DOI: 10.7860/JCDR/2021/47651.15203

Original Article

Pharmacology Section

Knowledge, Attitude and Practices of Clinicians, Nurses and Pharmacists Regarding Antimicrobial Stewardship: A Five Centre Survey from India

AKSHATA MANE[1], SHWETA KAMAT[2], HARISH THANUSUBRAMANIAN[3]

(cc) BY-NC-ND

ABSTRACT

Introduction: Increasing awareness and practice of Antimicrobial Stewardship (AMS) has gained immense importance in Indian hospitals for preventing the irrational use of antibiotics. India is one of the world's largest consumers for antibiotics. Assessment of the local Knowledge, Attitude and Practices (KAP) of Antimicrobial Resistance (AMR) and AMS among Healthcare Providers (HCPs) will help in designing effective public health policies and engaging the community in campaigns against increasing microbial resistance.

Aim: To understand the status of AMS programs and practices in five private sector multispecialty hospitals situated in the East, West, North and South zones of the country and to assess the KAP of HCPs regarding AMR and AMS.

Materials and Methods: The cross-sectional survey was conducted to assess the implementation of AMS in five hospitals among clinicians, nurses and pharmacists across India using a predeveloped AMS checklist between June 2019 and October 2019. The analysis was done between July and August 2020. Responses were collected using a five-point Likert scale, with choices ranging from 'strongly agree' to 'strongly disagree'.Descriptive analysis was done for the KAP survey to determine the percentages of participants under each response category.

Results: Total 32 clinicians, 55 nurses and eight pharmacists responded to the KAP survey (100% response rate). The clinicians were aware that AMR is caused by irrational prescribing of antimicrobials (n=31, 96.87%) and improper diagnosis of infective conditions (n=27, 84.37%). However, knowledge of clinicians on infection control practices (n=6, 18.75% disagreed) in controlling AMR and practice of referring local epidemiology before prescribing antimicrobials (n=7, 21.87% did not follow routinely) could be improved. The knowledge and practice of nurses and pharmacists on antibiotic use were spread over a wide range. According to the nurses, AMR was mainly caused by using antimicrobials for non bacterial infections (n=30, 54.54%) and deviations from their standard duration (~63.64%-72.73%). As per pharmacists, the lack of restrictions on antimicrobial usage and widespread use or overuse of antibiotics were major contributors to AMR (n=3, 37.5% strongly agreed). Both nurses and pharmacists could benefit from reinforced training on antibiotic usage.

Conclusion: Implementation of AMS was not adequate in private Indian hospitals. Although clinicians have good knowledge on antibiotic use, it was not equally reflected in their practice. The KAP data of nurses and pharmacists suggest that training and education on appropriate antibiotic usage should be emphasised. More efforts are required to improve AMS practices in hospitals.

Keywords: Antibiotics, Antimicrobial resistance, Healthcare providers, Infection control practices

INTRODUCTION

The AMR develops when bacterial strains become resistant to antibiotics. The emergence of AMR is worsened by the misuse and overuse of antibiotics [1]. AMR has become a global concern and has been identified as a serious threat to global public health by the World Health Organisation (WHO). Southeast Asian countries, including India, have become hubs for AMR [2-5]. Recent AMR trends in India are quite alarming and there is increasing resistance to last-resort antibiotics [6]. India is one of the world's largest consumers of antibiotics [4]. Different studies from India have reported antibiotic prescription rates between 49.9% and 81.8% [7-9].

The AMS has been identified as the primary intervention for curtailing AMR [3]. The successful implementation of AMS in other countries has demonstrated a reduction in AMR rates, healthcare costs and mortality rates [6]. The implementation of AMS helps to increase infection cure rates among patients, corrects prescription rates and prophylaxis and reduces treatment failure [10]. However, the implementation of AMS in Indian healthcare institutions is still at a preliminary stage [6]. A recent literature review on the implementation of AMS programs in different healthcare facilities in India reported low (35.2%) implementation of AMS practices in the country [11].

