	17%	38	17.8%	40	17.2%	112	**17.2%**
	Salmonella	21	10%	25	11.7%	33	14.1%	79	12%
	E.coli	20	9.5%	2	0.9%	10	4.2%	32	5%
	OtherNFGNB	17	8.0%	38	17.8%	30	13%	85	**13%**
	Acinetobacter	22	11%	8	3.6%	7	3%	37	6%
	Pseudomonas	22	11%	16	7.5%	21	9%	59	9%
	MSSA	36	17.5%	18	8.4 %	12	5.2%	66	10 %
	CONS	33	16%	68	31.8%	76	33%	177	**27.2%**
	Enterococci	-	-	1	0.5%	3	1.3%	4	0.6%
TOTAL		205		214		232		651	

Table.2 Antibiogram for three year period
(Jan 2013 – Dec 2015) of three prevalent Blood Stream Infections (BSI) pathogen
Microbiology Data – (n- 651)

Most Common Pathogens	**Number of Isolate**	**Prevalence %**	**Antibiotic Sensitivity %**
Klebsiella	112	112/651=17.2%	Amik-35%, Genta-13.4%, Cefotax-26%, Ceftaz-21.4%, Cipro-0.9%, Doxy-42%, Pip taz-89.3%, Imipenem & Colistin-100%. **ESBL: 78.6 %**
Other Non-Fermenting Gram negative bacilli	85	85/651=13%	Amik-65%,Genta-59%,Cefotax-49 %,Ceftaz-51.%,Cipro-58%, Pip -taz, Imipenem & Colistin-100%
Coagulase Negative Staphylococcus	177	177/651=27.25%	Genta-91%, Cefazolin-61%, Cefotaxime-96%,Cipro-86.4%,Erythro-79%,Clinda-86%,Linezolid-99.4%,Vanco-99.4%

Table.3 Trending Sensitivity pattern of three prevalent Blood stream Pathogen for three year study period

	***Klebsiella*-17.2% (112-Isolates)**			**NFGNB-13% (85-Isolates)**			**CONS-27.2% (177-Isolates)**		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
No of isolates	**34**	**38**	**40**	**17**	**38**	**30**	**33**	**68**	**76**
Amikacin	11.8%	39.5%	50%	100%	39.5%	73.3%			
Genta	5.8%	21%	12.5%	94.1%	39.5%	63.3%	100%	76.4%	100%
Cefazolin	0	0	2.5%				42.2%	90%	43.4%
Cefotaxime	5.8%	7.9%	60%	94.1%	60.5%	10%	100%	88.2%	100%
Ceftazidime	0	5.3%	55%	94.1%	63.5%	10%			
Ciprofloxacin	0	0	2.5%	88.2%	60.5%	36.6%	84.8%	88.2%	85.5%
Ofloxacin	0	39.5%	27.5%	94.1%	63.5%	53.3%	81.8%	88.2%	86.8%
Doxy	11.8%	60.5%	40%						
Imipenem	100%	100%	100%	100%	100%	100%			
Pi-Taz	88%	92.1%	87.5%	100%	100%	100%			
Colistin	100%	100%	100%	100%	100%	100%			
Erythro							51.5%	78%	92.1%
Clinda							48.4%	97%	92.1%
Linezolid							100%	98.5%	100%
Vanco							100%	98.5%	100%
ESBL	**100%**	**94.7%**	**45%**	**NIL**	**NIL**	**NIL**			

Table.4 Bacterial profile of Soft tissue/Wound Infection

		2013		**2014**		**2015**		**TOTAL**	
Total Number of Samples received		200		238		528		966	
	Organisms	NO	%	NO	%	NO	%	NO	%
Gram Negative bacilli	*E.coli*	56	22%	19	6%	90	15.2%	165	14.1%
	Klebsiella	20	8%	13	4%	33	5.6%	66	5.6%
	Proteus	12	4.8%	37	11.3%	84	14.2%	133	11.3%
	Citrobacter	4	1.6%	4	1.2%	19	3.2%	27	2.3%
Non fermenting GNB	*Pseudomo*	48	19%	76	23.2%	168	28.4%	292	25.3%
	Other NFGNB	11	4.4%	21	6.3%	13	2.2%	45	3.8%
	Acinetobacter	10	4%	4	1.2%	-	-	14	1.2%
Gram positive cocci	Staph aureus	72	28.4%	122	37%	116	19.6%	310	26.4%
	CONS	12	4.8%	32	9.8%	52	8.8%	96	8.2%
	Enterococci	7	3%	1	0.3%	17	2.8%	25	2.1%
TOTAL		252		328		592		1172	

