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Original Article

In-Depth Analysis of Urrent Infection Prevention and Control Practices in Class C Military Hospitals of Pakistan

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ABSTRACT

Objective: To assess the current Infection Prevention and Control practices in Class C Military Hospitals of Pakistan.
Study Design: Mix-method study.
Place and Duration of study: Pakistan Navy Shifa Hospital, Karachi, Pakistan, from Jan to Dec 2023.
Methodology: Three hospitals (corresponding to primary level) were selected from a total of ten, through random sampling. Data was collected using infection prevention and control assessment framework (IPCAF) tool which comprises of eight sections with a 100 score in each. Based on these scores, in-depth semi structured interviews from the focal person representing highest and lowest scoring hospitals were then conducted. Participants' responses were recorded during the interview. We typed and examined the coded script with eight themes.
Results: Out of a total of 800, the median score of the three hospitals was 632.5 with a mean of 543.3. One Class C hospital fell into adequate category with a score of 227.5 and the other two in advanced level with a score of 632.5 and 770. However, in depth interviews of the highest and lowest scoring hospitals showed significant difference in pre and post interview scores. This highlighted the gap in comprehending the Infection Prevention and Control Assessment Framework (IPCAF) by the designated infection prevention and control (IPC) focal person.
Conclusion: The sampled Class C Military hospitals demonstrated a varied but satisfactory infection prevention and control (IPC) level. Challenging areas observed were education and training, surveillance, monitoring/audit and staffing.

Keywords: Hospital, Infection Prevention and Control, Infection Prevention and Control Assessment Framework.

How to Cite This Article: *Ehsan A, Ehsan F, Hanif H. In-Depth Analysis of Urrent Infection Prevention and Control Practices in Class C Military Hospitals of Pakistan. Pak Armed Forces Med J 2025; 75(4): 735-741. DOI: https://doi.org/10.51253/pafmj.v75i4.12224*

INTRODUCTION

Healthcare related diseases constitute a major risk factor to patient safety and health and are a major public health challenge.[1,2] In the primary care context, Infection Prevention and Control (IPC) is shaped by the multifaceted nature of first-line care displaying inter-professional team approach.[3,4] For effective and successful infection prevention measures, critical analysis of barriers with alternate coping mechanisms must be identified and overcome.[5]

Infection Prevention measure is a largely ignored domain in hospitals and healthcare in most of the developing countries including Pakistan.[6] A variation of influences including dearth of infection prevention and control programs with resources, fragmented training and healthcare structure along with overpopulation are the contributing factors.[7,8] There is often a lack of coordination between different healthcare facilities, leading to disparities in providing quality care to patients and their families. Hence, training providers need to emphasize on improved interdepartmental communication as well as between patients and providers.[9] Additionally, the overpopulation in Pakistan poses another challenge for healthcare providers to implement effective disease prevention and control measures.[10]

Only a few health facilities in Pakistan have been assessed for IPC practices, and deficiencies have been found in IPC implementation.[11] Data from our Military hospitals are scarce and they are known for providing high quality medical care to patients. Hence, the present study tried to evaluate IPC implementation of Class C military hospitals through in-depth interviews in addition to quantitative survey for better understanding of the local infection control practices guidelines and strategies carried out under routine to identify strengths and gaps.

METHODOLOGY

This mixed method study design was carried out at Class C Military hospitals with focus on the qualitative assessment, from Jan to Dec 2023. Study

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Received: 13 May 2024; revision received: 25 Feb 2025; accepted: 27 Feb 2025

was being conducted after the clearance from Ethical Review Committee, Institutional Review Board, Armed Forces Post Graduate Medical Institute (Re: 295-AAA-ERC-AFPGMI).

Inclusion Criteria: Class C military hospitals with a capacity of at least 100 beds.

Exclusion Criteria: Hospitals with more than 250 beds were excluded.

Sample size was calculated using the proportion sampling formula. Twenty-five percent out of total 10 primary care hospitals, came to 2.5, which was rounded off to 3 hospitals. These were selected randomly though lottery method.

Infection Prevention and Control Assessment Framework (IPCAF) is a structured, self-administered, closed-formatted questionnaire with an associated scoring system. This WHO recommended universal framework is to assess the current infection prevention and control (IPC) situation in the hospital setting and identify strengths and gaps that can impact future plans. The score was calculated based on eight core components.[12] For every core component (CC) the scores of the individual questions were aggregated. The final IPCAF score was calculated by adding the scores of all eight core components. The maximum possible total score was 800.

