American Journal of Infection Control 000 (2021) 1–6

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Original Article

Self-reported survey on infection prevention and control structures in healthcare facilities part of a national level healthcare associated infection surveillance network in India, 2019

Omika Katoch PhD [a], Sonal Katyal MDS [a], Sharad Srivastav MSc [a], Camilla Rodrigues MD [b], Priscilla Rupali MD [c], Arunaloke Chakrabarti MD [d], Pallab Ray MD [e], Vibhor Tak MD [f], Manisha Biswal MD [e], Reema Nath MD [f], Chiranjay Mukhopadhyay MD [g], Sanjay Bhattacharya MD [h], Kanne Padmaja MD [i], Vijayshri Deotale MD [j], Vimala Venkatesh MD [k], Chand Wattal MD [l], Thirunarayan MA MD [m], Vijaya Lakshmi Nag MD [n], Raja Ray MD [o], Bijayini Behera MD [p], Sujata Baveja MD [q], Tadepalli Karuna MD [r], Sanjeev K. Singh MD [s], Bashir Fomda MD [t], Sulochana khumanthem devi MD [u], Padma Das MD [v], Neeta Khandelwal MD [w], Prachi Verma MS [x], Rajni Gaind MD [y], Prithwis Bhattacharyya MD [z], Puneet Kumar MD [aa], Ashutosh Srivastava MD [bb], Jyoti Iravane MD [cc], Tapan Majumdar MD [dd], Rajni Sharma MD [ee], Dhanapaul Sankara MD [ff], Vandana Kalwaje Eshwara MD [gg], Muralidhar Varma MD [hh], Shaista Nazir MD [ii], Swagata Tripathy MD [jj], Satyajeet Mishra MD [kk], Anupam Dey MD [ll], Premkumar Thangavelu M.Phil [mm], Lata Kapoor MD [nn], Rajesh Malhotra MS [oo], Kamini Walia MD [pp], Randeep Guleria MD [qq], Purva Mathur MD [a,*]

[a] *Department of Laboratory Medicine, JPNATC, All India Institute of Medical Sciences, New Delhi, India*
[b] *Department of Microbiology, P. D. Hinduja Hospital and Medical Research Center, Mumbai, Maharashtra, India*
[c] *Department of Infectious Diseases, Christian Medical College and Hospital, Vellore, Tamil Nadu, India*
[d] *Department of Microbiology, Graduate Institute of Medical Education and Research, Chandigarh, Punjab, India*
[e] *Department of Microbiology, Assam Medical College, Assam, India*
[f] *Department of Microbiology, All India Institute of Medical Sciences, Jodhpur, Rajasthan, India*
[g] *Department of Microbiology, Kasturba Medical College, Manipal, Karnataka, India*
[h] *Department of Microbiology, Tata Medical Center, Kolkata, West Bengal, India*
[i] *Department of Microbiology, Nizam's Institute of Medical Sciences, Hyderabad, Telangana, India*
[j] *Department of Microbiology, Mahatma Gandhi Institute of Medical Sciences, Sevagram, Maharashtra, India*
[k] *Department of Microbiology, King George's Medical University, Lucknow, Uttar Pradesh, India*
[l] *Department of Clinical Microbiology and Immunology, Sir Ganga Ram Hospital, New Delhi, India*
[m] *Department of Microbiology, Apollo Hospital, Chennai, Tamil Nadu, India*
[n] *Department of Microbiology, All India Institute of Medical Sciences, Jodhpur, Rajasthan, India*
[o] *Department of Microbiology, Institute of Post-Graduate Medical Education and Research, Kolkata, West Bengal, India*
[p] *Department of Microbiology, All India Institute of Medical Sciences, Bhubaneswar, Odisha, India*
[q] *Department of Microbiology, Lokmanya Tilak Municipal General Hospital, Mumbai, Maharashtra, India*
[r] *Department of Microbiology, All India Institute of Medical Sciences, Bhopal, Madhya Pradesh*
[s] *Department of Infection Control, Amrita Institute of Medicine Sciences, Amrita University, Kochi, Kerala, India*
[t] *Department of Microbiology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India*
[u] *Department of Microbiology, Regional Institute of Medical Sciences, Imphal, Manipur, India*
[v] *Department of Microbiology, All India Institute of Medical Sciences, Raipur, Chhattisgarh, India*
[w] *Department of Microbiology, Government Medical College, Surat, Gujarat, India*
[x] *Department of Critical Care Medicine, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur*
[y] *Department of Microbiology, Safdarjung Hospital and VMMC, Delhi, India*
[z] *Department of Anaesthesiology and ICU, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong, Meghalaya, India*
[aa] *Department of Microbiology, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India*
[bb] *Department of Microbiology MGM Medical College, Bhopal, Madhya Pradesh, India*
[cc] *Department of Microbiology, Govt. Medical College, Aurangabad, Maharashtra, India*
[dd] *Department of Microbiology, AGMC & GBP Hospital, Agartala,, Tripura, India*

