

# The Profile of Multi Drug Resistant Bacterial Infections in Long Term Care Facility

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## Abstract

**Background:** Data about infections in LTCFs is limited

**Aim:** To detect the commonest multidrug resistant bacteria and its antibiotic sensitivity in elderly residents at LTCF

**Methods:** 126 LTCF elderly residents and documented multi drug resistant organisms in their samples. Culture and sensitivity was done for collected samples documenting multidrug resistant organisms with its antibiotic susceptibility to a range of different antibiotic groups. Demographic data was collected and comorbidities were established. All samples were processed as per standard techniques and bacteria identified by standard biochemical tests. IBM SPSS statistics (version 24, IBM corp., USA, 2016) was used for data analysis.

**Results:** The age range from 60 to 98 years with mean 70.5794 +/- SD 10.17years. Males are 79 (~62.27%), while females are 47(~37.37%), The predominant resistant detected organism in these samples is Proteus (49.2 %), then Klebsiella (22.2 %), then E Coli (11.1%), then Pseudomonas (9.5%), then MRSA (4.8%) and lastly, Mix of [Klebsiella + Pseudomonas ] ~ (3.2%). Proteus is found to be highly statistically significant sensitive to Meronam (MEM), Imipenam (IMP), Ciprofloxacin (CP) and highly statistically significant resistant to Cefuroxime (CRM), Ceftazidime (CAZ), Gentamycin (GM), Colistin (CT), Trimethoprim/Sulfamethoxazole (TS), Nitrofurantoin (FD), Tobramycin (Tobra) while Klebsiella is highly statistically significant sensitive to Ceftazidime (CAZ), Colistin (CT) and highly statistically significant resistant to Imipenam (IMP) and E Coli is found to be highly statistically significant sensitive to Gentamycin (GM) and Nitrofurantoin (FD) while Pseudomonas is highly statistically significant sensitive to Tobramycin and highly statistically significant resistant to CD, MEM, Minocyclin (MN), Vancomycin .MRSA is found to be highly statistically significant sensitive to Trimethoprim/Sulfamethoxazole (TS), Clindamycin (CD), Minocyclin (MN), and Vancomycin while the mix of Klebsiella + Pseudomonas is highly statistically significant sensitive to Tobramycin.

**Conclusions:** Gram negative bacteria are the most common multidrug resistant bacteria at long term care facility mostly Proteus, the best antibiotics to use for proteus infections was Minocyclin (MN) then Meronam (MEM) then Imipenam (IMP).

**Keywords:** Antibiotic susceptibility, multi drug resistant bacteria, long term care facility, elderly residents.

## Background

As the population is aging so the functional dependency is increasing in the society and the need for long – term care facilities (LTCFs) is increasing. Residence at a Long term care facility (LTCF) and older age are both recognized as significant risk factors for harboring multidrug resistant Gram-negative bacteria (MDRGNB)<sup>1</sup>. Antimicrobial resistance problem is growing and need

further synchronized confrontation weapons. The Centers for Disease Control and Prevention estimates that in the United States, >2 million people become infected with a multidrug-resistant organism (MDRO) each year; subsequently, at least 23,000 die from these infections and from complications resulting from these illnesses<sup>2</sup>. Data about infections in LTCFs are limited<sup>3</sup>. Yet, in

long-term care, up to 75% of antimicrobial use is inappropriate or unnecessary. Thus, one of the most pressing areas in need for antimicrobial stewardship is in long-term care facilities. <sup>4</sup>.

The aim of this study was to detect the commonest multidrug resistant bacteria and its antibiotic sensitivity in long term care facility residents.

**Method:**

A descriptive study for 126 long term care facility elderly residents having multi drug resistant organisms in their biological samples (urine, sputum, purulent discharges from ear, eye, pressure sore, or percutaneous endoscopic gastrostomy (PEG) tube site).

All samples were processed as per standard techniques and bacteria identified by standard biochemical tests. Demographic data collected and comorbidities established for included cases.

**Statistical method**

IBM SPSS statistics (version 24, IBM corp., USA, 2016) was used for data analysis. Data were expressed as Mean ± SD for quantitative parametric measures in addition to both number and percentage for categorized data. Chi – square test was used to study the association between each 2 variables or comparison between 2 independent groups as regards the categorized data. The probability of error at 0.05 was considered significant, while at 0.01 and 0.001 are highly significant.

**Results:**

A sample of 126 elderly long term care facility (LTCF) residents having multi drug resistant bacterial infections with age range from 60 to 98 years with mean 70.57+/-SD 10.17years.