Permission was taken from the Commanding officers (CO) of Class C hospitals to carry out the necessary research after explaining them the study purpose, and obtaining informed consent. COs were assured of confidentiality of hospital's identity to cater for any biases. They were requested to appoint an officer, a focal person to communicate along with infection control nurse (if available) and who was responsible in consulting other stakeholders pertaining to the hospital to complete the essential questionnaire items. To remove any bias, names of hospitals were kept confidential and not disclosed. Each individual healthcare facility further had their average core component and subcomponent scores determined through calculation. These filled forms from the three hospitals were then collected through courier service at PNS Shifa Hospital Karachi.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 25. Due to the scoring system of the IPCAF, any unanswered questions were entered as zero. Descriptive statistics were presented as frequencies and percentages, mean and astandard deviation, along with median.

After analyzing the scores from the three hospitals, highest and lowest scoring hospitals were selected for in-depth interviews to get more information. Descriptive qualitative study design had been used with semi structured interviews. Interviews were conducted by the nominated focal persons who had previously filled up the questionnaire so that they were well-informed about the IPCAF tool. The interviews were conducted on WhatsApp audio conference in the presence of supervisor and lasted for about an hour. Initially, Zoom meetings were planned but after a brief trial we shifted to audio conference due to poor sound and picture quality on Zoom meetings. The 8 core components and the sub components of the tool were treated as themes. Transcription of data was done. Analysis was done manually by thematic content analysis. Specific codes were developed for questions and probes.

RESULTS

The three hospitals randomly selected from a total of ten primary care military hospitals all over Pakistan were allocated code of Echo1, Echo-2 and Echo-3.

As shown in Table-I, the 3 hospitals initially were evaluated on the basis of eight core components of the Infection Prevention and Control Assessment Framework (IPCAF). Detail scoring of 8 individual core components of each hospital along with total calculated score was added up with percentage and analyzed. Upon total scoring, 1 hospital fell into basic level, while the other 2 attained advance level. None fell into inadequate level. Echo-1 was our highest scorer with count above 80 in all core components. On

Table-I: Component-Wise Scoring of Selected Class C Military Hospitals in Infection Prevention and Control Assessment Framework (IPCAF) Assessment (n= 3)

Hospital Name	cc1	cc2	cc3	cc4	cc5	cc6	cc7	cc8	Total score n=800 n (%)	Mean scores n=800 n (%)
Echo1	95	100	100	97.5	90	95	95	97.5	770(96.25%)	543.3
Echo2	92.5	100	85	75	70	82.5	50	77.5	632.5(79.06%)	(68.1%)
Echo3	15	32.5	10	2.5	10	25	60	72.5	227.5(28.44%)	

**cc: core component*

the other hand, Echo-3, the lowest scoring hospital attained less than 50 in 6 out of 8 CC.

Echo-1 is a primary level hospital. The total strength of doctors is 12 and the focal person nominated by commanding officer (CO) of the hospital was an anesthetist. Echo-1 secured highest marks in infection prevention and control assessment framework (IPCAF) i.e. 770 out of 800, however, after the interview and reassessment its score dropped to 457.5 (Table-II).

Echo - 1				
CC	Score obtained	Re evaluation Score	Qualitative Responses	Total score before & after
CC1	95	45	• Lack of clearly defined obj • Lack of dedicated IPC staff • No microbiological lab • Lack of docu for trg, monitoring of IPC, cleaning record • Depart trg carried out • Lack of pers for surv and specialized IT sp • No use of reliable surv case definitions or evidence-based adaptation • Mostly self reliant in CC8	770/ 457.5
CC2	100	72.5		
CC3	100	45		
CC4	97.5	47.5		
CC5	90	37.5		
CC6	95	45		
CC7	95	72.5		
CC8	97.5	92.5		

Table-II: IPCAF Scoring Before and After In-Depth Interviews Of A Class C Military Hospital (Echo-1)

Core Component 1 – IPC Program (score obtained 95): The IPC team did not comprise of full-time dedicated staff, rather it consisted of members of various professionals who gathered together to collaborate on IPC issues of hospital. Moreover, they did have an IPC program but lacked clearly defined objectives, annual activity plan and measurable outcome indicators contrary to what was documented in the tool. Full implementation on IPC programs was not feasible due to various professional commitments as they lacked dedicated IPC staff.