* Address Correspondence to Purva Mathur, MD, Department of Laboratory Medicine, J.P.N. Apex Trauma Center, All India Institute of Medical Sciences, Ring Road, New Delhi 110029, India.
E-mail address: purvamathur@yahoo.co.in (P. Mathur).

Funding/support: This work was supported by the U.S. Centers for Disease Control and Prevention, Global Health Security Agenda cooperative agreement 1U2GGH001869.
Conflicts of interest: None to report.

https://doi.org/10.1016/j.ajic.2021.09.019

[ee] Department of Microbiology, SMS Medical College, Jaipur, Rajasthan, India
[ff] Department of Microbiology, K.A,V.P. Govt. Medical College, Trichy, Tamil Nadu, India
[gg] Department of Microbiology, Kasturba Medical College, Manipal, Karnataka, India
[hh] Department of Infectious Diseases, Kasturba Medical College, Manipal, Karnataka, India
[ii] Department of Microbiology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu and Kashmir, India
[jj] Department of Anesthesia and Critical Care Medicine, All India Institute of Medical Sciences, Bhubaneswar, Odisha, India
[kk] Department of Anesthesia, All India Institute of Medical Sciences, Bhubaneswar, Odisha, India
[ll] Department of General Medicine, All India Institute of Medical Sciences, Bhubaneswar, Odisha, India
[mm] Department of Infectious Disease, Christian Medical College and Hospital, Vellore, Tamil Nadu, India
[nn] Department of Microbiology, National Institute of Disease Control, New Delhi, India
[oo] Department of Orthopedics, JPNATC, All India Institute of Medical Sciences, New Delhi, India
[pp] Division of Epidemiology and Communicable Diseases, Indian Council of Medical Research, Ansari Nagar, New Delhi, India
[qq] Department of Pulmonary Critical Care and Sleep Medicine, All India Institute of Medical Sciences, New Delhi, India

Key Words:
Core components
Implementation
IPC guidelines
Tertiary care hospitals
Assessment
Multimodal strategies

Background: Healthcare associated infections (HAIs) are prevalent and difficult to treat worldwide. Most HAIs can be prevented by effective implementation of Infection Prevention and Control (IPC) measures. A survey was conducted to assess the existing IPC practices across a network of Indian Hospitals using the World Health Organization designed self-assessment IPC Assessment Framework (IPCAF) tool.
Methods: This was a cross sectional observation study. Thirty-two tertiary care public and private facilities, part of the existing Indian HAI surveillance network was included. Data collected was analyzed by a central team at All India Institute of Medical Sciences, New Delhi, a tertiary care hospital of India. The WHO questionnaire tool was used to understand the capacity and efforts to implement IPC practices across the network.
Results: The overall median score of IPCAF across the network was 620. Based on the final IPCAF score of the facilities; 13% hospitals had basic IPC practices, 28% hospitals had intermediate and 59% hospitals had advanced IPC practices. The component multimodal strategies had the broadest range of score while the component IPC guidelines had the narrowest one.
Conclusions: Quality improvement training for IPC nurses and healthcare professionals are needed to be provided to health facilities.

Healthcare associated infections (HAIs) are a major threat to patient safety worldwide and result in high mortality, morbidity, prolonged hospital stays and increased resistance of microorganisms to antimicrobial agents.[1-3] HAIs have become a global patient safety challenge but the true burden remains unknown, particularly in developing countries. According to the World Health Organization (WHO), on an average, at any given time, 7% of patients in developed and 10% in developing countries will acquire at least 1 HAI during their hospital stay. Accordingly, WHO and other agencies have laid special emphasis on preventing HAIs in developing countries.[4-6] HAI surveillance is crucial to prevent HAIs. Implementation of Infection Prevention and Control (IPC) measures in a healthcare facility are a key to prevent such infections. Surveillance can help a facility in investigating and managing any outbreak; and also help in managing pandemics like COVID-19 with its IPC components. Most of the HAIs can be prevented by changing the casual behavior of healthcare workers, enhancing safety culture in the hospitals, improving compliance with evidence-based infection prevention procedures and implementing guidelines.[7]