Table.5 Antibiogram for three year period (Jan 2013 – Dec 2015) of three prevalent Wound infection pathogen Microbiology Data – (n- 1172)

Most Common Pathogens	**Number of Isolate**	Prevalence %	Antibiotic Sensitivity %
Pseudomonas	292	25.3%	Amik-84%,Genta-62%,Cefotax-%,Ceftaz-64.%,Cipro-67%, Pip taz-85.3%, Imipenem & Colistin-100%. **MDR-30.1%**
E.coli	165	14.2%	Amik-88%,Genta-38%,Cefotax-8%,Ceftaz-10%,Cipro-13.3%,Doxy-13.3%,Pip taz-82%, Imipenem -94%& Colistin-99% **ESBL-90.3%**
Staphylococcus aureus	310	26.4 %	Genta-68.3%, Cefazolin-64%, Cefotaxime-71%,Cepoxitin-73 5Cipro-46%,Erythro-63.2%,Clinda-78%,Linezolid-99.4%,Vanco-98.7% **MRSA-27%**

Table.6 Trending Sensitivity pattern of three prevalent wound infection Pathogen for three year study period

	***Pseudomonas*-25.3% (292-Isolates)**			***E.coli*-14.2% (165-Isolates)**			**Staphylococcus-26.4% (310-Isolates)**		
	2013	**2014**	**2015**	**2013**	**2014**	**2015**	**2013**	**2014**	**2015**
No of isolates	**48**	**76**	**168**	**56**	**19**	**90**	**72**	**122**	**116**
Amikacin	75%	68%	92%	67%	89.4%	100%			
Genta	41.6%	59.2%	69%	29%	42.1%	42.2%	56%	67.2%	78%
Cefazolin	-		-	7%	10.5%	4.4%	56%	57%	43.1%
Cefotax	-		-	11%	15.7%	4.4%	78%	62.3%	56.8%
Ceftazidime	58%	56.5%	69%	11%	31.5%	4.4%			
Cipro	58%	67.1%	69%	7%	31.5%	13.3%	13.8%	46%	67.2%
Oflox	75%	70.4%	70.2%	7%	42.1%	15.5%	16.6%	51%	78%
Doxy	-	-	-	14%	21%	22%	35%	66%	91.4%
Imipenem	100%	100%	100%	100%	100%	88.8%			
Pi-Taz	75%	100%	82%	75%	89%	78%			
Colistin	83.3%	100%	91.6%	100%	100%	98%			
Erythro							56%	64%	67.2%
Clinda							67%	85.2%	78%
Linezolid							97%	100%	100%
Vanco							97%	95%	100%
MDR	**41.6%**	**34.2%**	**13.1%**						
ESBL				**89%**	**68%**	**96%**			
MRSA							**40%**	**25%**	**20%**

Table.7 Bacterial profile of Respiratory Tract Infection

		2013		2014		2015		TOTAL	
Total Number of Samples received		429		659		1310		2398	
	Organisms	NO	%	NO	%	NO	%	No	%
Gram Negative bacilli	*Klebsiella*	56	26.3%	72	30.5%	211	43.2%	339	36.1%
	E.coli	10	4.7%	9	3.8%	9	1.8%	28	2.9%
	citrobacter	1	0.5%	-	-	9	1.8%	10	1.1%
Non fermenting GNB	*Pseudomonas*	36	17%	47	20%	127	26.0%	210	22.4%
	Acinetobact	40	18.7%	23	9.7%	9	1.8%	72	7.7%
	Other NFGNB	11	5.2%	27	11.4%	34	7.0%	72	7.7%
Gram positive cocci	Staph aureus	30	14%	24	10.2%	18	3.7%	72	7.7%
	CONS	3	1.3%	6	2.5%	9	1.8%	18	2.0%
	Enterococci	2	1%	1	0.5%	4	0.8%	7	0.7%
	Streptococci	24	11.3%	27	11.4%	59	12.1%	110	11.7%
TOTAL		213		236		489		938	