Another differing point was non availability of microbiological laboratory service which was marked as Yes "We do not possess microbiological lab facility rather we send our samples to nearest military hospital." Although there is no dedicated budget but the resources are provided to the IPC team as per their requirement.

Core Component 2 - IPC Guidelines (score obtained 100): Regarding outbreak management and preparedness, IPC committee stays up-to-date with the latest information keeping themselves abreast with latest data. Being a small hospital, they have limited number of such outbreak cases.

Hand hygiene and Operation Theatre sterilization techniques were observed and checked practically but no documentary record or measuring tool existed. Same was the case with surgical site and catheter associated infection prevention, for which WHO checklist was followed but no record keeping was there.

Core Component 3 - Education and training (score 100): Departmental training was monitored by senior staff and departmental heads. However, record was not maintained. Training was conducted through lectures, print material and practical demonstrations. And for training effectiveness evaluation compared with previous record if record was available.

Core Component 4 - HAI Surveillance (score 97.5): Trained staff was doctors and nurses who were available but were not IPC certified professionals. Personnel responsible and trained for surveillance and specialized IT support were not available. "We are a small hospital with limited capabilities, we liaison with our local THQ hospital for information regarding locally endemic diseases". For prioritization of HAI, Echo-1 focused on prevention rather than treatment. e.g. hepatitis B and C, measles. Reliable surveillance case definitions or evidence-based adaptation process was not employed. The feedback process on surveillance was again not documented.

Core Component 5 - Multimodal strategies (score 90): This was the lowest score secured by Echo-1 among its core components. Interventions like lectures, practical demos, orientation and demonstrations were conducted and continuous availability of supplies and resources ensured to come up with infection control standards.

Core Component 6 - Monitoring/Audits of IPC Practices and Feedback (score 95): Visual monitoring was undertaken continuously for wound infection, hand hygiene, intravascular catheter insertion, prevention of multidrug resistance infection spread.

Core Component 7 - Workload, Staffing and Bed Occupancy (score 95): There was enough staff to maintain WHO recommended ratio of health care workers to beds across the facility. Most of the points were fulfilled in this category.

Core Component 8 - Built Environment, Materials and Equipment for IPC at Facility Level (score 97.5): Most of the requirements were met under this heading as well. There was safe drinking water available, PPE and hand hygiene stations, toilet

facility, dual power supply, waste disposal pit were all accessible. However, cleaning record signed by cleaners was not accessible.

Echo-3 is another primary level hospital with basic specialties and commanded by a colonel. The respondent was an anesthetist and was in charge of operation theatre (OT) and intensive care unit (ICU) of his hospital. This hospital secured lowest points in its infection prevention and control assessment out of 3 hospitals; 227.5 out of 800. Upon cross questioning and reevaluation its total score jumped to 332.5.

Core Component 1 – IPC Programs (marks secured 15): The participation of senior administrative employees, as well as the availability of cleaning agents and disinfectants were insufficient, especially considering the recent COVID-19 scenario. Latest cleaning products, such as Parasafe, were pricey, rendering older alternatives, such as formalin. Well-defined Standard Operating Procedures (SOPs) were in place but due to inadequate manpower and financial constraints, it could not be implemented in true letter and spirit.

An infection control committee did not exist nor any dedicated staff for IPC. "We do not have infection control committee hence no IPC meetings and no record". Full time dedicated and trained staff for IPC committee was not available although recently plans were in the work to establish dedicated employees under the supervision of a microbiologist or pathologist.

Core Component 2 – IPC Guidelines (score obtained 32.5): The only source of guidelines was Standard Operating Procedures (SOPs) on the Medical Directorate OAS portal; however, evaluation mechanisms were conspicuously absent.

Inadequate training and frequent staff rotations influenced hand hygiene procedures in the OT and ICU. Hand hygiene practice was not followed as per SOPs, mostly due to lack of training and staff rotation. Garbage disposal process suffered due to a lack of availability of garbage bags and resultant color coding, resulting in mixed disposal. Safe injection techniques were used and sharps disposal boxes were provided. The ICU was an open ICU system where nursing and patient spaces were merged, therefore barrier nursing standards could not be followed.

