



# DEVICE ASSOCIATED INFECTIONS IN INTENSIVE CARE UNIT

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## INTRODUCTION: FROSTBITE

- Healthcare-associated infections (HAI)- acquired after 48 hours of admission/surgery/use of healthcare-devices up to 30 days of discharge
- up to one year in case of implants
- all occupational infections; not evident or incubating initially
- Device-associated infections (DAI), non-device assoc HAI
- Ventilator-Associated Pneumonia (VAP)
- Central-Line-Associated Blood Stream Infections (CLABSI)
- Catheter-Related Blood Stream Infections (CRBSI)
- Catheter-Associated Urinary Tract Infection (CAUTI)
- HAI- Prolong morbidity, patient-safety challenges
- Study characterizes morbidity, mortality, emerging drug resistance in DAI (VAP, CLABSI and CAUTI) in the ICU of a 1000-bedded hospital

## METHODS AND RESULTS

- Prospective active-outcome surveillance over two years
- US CDC-NHSN and INICC definitions and criteria
- Daily clinical surveillance matched with lab surveillance

## DISCUSSION AND CONCLUSION

- Patient safety, preventive, monitoring and outcome paradigm
- Two-tier infection prevention and control to be strengthened
- Bundles of care to be followed diligently

S. No.	Country/Region	Year(s) of surveillance	No of hospitals/ ICUs	No of patients	No of patient/ bed/ ICU days	VAP	CLABSI	CAUTI
Benchmarking parameters								
1	Present study	2017-19	11	2157	8824	14.4	8.1	4.5
2	INICC Rates <sup>4</sup> (43 countries)	2007-12	43/503	605310	3338396	16.8	4.9	5.5
3	INICC Rates (45 countries) <sup>5</sup>	2012-17	242/523	532483	2197304	14.1	5.05	5.1
4	US CDC-NHSN Rates <sup>6</sup>	-	-	-	-	0.9	0.8	1.7
Comparison within India								
5	New Delhi, India <sup>8</sup>	2015-2016	1	343	3755	11.8	7.4	9.7
6	South India	2015-16	18	293	-	25	7.2	6.1
7	20 Indian cities <sup>7</sup>	2004-13	40/40	236700	970713	9.4	5.1	2.1
8	Kolkata <sup>1</sup>	2014-16	11	2157	8824	14.4	8.1	4.5
Comparison with Lower Middle Income Countries excluding India								
9	Vietnam <sup>9</sup>	2008-15	44	1592	12580	13.4-23.7	1.5-9.8	0.5-3
10	Venezuela <sup>21</sup>	2008-15	22	1041	4832	7.2	5.1	3.9
11	Ecuador <sup>22</sup>	2013-15	22	776	4818	44.3	6.5	5.7
12	Mongolia <sup>23</sup>	2013-15	33	467	2133	43.7	19.7	15.7
Comparison with Upper Middle and High Income Countries								
18	Saudi Arabia <sup>3</sup>	2013-2016	12/12	6178	13492	57.4	14.2	28.7
19	Cyprus <sup>24</sup>	2016	11	198	-	10.1	15.9	2.4
20	Iran <sup>25</sup>	2014	11	2584	16796	7.9	5.8	9.0
21	Kuwait <sup>26</sup>	2013-15	7/7	3732	21611	4.0	3.5	3.3

Table 1: Device-Associated Infections (DAI) in a Multidisciplinary Intensive Care Unit (ICU) of a 1000-bedded Tertiary-Care Teaching Hospital in New Delhi, India