Table.8 Antibiogram for three year period
(Jan 2013 – Dec 2015) of three prevalent Respiratory tract Infection pathogen
Microbiology Data – (n- 938)

Most Common Pathogens	**Number of Isolate**	**Prevalence %**	**Antibiotic Sensitivity %**
Klebsiella	339	36.1%	Amik-95%,Genta-63.%,Cefotax 53%,Ceftaz-50%,Cipro-76%,Doxy-68%,Pip taz-100%, Imipenem-98.5% Colistin-100% **ESBL-50%**
Pseudomonas	210	22.4%	Amik-99%,Genta-88%,Ceftaz -90%,Cipro-90%, Pip taz-98%, Imipenem -98.5%& Colistin-99.5%,**MDR-10.5%**
Staphylococcus aureus	72	7.7%	Genta-83%, Cefazolin-74%, Cefotaxime-86%,,Cipro-57%,Erythro-73.6%,Clinda-89%,Linezolid-100%,Vanco-100% **MRSA-17%**

Table.9 Trending Sensitivity pattern of three prevalent Respiratory Pathogen for three year study period

	***Klebsiella*-36.1%** (339-isolates)			***Pseudomonas*-22.4%** **(**210- isolates)			**Staphylococcus-7.7%** **(72-** isolates)		
	2013	**2014**	**2015**	**2013**	**2014**	**2015**	**2013**	**2014**	**2015**
No of isolates	**56**	**72**	**211**	**36**	**47**	**127**	**30**	**24**	**18**
Amikacin	96.4 **%**	90%	96.1%	**100**%	**96%**	**100**%			
Genta	89.3**%**	60%	56.2%	**81**%	**85%**	**91**%	**60**%	100%	100%
Cefazolin							**50**%	91.6%	89%
Cefotax	14.3%	50.3%	64.4%	**86**%	**85%**	**93**%	**80**%	91.6%	89%
ceftazidime	11%	37%	64.2%	**86**%	**85%**	**93**%			
Cipro	80.3**%**	60%	80%	**81**%	**85%**	**94**%	**50**%	50%	78%
Doxy	45%	50.3%	68.2%				**50**%	66.6%	89%
Imepene	100**%**	97.2%%	100%	**97.2**%	**95.7%**	**100**%	**100%**	100%	100%
Piepricillin				**89**%	**87.2%**	**87**%			
Pi-Taz	100%	100%	100%	**94.2**%	**95.7%**	**100**%			
Colistin	100%	100%	100%	**100**%	**97.8%**	**100**%			
Erythro							**50**%	91.6%	89%
Clinda							**80**%	100%	89%
Linezolid							**100%**	100%	100%
Vanco							**100%**	100%	100%
MRSA %							**21%**	**17%**	**11%**
ESBL %	**89%**	**63%/**	**36%/**	-	-	-			
MDR				**10.8%**	**17.1%**	**7.1%**			

Table.10 Bacterial profile of Urinary Tract Infection

		2013		2014		2015		TOTAL	
Total Number of Samples received		929		1377		2636		4942	
	Organisms	NO	%	NO	%	NO	%	NO	%
Gram Negative bacilli	*E.coli*	139	34.8%	211	35.5%	600	54%	950	45%
	Klebsiella	82	20.4%	129	21.7%	147	13.2%	358	17%
	Proteus	9	2.6%	22	3.6%	28	2.5%	59	2.8%
	Citrobacte	17	4%	33	5.6%	19	1.7%	69	3.3%
Non fermenting GNB	Pseudo	43	10.8%	33	5.6%	56	5%	132	6.3%
	Acineto	4	1.1%	11	1.9%	-	-	15	0.7%
	Other NFGNB	-	-	-	-	38	3.4%	38	1.8%
Gram positive cocci	Staph	1	0.3%	0	-	28	2.5%	29	1.4%
	CONS	65	16.2%	44	7.4%	66	6%	175	8.3%
	Enterococci	39	9.8%	111	18.7%	130	11.7%	280	13.4%
TOTAL		399		594		1112		2105	

Table.11 Antibiogram for three year period (Jan 2013 – Dec 2015) of three prevalent Urinary tract Infection pathogen Microbiology Data – (n- 2105)