IPC should be a universal component of all healthcare facilities; it not only protects the health and safety of patients but also healthcare workers. To strengthen the IPC, WHO has released guidelines on core components of IPC programmes at the national and acute health care facility level.[8,9] At the facility level, implementation of IPC key aspects differ widely, not only between the developed and developing countries, but also within developing countries.[10-13] Therefore, to strengthen the implementation of guidelines on core components of existing IPC programs at acute healthcare facility level, WHO has developed a scoring-based Infection Prevention and Control (IPC) Assessment Framework (IPCAF) tool in 2018.[14] This tool supports the "baseline assessment" and "assessing impact" steps of the WHO proposed IPC facility programmes. The baseline assessment is concerned with understanding the current situation, including strengths and weaknesses, to guide action and planning for improvement. Assessing impact is concerned with evaluating the effectiveness of activities undertaken in the context of the action plan. This IPCAF tool has 8 core components which addresses different aspects of IPC: IPC program (CC1), IPC guidelines (CC2), IPC education (CC3), HAI surveillance (CC4), Multimodal strategies (CC5), Monitoring/audit of IPC practices and feedback (CC6), Workload, staffing and bed occupancy (CC7), Environments, materials and equipment for IPC (CC8).

In developing countries like India, the IPC measures are diverse among the different healthcare facilities. Many of these healthcare facilities face challenges to implement appropriate IPC practices.[15,16] Also, during the site support visit conducted by a central team of All India Institute of Medical Sciences (AIIMS), New Delhi of different facilities as part of existing HAI Surveillance (www.haisindia.com), we found that the IPC measures were varying across the network. Therefore, to understand the gaps in existing IPC measures, we conducted a survey in different healthcare facilities, part of the Indian HAIS network using the IPCAF tool.

METHODOLOGY

AIIMS, New Delhi in collaboration with Indian Council of Medical Research (ICMR) and National Centre for Disease Control (NCDC) conducted this cross-sectional study as part of the US-CDC Global Health Security Agenda (GHSA) cooperative agreement 1U2GGH0011869 work. In this survey, we enrolled a total of 32 tertiary care hospitals (24 public and 8 private hospitals) located across 23 states of India. All 32 hospitals were teaching hospitals; out of these, 2 were super specialty hospitals.

During January-September 2019, AIIMS, New Delhi sent the soft copy of IPCAF tool to all 32 tertiary care centers across the network to

assess the existing IPC practices in their facility and to share their scores. Along with this IPCAF tool, a guidance document was also sent to the centers to guide them on how to fill this tool. Queries were addressed via telephone or emails. IPCAF is a structured, closed-formatted questionnaire with an associated scoring system. It has 81 indicators; framed as questions with defined answers to provide an orientation for assessment. Every possible answer of a question was allocated a score, which makes it easy to fill. Each section has a maximum score of 100. The senior investigators along with Infection control nurses of each center assessed their IPC practices, scored all the 8 sections of IPCAF that reflected the 8 different WHO IPC core components; and based on the total scores of IPCAF facilities, assigned their IPC level into inadequate (0-200), basic (201-400), intermediate (401-600) and advance (601-800). These results were shared with AIIMS via email or via hard copies. The AIIMS team reviewed completed IPCAF tools and in case of queries, called the site to clarify the answers.

Data analysis

After receiving the filled IPCAF tool from all sites, AIIMS team reviewed and entered the data in a master excel sheet for further analysis. Summary statistics such as Mean with standard deviation (SD) and Median with Interquartile range (IQR) were calculated and presented for total IPC level score of each facility as well as for each component of the IPCAF tool across the network. Outliers were also assessed using boxplot. Mann-Whitney U test with the level of significance (α = 0.05) was used to test for differences between the median scores of government and private hospitals.

Ethical approval

Ethical approval for this study was obtained (IEC/NP-386/10.09.2015) from Institutional Ethics committee, All India Institute of Medical Sciences (AIIMS), New Delhi.