Males are 79 (~62.27%), while females are 47(~37.37%), The resistant organism detected in these samples were Proteus (49.2 %), Klebsiella (22.2 %), E Coli (11.1%), Pseudomonas (9.5%), MRSA (4.8%) and lastly, Mix of [Klebsiella + Pseudomonas ] ~ (3.2%).

**Table (1): prevalence of MDR organisms in different age groups**

Organism		Age		Total
		60-70	71-98	
E.coli	N	4	10	14
	%	5.7%	17.9%	11.1%
Proteus	N	42	20	62
	%	60.0%	35.7%	49.2%
Klebsiella	N	13	15	28
	%	18.6%	26.8%	22.2%
pseudomonas	N	7	5	12
	%	10.0%	8.9%	9.5%
MRSA	N	4	2	6
	%	5.7%	3.6%	4.8%
Klebsiella+Pseudomonas	N	0	4	4
	%	0.0%	7.1%	3.2%
Total	N	70	56	126
	%	100.0%	100.0%	100.0%
<b>Chi-Square Tests</b>				
		Value	P	
Pearson Chi-Square		14.140a	0.015	

follow: 59.3% of urine,50% of sputum samples, 53.8% of bed sores, 50% of tracheostomy site , 15.4% of PEG sites, 0% of ear discharge, finally 25% of eye discharge. Proteus is isolated mainly from samples obtained from patients with the comorbidity of Anoxic Brain Damage (ABD).

**Table (2):gender difference of MDR bacterial infection profiles**

Organism		Sex		Total
		male	Female	
E.coli	N	10	4	14
	%	12.7%	8.5%	11.1%
Proteus	N	45	17	62
	%	57.0%	36.2%	49.2%
Klebsiella	N	14	14	28
	%	17.7%	29.8%	22.2%
Pseudomonas	N	6	6	12
	%	7.6%	12.8%	9.5%
MRSA	N	2	4	6
	%	2.5%	8.5%	4.8%
Klebsiella+Pseudomonas	N	2	2	4
	%	2.5%	4.3%	3.2%
Total	N	79	47	126
	%	100.0%	100.0%	100.0%
<b>Chi-Square Tests</b>				
Pearson Chi-Square		Value	P	
		8.291a	.141	

**The Antibiotics efficiency for different MDR bacteria isolated in this study is as the following:**

- Proteus responded best to Minocyclin, Meronam, and imepenem. It was highly resistant and nitrofurantoin
- Klebsiella responded best to Meronam, colistin and Amikacin. The antibiotic with highest resistance in klebsiella was Cefotaxime.
- E Coli was highly sensitive to Meronam, minocycline and Colistin of cases; Gentamycin was the most resistant Antibiotic in E Coli infections.
- Pseudomonas responded best to Colistin, it was highly resistant to Meronam and Vancomycin.

**Correlations of organisms with comorbidities:**

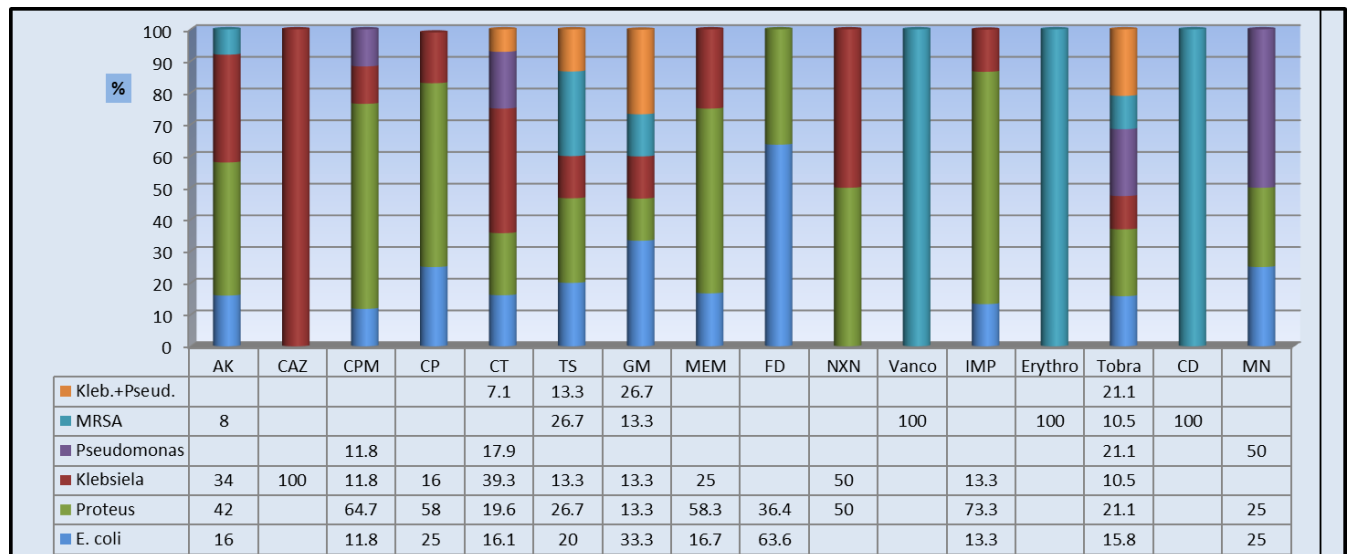
- 42.9% of E Coli occurred in patients with parkinsonism and dementia, 33.3% of Pseudomonas have Diabetes Mellitus (DM) + Cerebrovascular stroke (CVS) + Dementia + Renal impairment(RI) + Pressure ulacer (PU) + Post cardiac arrest(PCA), 28.6% of Klebsiella have CVS, 25.8% of Proteus have Anoxic Brain Damage (ABD). 50% of patients with the mix (Klebsiella +Pseudomonas) have DM +RI +Dementia and the other 50% have DM +Hypertension (HTN)+CVS+PU.
- 33.3% of patients with MRSA have ABD, 33.3% of patients with MRSA have DM + CVS+ Dementia, and 33.3% have DM + PU+ Dementia.