Core Component 3 – IPC Education and Training (score obtained 10): The overall educational training score was low. Importantly, infection prevention and control (IPC) was the duty of the infection control office, not the Heads of Departments (HODs). There was no expert oversight to evaluate progress of disinfection and other activities. "My ICU staff dedicated for treatment is involved in disinfecting and cleaning of beds, side tables and other equipment and there exists no system for evaluation of disinfection process".

Core Component 4 – Surveillance (score 2.5): The surveillance score was currently at its lowest point i.e. 2.5. Key Performance Indicators (KPIs) had recently been circulated across all departments to monitor their progress in different fields. While clinical personnel were assigned the duty of entering data and submitting it to the statistics office, staff deficit made it difficult to analyze and present this data properly using graphs and pie charts.

A register for VAP (Ventilator-Associated Pneumonia) had recently been maintained in ICUs to count positive cases. Regrettably, data collection for Surgical Site Infections (SSI) was limited to the operation theatre (OT) and did not extend to the wards. There were limits in lab capacity, notably the lack of culture media, however recent improvements had resulted in positive culture reports and the identification of species in growth.

Core Component 5 – Multimodal Strategies (score 10): Echo-3 lacked a dedicated think tank, a focused infection control department, to build rigorous policies and provide appropriate resources, "We do not have a think tank or a system to formulate, educate, train, monitor and give feedback regarding infection control practices". Although educational material was available, but coordinated team effort was lacking.

Core Component 6 – Monitoring/ Audits of IPC Practices and Feedback (score 25): Because no formal system existed, feedback was handled by administrative staff. Only MOICs (Medical Officers in Charge) were available for this purpose. It was a need-based system, verbal checking was given mostly and no system for follow up was there.

Core Component 7 – Workload, Staffing and Bed Occupancy (score 60): While extra staff was periodically supplied, it did not necessarily correspond to actual needs, despite SOPs requiring extra personnel when ICU patient counts surpass 4-5. Furthermore, attempts to hire critical personnel such as optometrists, phlebotomists, and physiotherapists

had proven futile as their salary packages were unable to attract trained staff. Furthermore, no higher headquarters relief was available to fill these staffing deficits.

Core Component 8-Built Environment: Materials and Equipment for IPC at the Facility (score 72.5): The overall score in this component was 72.5 which were quite high as compared to other components, meaning the hospital was moderately self-sufficient in this regard.

Echo – 3				
CC	Score obtained	Re evaluation Score	Qualitative Responses	Total score before & after
CC1	15	30	• Well defined obj, but lmtd implementation due to HR shortage & aval of resources • IPC prac observed at indl dept lvl, like trg, surv, audit • Aloc budget unaval but req resources provided by adm • Staff dedicated for disinfecting & cleaning eqpt involved in IPC • Use of KPIs, data collection & analysis recently intro • Recent enhancement in lab capacity • Moderately self sufficient	227.5 / 332.5
CC2	32.5	47.5		
CC3	10	30		
CC4	2.5	27.5		
CC5	10	25		
CC6	25	30		
CC7	60	70		
CC8	72.5	72.5		

Table-III: Infection Prevention and Control Assessment Framework (IPCAF) scoring before and after in-depth Interview of Class C Military hospital (Echo-3)

To assess the normality of our data in ECHO-1 (before and after scores) and Echo-2 (before and after scores), Shapiro-Wilk test was used as the sample size was small. As all the significant values were less than 0.05 except Echo-3 (after scores) the assumption of normality was met for the subsequent analysis.

Table- IV presents the Mean+SD, median with interquartile range (IQR) and *p*-values for the comparison of two groups (Echo-1 and Echo-3) before and after the in-depth interview.

For Echo-1, there was a significant difference in the mean values before (95.63±2.91) and after (57.19±19.43) the interview (p=0.001). For Echo-3, there was a significant difference in the median values before [20 (10-53.13)] and after [30 (28.13-64.38)] the interview (p=0.017).

The between-groups comparison indicated that there was a significant difference between Echo-1 and Echo-3 after the interview (p=0.083).

In summary, the in-depth interviews appeared to have a significant effect within both Echo-1 and Echo-3 groups as well as between groups after the in-depth interview, based on a non-parametric test due to the non-normal distribution of the data.