RESULTS

The demographics of participating hospitals showed that 8 hospitals were <500 bedded and the remaining were 500-4,000 bedded. The average daily bed occupancy was 73% across the network. The overall median (IQR) score of IPCAF across the network was 620 (IQR: 497.5-732.5) (Table 1). Based on the final IPCAF score of the facilities, 4 hospitals (13%) had basic IPC practices, 9 hospitals (28%) had intermediate and 19 hospitals (59%) had advanced IPC practices. None of the participating hospitals across the network fell into the "inadequate" category for IPC practices that is, none of the hospitals had IPCAF score less than or equal to 200. Figure 1 illustrates the distribution of total IPCAF scores of the participating government and private facilities. Out of 8 private facilities, 1 (12.5%) facility fell under the intermediate IPC category and 7 (87.5%) had advanced IPC practices in their facilities. Out of 24 Government run facilities, 5 (21%) had basic, 7 (29%) had intermediate and 12 (50%) had advanced IPC practices in their hospitals.

Table 1
Distribution of total IPCAF and individual core components scores across the network

	Core components	Median	IQR
CC1	IPC programme	86.3	23.8
CC2*	IPC guidelines	**98.8**	18.8
CC3	IPC education and training	75.0	37.5
CC4	HAI surveillance	85.0	27.5
CC5	Multimodal strategies	75.0	50.0
CC6	Monitoring/audits of IPC practices and feedback	73.8	28.8
CC7†	Workload, staffing and bed occupancy	**72.5**	45.0
CC8	Built environment, materials and equipment for IPC at the facility level	88.8	35.0
	Final total score	**620.0**	235.0

IQR, inter quartile range.
*Highest median score.
†Lowest median score.

The median (IQR) score of each 8 component (CC1-CC8) of the IPCAF tool was calculated (Table 1). The mean score for overall IPCAF across the network was 599 with standard deviation of 147. The difference between the government and private facilities' individual core component score is illustrated in Figure 2. Except the scores of IPC guidelines (CC2) and IPC education and training (CC3) all other component scores along with the total IPC level score showed significant differences between the government and private hospitals ($P < .05$).

Box plot (Fig 3) shows the median scores with inter quartile range for each core component. The median scores for all the 8 core components fell in the range of 72.5-98.8. The component "workload, staffing and bed occupancy" (CC7) had the lowest median score 72.5 while CC2 had the highest median score 98.9. CC5 and CC7 had the lowest mean score (64 each) across the network and the highest mean score was of CC2. The component multimodal strategies (CC5) had the broadest interquartile range (50) while the component IPC guidelines (CC2) had the narrowest one (18.8). Also, CC2 had 2 outliers with score below 40.0 and component CC6 had 1 outlier with score of 0.

The components with lowest mean scores were the component "workload, staffing and bed occupancy" (CC7) and "multimodal strategies" (CC5). In "Workload, staffing and bed occupancy" (CC7), 16/32 (50%) hospitals (all were government hospitals) had scores less than the median score (73). This component ranked the second largest IQR with minimum score of 10 and maximum score of 100. Three hospitals had a maximum component score for CC7 (1 was government and 2 were private hospitals). Within the component, only 17 hospitals (53%) assessed the needs of staffs at their facilities using national or international standards. Twenty-eight percent of hospitals had maintained appropriate health care workers to patients' ratio across their entire facilities. Seventy-two percent of hospitals had a system in place to address the staffing needs assessment. Only 22% of hospitals had designed all their departments in accordance with international standards. Sixty-six percent of hospitals had maintained 1 patient per bed in all units of their facility. Seventy-two percent of hospitals did not have beds standing in the corridor outside of the room. Forty percent of hospitals had adequate spacing of more than 1 meter between the patients in their facilities. Seventy-five percent facilities had hospital administration or management to assess and respond to the adequate bed capacity when exceeded.

For multimodal strategies for implementation of IPC (CC5) component, 28 facilities (88%) reported this component while 4 facilities didn't score it (all were government). Eighteen of 28 (64%) hospitals had scores less than or equal to median score (75). Out of these 18 hospitals, 2 were private and all others were government. Within the component, 3 of 28 (11%) hospitals did not use multimodal strategies to implement IPC in their facilities. Out of these 3 facilities, 2 were government and 1 was private. Twenty-one of 28 (75%) facilities had multidisciplinary teams to implement IPC multimodal strategies. Twenty-three of 28 (82%) facilities reported that staff from quality improvement and patient safety were involved to promote IPC multimodal strategies. Bundles and checklists were used by 23 of 28 (82%) hospitals to improve the multimodal component of IPC. Twenty-six facilities used 1 or more of these elements in multimodal strategies.