S. No.	Month/Year	Pooled Data of DAI (VAP, CLABSI, CAUTI)							VAP			CLABSI			CAUTI					
		No of patients admitted	Patient staying >48h	Patient / bed / ICU days	Device days	Device Utilization ratio	Episodes of DAI	Overall rate of DAI	Ventilator days	Ventilator Utilization ratio	Episodes of VAP	Rate of VAP	Central Line days	Central Line Utilization ratio	Episodes of CLABSI	Rate of CLABSI	Urinary catheter days	Urinary catheter Utilization ratio	Episodes of CAUTI	Rate of CAUTI
1	Apr 17	66	48	307	488	1.59	4	8.20	91	0.30	3	32.97	300	0.98	1	3.33	259	0.84	0	0.00
2	May 17	102	70	405	613	1.51	10	9.79	165	0.41	6	36.36	200	0.49	0	0.00	248	0.61	0	0.00
3	Jun 17	98	59	340	602	1.77	2	3.32	104	0.31	1	9.62	194	0.57	1	5.15	304	0.89	0	0.00
4	Jul 17	49	40	265	443	1.67	7	11.29	89	0.34	5	35.71	144	0.54	0	0.00	210	0.79	0	0.00
5	Aug 17	75	33	261	337	1.29	1	2.97	74	0.28	0	0.00	288	1.10	1	3.47	164	0.63	0	0.00
6	Sep 17	50	33	208	366	1.76	1	2.73	85	0.41	0	0.00	107	0.51	1	9.35	174	0.84	0	0.00
7	Oct 17	79	47	326	585	1.79	2	3.42	148	0.45	1	6.76	198	0.61	0	0.00	239	0.73	1	4.18
8	Nov 17	87	53	357	689	1.93	8	10.16	185	0.52	6	32.43	295	0.83	1	3.39	309	0.87	0	0.00
9	Dec 17	73	50	265	549	2.07	3	5.46	127	0.48	2	15.75	264	1.00	1	3.79	258	0.97	0	0.00
10	Jan 18	54	36	217	482	2.22	8	14.52	133	0.61	6	45.11	278	1.28	1	3.60	201	0.93	0	0.00
11	Feb 18	67	46	175	326	1.86	5	15.34	122	0.70	4	32.79	292	1.67	1	3.42	150	0.86	0	0.00
12	Mar 18	35	28	203	491	2.42	15	12.22	143	0.70	4	27.97	153	0.75	0	0.00	195	0.96	2	10.26
13	Apr 18	87	78	370	567	1.53	8	10.58	104	0.28	4	38.46	288	0.78	1	3.47	275	0.74	1	3.64
14	May 18	115	58	395	315	0.80	10	15.87	118	0.30	3	25.42	303	0.77	1	3.30	94	0.24	1	10.64
15	Jun 18	104	66	336	700	2.08	6	5.71	189	0.56	2	10.58	233	0.69	1	4.29	278	0.83	1	3.60
16	Jul 18	116	23	359	551	1.53	4	7.26	142	0.40	3	21.13	123	0.34	0	0.00	286	0.80	1	3.50
17	Aug 18	104	34	392	443	1.13	1	2.26	118	0.30	0	0.00	79	0.20	0	0.00	246	0.63	1	4.07
18	Sep 18	106	76	330	585	1.77	2	3.42	138	0.42	1	7.52	198	0.60	0	0.00	249	0.75	1	4.02
19	Oct 18	110	74	324	584	1.80	4	6.85	98	0.30	4	40.82	188	0.58	0	0.00	298	0.92	0	0.00
20	Nov 18	97	60	336	700	2.08	5	7.14	176	0.52	3	17.05	224	0.67	1	4.46	3000	8.93	1	3.33
21	Dec 18	76	45	378	783	2.07	5	6.39	177	0.47	4	22.60	267	0.71	1	3.75	339	0.90	0	0.00
22	Jan 19	88	55	298	360	1.21	3	8.33	68	0.23	2	29.41	166	0.56	1	6.02	126	0.42	0	0.00
23	Feb 19	110	77	256	605	2.36	1	1.65	99	0.39	0	0.00	177	0.69	0	0.00	329	1.29	1	3.04
24	Mar 19	113	69	278	718	2.58	2	2.79	120	0.43	1	8.33	290	1.04	0	0.00	308	1.11	1	3.25
Total		2061	1258	7381	12882	42.85	117	177.67	3064	10.10	65	496.52	5249	17.96	14	60.80	5839	27.47	12	53.51
Average		85.88	52.42	307.54	536.75	1.79	4.88	7.40	127.67	0.42	2.71	20.69	218.71	0.75	0.58	2.53	243.29	1.14	0.50	2.23
SD		23.49	16.57	5.29	133.81	0.43	3.57	4.31	34.30	0.13	1.97	14.57	67.91	0.31	0.50	2.51	66.12	1.67	0.59	3.08
95% CI		31.06	51.50	306.05	534.44	1.66	4.23	6.77	126.45	0.34	2.23	19.41	216.87	0.60	0.32	1.90	241.60	0.51	0.17	1.40
95% CI		40.69	53.33	309.03	539.06	1.91	5.52	8.04	128.88	0.50	3.19	21.97	220.55	0.90	0.85	3.17	244.99	1.78	0.83	3.06
Confidence		54.82	0.92	1.49	2.31	0.13	0.65	0.64	1.21	0.08	0.48	1.28	1.84	0.15	0.26	0.64	1.70	0.63	0.33	0.83

Legend: VAP – Ventilator Associated Pneumonia, CLABSI – Central Line Associated Blood Stream Infections, CAUTI – Catheter Related Urinary Tract Infection