DISCUSSION

Aside from variances in total scoring among these selected hospitals, we discovered significant similarities and contrasts in the aggregated scores of the relevant IPCAF sections, adding to our understanding of IPC implementation in these contexts. Most of these class C hospitals had well established IPC guidelines, environment, materials and equipment with areas of concern regarding HAI surveillance, followed by monitoring / audit and inadequate staffing and workload. These results share similarities to an international study conducted in public sector hospitals. Although their study was conducted on tertiary care hospitals with majority falling in basic level category (73%) but the issues faced were more or less identical.[13] In our study, lack of IT support with limited use of interactive feedback of surveillance data highlights the need for improvement. Proper training along with collaborative feedback of observation data has been established to be effective control of hospital acquired infections in previous publications.[14]

One of the three hospitals lacked functional toilets and hand hygiene stations with regular supplies of soap and hand rub solution that could be related to maintenance and repair service issue. This was also observed in findings from other hospitals of Pakistan as well as other South Asian countries with poor compliance of hand hygiene practices among healthcare workers.[15-17]

Most of our studied hospitals reported having monitoring and auditing processes (CC6) in place, but during interview, it became apparent that documentation was lacking in monitoring and audit.

Table-IV: Comparison of Highest (Echo-1) and Lowest Scoring (Echo-3) Class C Hospitals (Ipcaf Scores Before and After the Interview)

	Before		After		Within group
	Mean±SD	Median (IQR)	Mean±SD	Median (IQR)	*p*
Echo-1	95.63±2.91	95(95-97.5)	57.19±19.43	46.25(45-72.5)	0.012
Echo-3	28.44±25.35	20(10-53.13)	41.56±19.55	30(28.13-64.38)	0.017
Between groups	p= 0.0047		p=0.083		

**IPCAF: Infection Prevention and Control Assessment Framework*

This is in line with another study reporting lowest scores in the core components "surveillance of hospital-acquired infections" and "monitoring, auditing of IPC practices and feedback" in acute healthcare facilities in Turkey.[18] These findings are also consistent with data from another low income country where documentation and record keeping is especially negligible probably due to overburdened staff with lack of set priorities.[19] Same is observed in another study where the overburdened staff struggled with documentation and did not have processes to review data regularly.[20] There is no doubt that physicians battle significant time constraints as mentioned during interview of Echo-3 IPC In charge. Such reports have been documented in advanced countries as well highlighting that in addition to qualified staff, insufficient staff may also hamper the quality of care and practices.[20]

Likewise, regarding multimodal strategies, infection control practices were a fragmented system, each department working at individual level and lacking interdepartmental and multidisciplinary approach, which is similar to multiple local and international studies.[21-23] A nationwide survey in Korea while facing similar difficulties suggested systematically integrating individual elements of multimodal strategies to achieve behavioral change.[24]

A recent similar study in North Italy found an overall high implementation of multimodal strategies for IPC.[25] In general, these Class C Military Hospitals were found to be lacking in documentary record regarding training and surveillance, staffing level requirements, Healthcare-Associated Infection (HAI) surveillance and dedicated IPC professionals, quite similar to another scoping review report.[26] An online IPCAF survey distributed to 222 hospitals of Zheijung, China had somewhat similar results with CC2 (IPC guidelines) and CC6 (Monitoring/audit of IPC practices and feedback) having the highest and lowest median scores, respectively.[27]

There was a significant difference in both Class C hospitals after post scoring indicating a perceptual error in comprehending the IPCAF tool. However, the highest (Echo-1) and lowest scoring (Echo-3) Class C hospitals still exhibited a significant difference after post scoring indicating some variance in the eight core component standards among the two.

Although our study is limited by its small sample size, it makes several important implications and suggests new avenues for further exploration. More observational studies to illuminate understanding of what actually happens in clinical practice are required. A dedicated IPC team with designated budget, assigned tasks and periodic training of faculty and staff in related matters will better equip them to understand and comply with international standards.

LIMITATIONS OF STUDY

Our main limitation was a small sample size, and inability to access certain facilities due to protocols.

CONCLUSION

Military Class C hospitals showed satisfactory IPC practices as evaluated through WHO Infection Prevention and Control Assessment Framework tool and in-depth interviews. Areas requiring attention are Healthcare-Associated Infection (HAI) surveillance, monitoring, audit and feedback and multimodal strategies to further upgrade safety of patients and healthcare professionals.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AE & FE: Data acquisition, data analysis, critical review, approval of the final version to be published.

HH: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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