DISCUSSION

We found that more than half of the hospitals participating in this survey had advanced IPC practices. None of the hospitals in the network fell under the inadequate IPC practices category. Thus, our survey demonstrated good IPC practices across the network. However, we

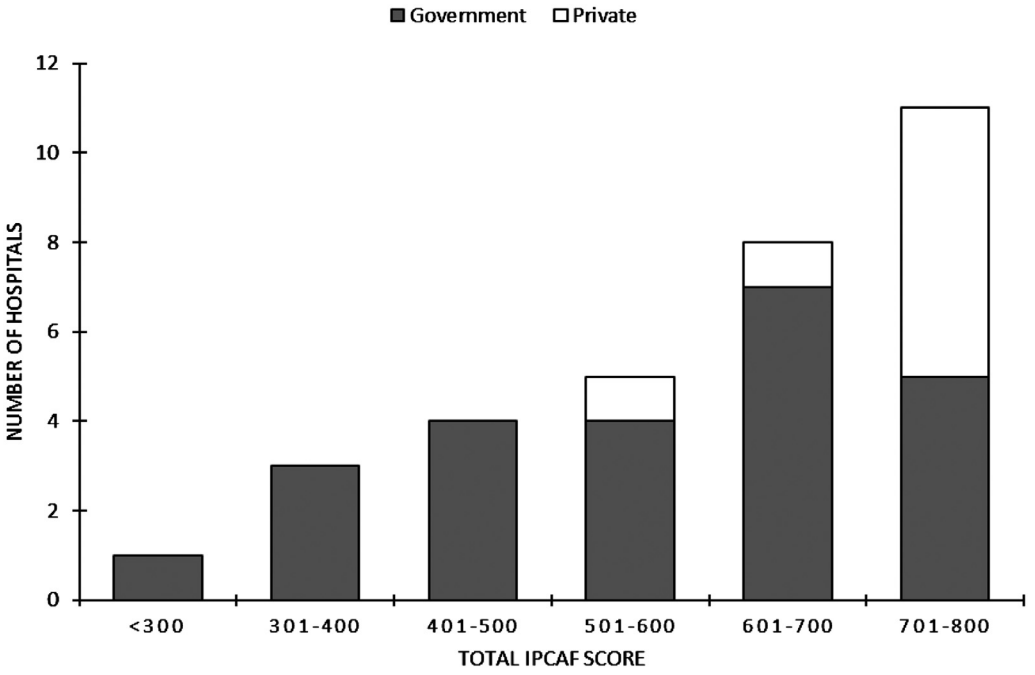

Fig 1. Distribution of IPCAF score among different participating government and private facilities.

conducted this survey after the initiation of HAI surveillance, so the centers were well aware of the importance of IPC practices for HAI surveillance. Facilities having basic and intermediate IPC practices need strict implementation of National Guidelines for IPC practices and systematic surveillance in Healthcare Facilities as advocated by the Ministry of Health and Family Welfare, Government of India, to further improve the collective IPCAF score across the network.

The ICMR has recently released guidelines on IPC.[17] India has also launched programmes like Swachh Bharat Abhiyan and Kayakalp program[18] (clean and green hospital initiative), which will eventually go a long way in improving hospital hygiene and IPC practices (https;//nhm.gov.in).

Within the individual components of the IPCAF, we found substantial differences between the respective scores. For the IPC programme (CC1) only one-fifth facilities had 100% score for this component. The median score for IPC guidelines (CC2) revealed it is well established within the network. Half of the facilities had 100% score for this component. The data from the component IPC education and training (CC3) illustrated the need for strengthening of this component. We found that half of the participating hospitals had no specific IPC training for administrative or managerial staff, patients or family members to minimize the potential for HAIs.