**Table (3): Sites of MDR bacteria isolation among the participants**

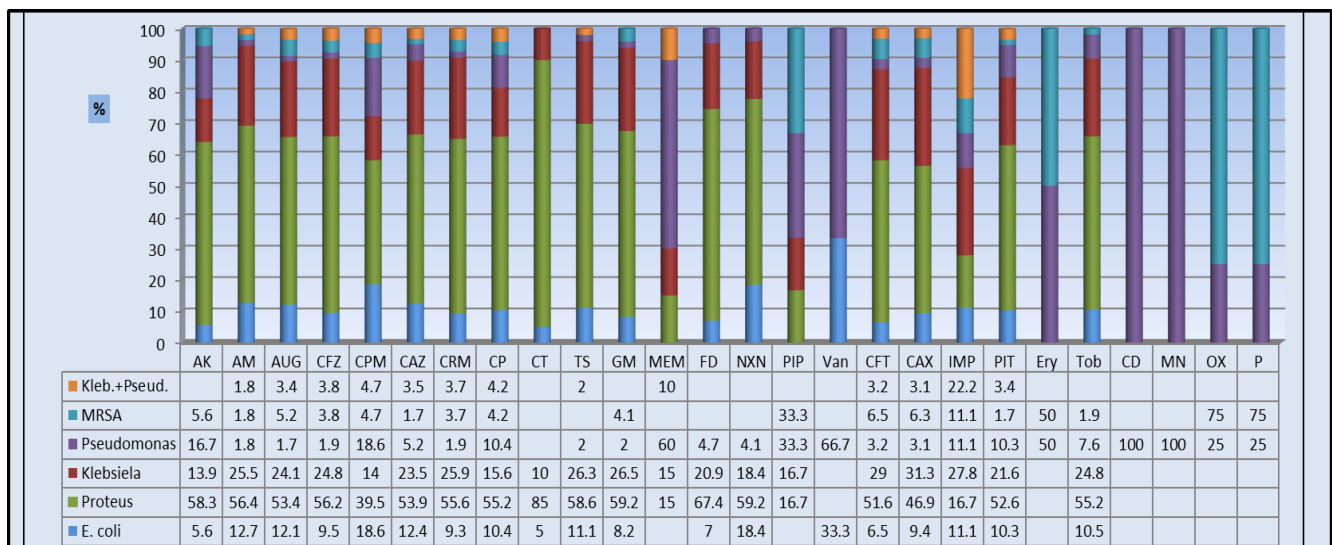
Organism	E.coli	Count	Site							Total
			sputum	Urine	bed sore	tracheostomy	PEG site	Ear	Eye	
		2	10	0	0	0	0	0	14	
		5.6%	18.5%	0.0%	0.0%	15.4%	0.0%	0.0%	11.1%	
	proteus	18	32	7	2	2	0	1	62	
		50.0%	59.3%	53.8%	50.0%	15.4%	0.0%	25.0%	49.2%	
	klebsiella	8	10	0	0	9	0	1	28	
		22.2%	18.5%	0.0%	0.0%	69.2%	0.0%	25.0%	22.2%	
	pseudomonas	4	2	2	2	0	2	0	12	
		11.1%	3.7%	15.4%	50.0%	0.0%	100.0%	0.0%	9.5%	
	MRSA	2	0	2	0	0	0	2	6	
		5.6%	0.0%	15.4%	0.0%	0.0%	0.0%	50.0%	4.8%	
	Klebsiella + Pseudomonas	2	0	2	0	0	0	0	4	
		5.6%	0.0%	15.4%	0.0%	0.0%	0.0%	0.0%	3.2%	
<b>Total</b>		<b>36</b>	<b>54</b>	<b>13</b>	<b>4</b>	<b>13</b>	<b>2</b>	<b>4</b>	<b>126</b>	
		<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	