Table 2: Microorganism profile and resistance from Device-Associated Infections (DAI) from Multidisciplinary Intensive Care Unit (ICU) of a 1000-bedded Tertiary-Care Teaching Hospital in New Delhi, India

Pathogens (N= 97 DAI /Antimicrobials)	<i>Klebsiella pneumoniae</i> (n= 14, 14.4%)			<i>Escherichia coli</i> (n= 12, 12.4%)			<i>Enterobacter aerogenes</i> (n= 9, 9.3%)			<i>Pseudomonas aeruginosa</i> (n= 19, 19.6%)			<i>Acinetobacter baumannii</i> (n= 14, 14.4%)			<i>Burkholderia cenocepacia</i> (n= 6, 6.2%)			<i>Protex</i> (n= 7, 7.2%)			<i>Staphylococcus aureus</i> (n= 7, 7.2%)			<i>Enterococcus</i> (n= 8, 8.2%)			
	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	R%	MIC	Brkp	
VAP	8			8			6			15			9			5			6			4			1			4
CLABSI	5			3			2			4			3			1			0			1			1			0
CAUTI	1			1			1			0			2			0			2			2			2			4
Resistance																												
Ceftriaxone	100	≥84	≤1	91.7	≥84	≤1	100	≥84	≤1	42.1	≥84	≤8	100	≥84	≤8	-	-	-	100	≥84	≤1	-	-	-	-	-	-	-
Ceftazidime	100	≥84	≤4	91.7	≥84	≤4	100	≥84	≤4	100	≥84	≤8	100	≥84	≤8	50.0	≥4	≤8	100	≥84	≤4	-	-	-	-	-	-	-
Cefepime	100	≥84	≤2	91.7	≥84	≤2	100	≥84	≤2	42.1	≥84	≤8	100	≥84	≤8	50.0	≥4	-	100	≥84	≤2	-	-	-	-	-	-	-
Amoxicillin-Clavulanate	92.9	≥32	≤8	75.0	≥32	≤8	100	≥32	≤8	-	-	-	-	-	-	-	-	100	≥32	≤8	-	-	-	-	-	-	-	-
Piperacillin-Tazobactam	92.9	≥128	≤16	83.3	≥128	≤16	100	≥128	≤16	73.7	≥128	≤16	92.9	≥128	≤16	83.3	≥128	≤16	100	≥128	≤16	-	-	-	-	-	-	-
Ticarcillin-Clavulanate	92.9	≥128	≤16	83.3	≥128	≤16	100	≥128	≤16	89.5	≥128	≤16	92.9	≥128	≤16	83.3	≥128	≤16	100	≥128	≤16	-	-	-	-	-	-	-
Cefoperazone-Subactam	92.9	≥84	≤16	66.7	≥128	≤16	100	≥128	≤16	63.2	≥84	≤16	92.9	≥84	≤16	83.3	≥84	≤16	100	≥84	≤16	-	-	-	-	-	-	-
Ceftriaxone-Subactam-Disodium-edetate (CSE)	14.2	Zone ≥23 mm	0	Zone ≥23 mm	-	-	-	Zone ≥23 mm	≤16	63.2	Zone ≥21mm	-	21.4	Zone ≥21 mm	-	50.0	Zone ≥21 mm	-	57.1	Zone ≥23 mm	-	-	-	-	-	-	-	-
Ciprofloxacin	100	≥4	≤1	100	≥4	≤1	100	≥4	≤1	42.1	≥4	≤1	100	≥4	≤1	-	-	-	100	≥4	≤1	100	≥4	≤1	-	-	-	-
Gentamicin	85.7	≥16	≤4	83.3	≥16	≤4	100	≥16	≤4	42.1	≥16	≤4	100	≥16	≤4	-	-	-	100	≥16	≤4	28.6	-	≤4	-	-	-	-
Amikacin	71.4	≥84	≤16	41.7	≥84	≤16	100	≥84	≤16	10.5	≥84	≤16	85.7	≥84	≤16	-	-	-	100	≥84	≤16	-	-	-	-	-	-	-
Imipenem	92.9	≥16	≤1	50.0	≥16	≤1	100	≥16	≤1	42.1	2	≤2	100	≥16	≤2	33.3	4	-	100	≥16	≤1	-	-	-	-	-	-	-
Meropenem	92.9	≥16	≤1	50.0	≥16	≤1	100	≥16	≤1	42.1	8	≤2	100	≥16	≤2	33.3	4	≤4	100	≥16	≤1	-	-	-	-	-	-	-
Cotrimoxazole (SXT)	92.9	≥320	≤40	66.7	≥320	≤40	100	≥320	≤40	-	-</																	