Microbiological testing is a crucial component for HAI surveillance. Accurate and rapid identification of causative pathogens and its sensitivity patterns would help the clinicians to treat the patient at an early stage of infection. Moreover, it would also help in identification of multi drug resistance (MDR) pathogens like MRSA, VISA, VRE, MDR *Pseudomonas aeruginosa*, carbapenem and colistin-resistant *Enterobacteriacae* etc. and for identification and management of outbreaks, if any. In our survey, we found that in some facilities

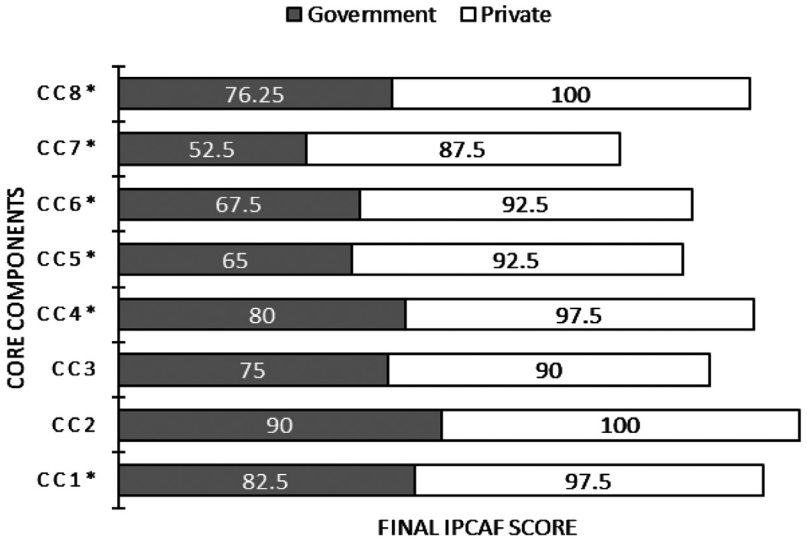

Fig 2. Distribution of core component scores of IPCAF of participating government and private facilities.*Significant difference between the scores for government and private facilities.

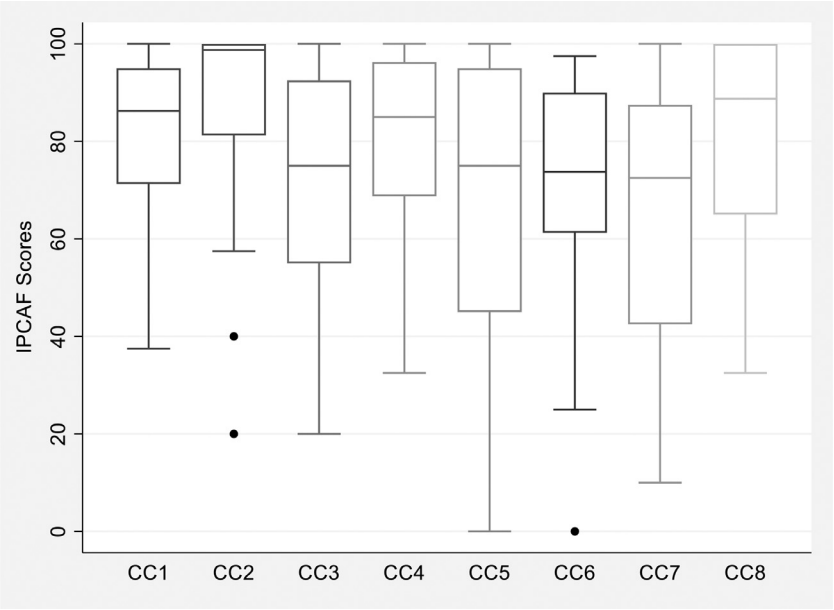

Fig 3. Box plot showing the median, inter-quartile range and outliers of core components.

clinicians started their treatment based on the symptoms without sending samples for culture. This might result in the growth of non-responsive behavior and antimicrobial resistance against the drug given. There should be proper communication between the laboratories and clinicians in order to institute appropriate prescription protocols. In our survey we found that only half of the facilities had informatics/IT support to conduct the surveillance in their facility. According to the interim practical manual of WHO, evaluation of surveillance should be done in a timely manner to achieve the targeted goal[8]; we found that one-fourth of facilities did not evaluate their surveillance data regularly.

The multimodal strategies in IPC (CC5) have been the best evidence-based approach to achieve sustained system and behavioral change for the implementation of IPC interventions. It is a new concept added in the practice of infection control.[19-21] We observed the highest diversity of results within this component. One-fifth of hospitals did not use any multimodal strategies like system change; education and training; monitoring and feedback; communication and reminders; safety climate and culture change to implement IPC interventions. In the network, 6.25 % facilities did not include education and training elements; 12.5% did not include monitoring and feedback elements; 17% of facilities did not include system change and communication and reminder elements in their multimodal strategies. Safety, climate and culture change was the least reported element among different multimodal elements; approximately two-third facilities included this element in their multimodal strategies to implement IPC interventions. The data collected revealed substantial improvement in this component.