**Chi-Square Tests**

Pearson Square	Chi-	Value	P
		90.749a	.000



**Figure (1): Frequency of all studied antibiotics as regards their sensitivities.**  
 {Amikin (AK), Ceftazidime (CAZ), Cefepime (CPM), Ciprofloxacin (CP), Colistin (CT), Trimethoprim/Sulfamethoxazole (TS), Gentamycin (GM), Meronam (MEM), nitrofurantoin (FD), Norfloxacin (NXN), Vancomycin (Vanco), Imipenam (IMP), Erythromycin (Erythro), Tobramycin (Tobra), Clindamycin (CD), Minocyclin (MN)}.



**Fig. (2): Frequency of all studied antibiotics as regards their resistance.**  
 { Amikin (AK), Ampicillin (AM), Augmentin (AUG), Cefazolin (CFZ), Cefepime (CPM), Cefuroxime (CRM), Ciprofloxacin (CP), Colistin (CT), Trimethoprim/Sulfamethoxazole (TS), Gentamycin (GM), Meronam (MEM), Nitrofurantoin (FD), Norfloxacin (NXN), piperacillin (PIP), Vancomycin (Vanco), Ceftriaxone (CFT), Cefotaxime (CAX), Imipenam (IMP).

The best antibiotics sensitivity of each detected resistant organism under current study:

Figure(3) The best antibiotics sensitivity of E. coli (Above or equal 50% sensitivity) (The most preferable are MEM or MN)

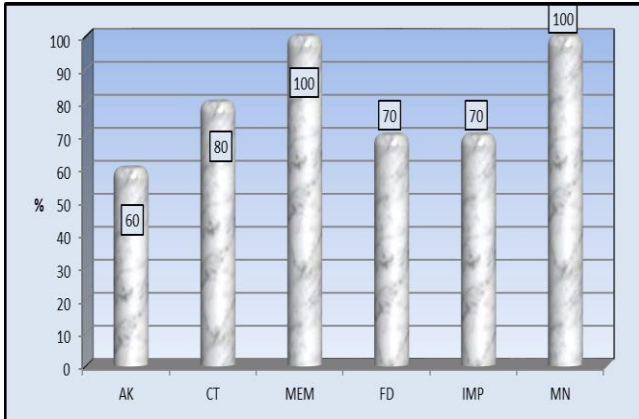


Figure (4): The best antibiotics sensitivity of Proteus (Above or equal 50%)

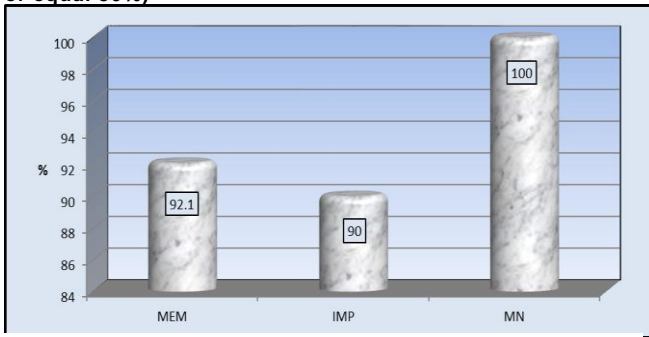


Figure (5): The best antibiotics sensitivity of Klebsiella (Above or equal 50%)

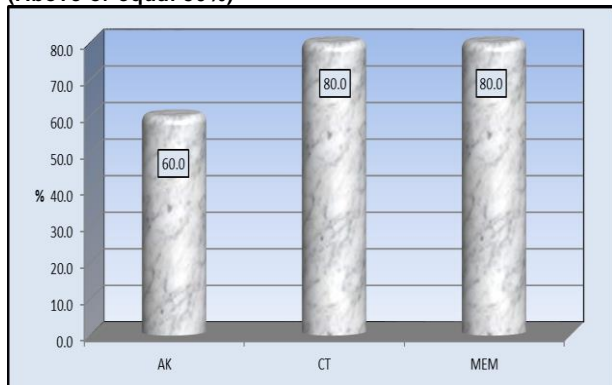


Figure (6): The best antibiotics sensitivity of Pseudomonas (Above or equal 50%)