Most Common Pathogens	**Number of Isolate**	**Prevalence %**	**Antibiotic Sensitivity %**
E.coli	950	45%	Amik-84.4%,Genta-35.3%,Ceftaz-25.7 %, Ceftrioxone-24.3%,Norflox-22 %,Nitrofurantoin-93.2%, Cotrimox-26.3 %, Pip taz-92.5 %, Imipenem -97.5%& Colistin-100% **ESBL-74.3%**
Klebsiella	358	17%	Amik-82 %,Genta-34%,Ceftaz-23.2 %, Ceftrioxone-25.1%,Norflox-31.3 %,Nitrofurantoin-72%, Cotrimox-35 %, Pip taz-100 %, Imipenem -97.2%& Colistin-99.4% **ESBL-76.8%**
Enterococci	280	13.4%	Pen-15.4%, Amp-27.5%,Cefazolin-38.2%,Norflox-33.9%,Nitrofurantoin-36.4%,Linezolid-97.9%,HCG-48.9%, vanco-98.9%% **VRE-1.1%**

Table.12 Trending Sensitivity pattern of three prevalent Urinary Tract infection pathogen for three year study period

	***E.coli* -45% (950-isolates)**			***Klebsiella* -17% (358 -isolates)**			**Enterococci-13.4% (280-isolates)**		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
No of isolated	**139**	**211**	**600**	**82**	**129**	**147**	**39**	**111**	**130**
Amikacin	81%	90%	90%	59%	78%	100%			
Genta/HCG	41%	29%	37%	63%	30%	20%	23%	30%	73%
cefazolin							**70%**	**28%**	**50%**
Ceftriox	7%	42%	22%	22%	32%	19.7%			
ceftaz	12%	42%	23%	22%	27%	20.4%			
Norflox	16%	24%	22%	22%	27%	20.4%	**34%**	**35%**	**33%**
Nitrofuran	84%	97%	94%	48%	78%	40.1%	**23%**	**25%**	**50%**
Cotrimoxazol	19%	29%	27%	32%	30%	10.2%			
Imepene	100%	100%	96%	89%	100%	100%			
Piepricillin									
Pip-Taz	81%	90%	96%	100%	100%	100%			
Colistin	100%	100%	100%	97%	100%	100%			
Linezolid							**100%**	**100%**	**95.4%**
Vanco							**100%**	**99%**	**98.5%**
ESBL %	**78%**	**58%**	**77%**	**78%**	**73%**	**80%**			

Studies by Eswarappa *et al*., (2011) Aswani *et al.*, (2014) Verma *et al*., (2016) Syed *et al.,* (2012) & Lathika *et al.,* (2015) reported *E.coli* & *Klebsiella* as predominant Uropathogens. Aswani *et al*., showed enterococci as prevalent gram positive pathogen. All the studies except Lathika *et al.,* reported good susceptibility profile for common antibiotics tested for UTI when compared to our study.

During the reference period overall there was a decrease in prevalence of drug resistant pathogens irrespective of specimen type. Vancomycin resistant Enterococci decreased from 6% in 2013 to 1.2% in 2015,MRSA reduced from 41% in 2013 to 20% in 2015, ESBL *Klebsiella* pneumonia from 89% in 2013 to 51% in 2015, Carbapenam resistant *Klebsiella* reduced from 4.7% to 0.5%, MDR Acinetobacter from 52% in 2013 to 25% in 2015, Carbapenam resistant Acinetobacter from 28% to 25%,MDR *Pseudomonas* from 37% to 12%, carbapenam resistant *Pseudomonas* from 2.4% in 2013 to 1.8% in 2015.Carbapenam resistant *E.coli* increased from 0% to 4.7%. With reference to individual prevalent pathogens, there was a low susceptibility profile for *E.coli* for both wound infections and UTI. *Klebsiella* had better susceptibility profile for respiratory infections when compared to blood stream infections & UTI. *Pseudomonas* showed improved susceptibility profile for Respiratory infection when compared to wound infections. Staphylococcus aureus showed better susceptibility profile for both wound & respiratory infections.

In conclusion, during the reference period though, there was increase in sensitivity percentage for most of the antibiotics during the prospective period when compared to retrospective period a narrow spectrum of sensitivity was observed for commonly used antibiotics. An empirical antimicrobial Guideline was drafted following retrospective antibiogram Surveillance. Following retrospective period an educational intervention with specific reference to Infection control measures & antimicrobial stewardship had proven to be modestly effective in our study.

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