As IPC is a crucial component in controlling HAIs; monitoring of data; feedback of IPC processes and indicators at regular intervals is mandatory. In our survey we found that despite availability of trained personnel for monitoring/audit of IPC practices and feedback, only one-fourth of facilities had well defined monitoring plans and tools to collect data in a systematic way. We also observed that only one-fourth of facilities conducted safety culture surveys like hospital survey on patient safety culture; safety attitudes questionnaire, patient safety climate in healthcare organizations; and hospital safety climate scale.

The workload, staffing and bed occupancy component (CC7) of IPCAF had the lowest mean and median score. Appropriate staffing level as well as the nurse-to-patient ratio is very important to prevent the HAIs. Some studies have found that increasing the nurse staff results in reduced HAI events.[22-23] The lowest score of this component in our survey emphasizes that it needs substantial improvement. Almost half of the hospitals did not have appropriate staffing levels for the patient workload. This is an urgent necessity in developing countries like India.

The CC8 component deals with the environment, material and equipment to be needed for IPC at a given facility. The median score for this component indicated that improvements can be made. This can be achieved by installation of hand hygiene stations at all points of care and providing sufficient supplies of water and hand hygiene supplies.

Viewing the means of each component, it was observed that the multimodal strategies and workload, staffing and bed occupancy components were the weakest among other components and needed more attention. These results are in concordance with the results of a survey conducted in Germany.[24] Challenges like low human resources, hospital overcrowding, and low nurse-to-patient ratios need urgent support. Gupta et al. found that half of the hospitals which participated in their study had an infection control programme; however, its effectiveness needs to be further evaluated. They also identified several key areas of concern in Indian hospitals that needs improvement. It included recognizing epidemiologists, guidelines/SOP formulation for Infection control and antibiotic-prescribing audit as a strategy to prevent antimicrobial resistance.[25] There was significant difference between the private and government hospitals scores except the components CC2 and CC3 indicating that the government hospitals needed more attention in these areas.

Our study has some limitations too. The number of participating healthcare facilities in this study was not too large to interpret the IPC level on a national level. Most of the reporting facilities were well established and well-funded; they may have higher resources, staff and motivation than many other facilities in India. Some facilities did not fully understand some components like multi-modal strategies, which led to false reporting. The IPCAF collected information may have been perceived as potentially compromising by some facilities. Therefore, they may be overrepresented or some questions could have been answered wrongly.

Also, this is the first study of this type across the nation including both private and public hospitals. The participating hospitals are part

of the ICMR/NCDC, AMR and HAI surveillance networks, which are feeding Quality controlled AMR and HAI data to our National networks (www.haisindia.com). This study will help the facilities to understand the concept of many components of IPC practices and also craft readiness of hospitals to participate in the HAI surveillance network. The scoring system of IPCAF will help the facilities to identify and to deal with gaps in existing IPC practices.

RECOMMENDATIONS

- Assessment using IPCAF tool within the facility should be done on a regular basis to identify and address the gaps in existing IPC practices; which would result in improvisation of IPC practices.
- Trained IPC nurses and health care professionals are required. Nurse to patient ratio needs to be improved.
- Implementation of HAI prevention bundles for central line associated bloodstream infection, catheter associated urinary tract infection, hand hygiene and ventilator associated pneumonia needs to be implemented and monitored.
- Quality improvement training and guidance materials need to be provided and trained upon.
- Proper communication between the Microbiology and Clinical teams is essential; availability of automated systems would reduce the time of reporting.
- Hospital administration and managerial staff should be in the IPC committee to keep a track on the supplies required and efficient running of the IPC practices in the facility.
- Average network IPCAF score should be displayed on a regular basis on digital platforms. Sites should be motivated to improve their IPCAF score by addressing the identified gaps in their IPC practices when they compare their scores with the average network score.

Acknowledgments

This study was conducted as part of multicentric surveillance project titled “Capacity Building and Strengthening of Hospital Infection Control to Detect and Prevent Antimicrobial Resistance in India.” We thank Paul Malpiedi, Daniel VanderEnde, Siromany Valan (U.S. Centers for Disease Control and Prevention) and the ICMR and AIIMS team for their assistance with this capacity building project. We acknowledge the support of the Global Health Security Agenda (GHSA) cell of the Ministry of Health and Family Welfare and the Directorate General of Health Services for this work.

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