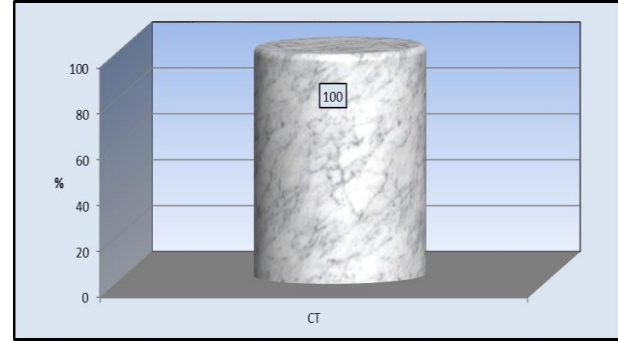
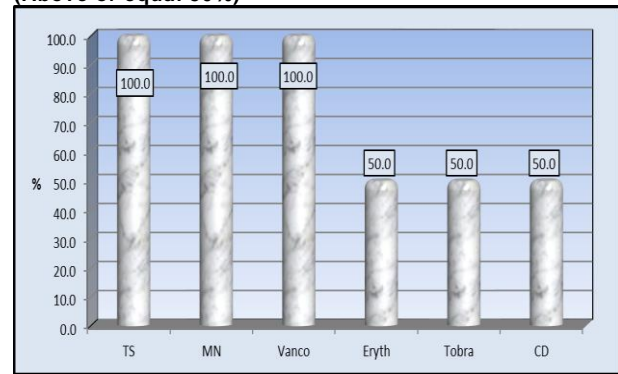


Figure (7): The best antibiotics sensitivity of MRSA (Above or equal 50%)



**Discussion:**

Infections with MDROs are associated with higher mortality rates, prolonged hospital length of stays, increased need for intensive care, and higher care costs.<sup>5</sup> Moreover, older persons are also particularly susceptible to adverse effects of antimicrobials, including Clostridium difficile infections.<sup>6</sup> thus, antibiotic stewardship is a mandatory health intervention among LTC residents.

In the current study, gram negative bacteria are the most common multidrug resistant bacteria at long term care facility mostly Proteus. Similarly, Pop-Vicas et al, found that the prevalence of MDR gram negative bacteria in elderly residents living in an LTCF was substantially higher than the prevalence of VRE and MRSA.<sup>7</sup>

In this study, Proteus best sensitivity was towards Minocyclin (MN) then Meronam (MEM) then Imipenam (IMP). Klebsiella best sensitivity was to Colistin (CT) and Meronam (MEM) then Amikin (AK) while Pseudomonas best sensitivity was to Colistin (CT). The resistance was high for ciprofloxacin, nitrofurantoin, and Trimethoprim/Sulfamethoxazole

In previous results, a substantial proportion of MDR gram negative isolates recovered were resistant to commonly prescribed oral antimicrobials, with 85%, 83%, and 57% of isolates resistant to ciprofloxacin, first-generation cephalosporins, and trimethoprim-sulfamethoxazole, respectively.<sup>7</sup>

#### **Conclusion:**

According to current study results, gram negative bacteria are the most common multidrug resistant bacteria at long term care facility mostly *Proteus*. *Proteus* best sensitivity is towards Minocyclin (MN) then Meronam (MEM) then Imipenam (IMP). So, these antibiotics clinically are preferable to be used with *Proteus* but if these antibiotics improperly are used against *Proteus*, it will lose these sensitivities and become resistant to them. The same can be concluded for other detected resistant organisms in current study as *Klebsiella* best sensitivity is to Colistin (CT) and Meronam (MEM) then Amikin (AK) while *Pseudomonas* best sensitivity is to Colistin (CT) on the other hand MRSA best sensitivity is towards Trimethoprim/Sulfamethoxazole (TS), Minocyclin (MN), and Vancomycin then Erythromycin, Tobramycin and Clindamycin (CD). The mix of *Klebsiella* + *Pseudomonas* has best sensitivity to Colistin (CT), Gentamycin (GM), and Tobramycin then Trimethoprim/Sulfamethoxazole (TS). Those antibiotic sensitivities may be due to infrequent use or proper use of those antibiotics with corresponding organism till now.

#### **Recommendations:**

This study recommends the proper use of preferable antibiotics for each resistant organism at long term care facility and also recommends further studies at LTCF elderly to confirm its findings.

#### **References:**

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