The frontline stakeholders, i.e., physicians and nurses, bear the dual responsibility in controlling AMR by rationalising antibiotic usage and sensitising the general population [1]. Promoting awareness about AMR among these HCPs thus becomes a key priority from an Indian perspective [12]. Given that physicians with higher knowledge and experience prescribe fewer antibiotics, filling the gaps in the knowledge of physicians is crucial [13,14]. Nurses have a critical role in patient care and their involvement in AMS has been highlighted by the Centres for Disease Control and Prevention (CDC) [15]. However, their role and involvement in AMS are not clearly understood [16]. An understanding of the local KAP of AMR and AMS among HCPs will aid in designing effective public health policies and engaging the community in campaigns against AMR [4].

Although there are a few reports on KAP in the context of AMR in the Indian setting [14,17-20], there is limited evidence regarding KAP on AMR and AMS among HCPs in hospitals across the country. With this background, an assessment of the implementation of AMS was done along with a KAP survey in five key hospitals selected from four zones (East, West, North and South) across the country to assess AMR awareness and AMS practices among clinicians, nurses and pharmacists regarding antibiotic usage.

MATERIALS AND METHODS

A cross-sectional survey was conducted among clinicians, nurses and pharmacists of five private hospitals representing four zones of India (East, West, North and South) between June 2019 and October 2019. The Analysis was done between July and August 2020. The survey was conducted during an ongoing AMS training session in these hospitals. The hospitals were selected based on their interest in successful implementation or improvisation of AMS practices in their institutions.

Study Procedure

The AMS checklist was filled in by one of the key stakeholders in AMS, i.e., the microbiologists. Those participants (clinicians, nurses and pharmacists) of the training session who voluntarily agreed to fill in the questionnaire were selected for the KAP survey. The anonymity of the participants was maintained since the questionnaire only asked for the designation of the HCP and half an hour was given to fill in the questionnaire.

A prevalidated checklist was used to assess the level of implementation of AMS and AMS-readiness in these five hospitals. The questions were consistent with the Transatlantic Taskforce on Antimicrobial Resistance (TATFAR) set of core and supplementary indicators for hospital AMS programs [21,22]. The checklist questions are also consistent with the CDC checklist for core elements of hospital AMS programs [15]. The questions in the AMS checklist were aimed at evaluating different aspects of AMS implementation. Subsequently, a KAP survey on AMR and AMS was also conducted in these five hospitals, between June 2019 and October 2019. Based on previous studies, a self made KAP survey questionnaire was developed for the present study [23-28]. The questionnaire was distributed prior to the AMS training session. The survey involved key stakeholders closely involved with AMS implementation, viz., clinicians, pharmacists and nurses. All the participants were voluntarily involved in the study.

Data Collection

The KAP of the clinicians, nurses and pharmacists in the context of antibiotic usage were assessed by separate sets of questions for each category of responders. The questionnaire consisted of domains regarding KAP of participants towards AMR including the antibiotic usage and prescription practices. The survey was rolled out to all participants of the AMS training session and only the filled-in survey responses were considered for the analysis. Responses from the participants were collected using a five-point Likert scale and the choices ranged from 'strongly agree' to 'strongly disagree', thereby providing a holistic view of participants' opinions.

STATISTICAL ANALYSIS

Descriptive analysis was used for the KAP survey to determine the percentages of survey participants under different categories of response.

RESULTS

Study participants: The survey was conducted in five Indian tertiary care hospitals located in five different cities across the country: Andhra Pradesh and Tamil Nadu in South India, Maharashtra in Western India, Punjab in North India and Patna in East India. Hospitals from the North and West zones were superspecialty hospitals (≥300 bedded), while the remaining three were multispecialty hospitals (100-300 bedded). All participating hospitals were from tier two cities of the country. The study involved a total of 95 healthcare-associated personnel, including 32 clinicians, 55 nurses and eight pharmacists from the five hospitals. The response rate to the survey was 100%.

Assessment of Antimicrobial Stewardship (AMS): First, implementation of the AMS program was evaluated in the participating hospitals: Hospital 1 from North zone, Hospitals 2 and 3 from South zone, Hospital 4 from West zone and Hospital 5 from East zone. The AMS checklist revealed that for improving antibiotic use, all participating hospitals had a formal statement of support for AMS activities.

The majority of the hospitals (Hospitals 1 to 4) had a physician (or other) leader responsible for AMS activities with specialised training on infectious diseases (Hospitals 2, 3 and 4). All the hospitals had infection control, microbiology and nursing staff who worked with physicians or pharmacists to improve AMR and AMS.

In the context of AMS interventions, prospective audits and feedback for restricted antibiotics within 48 hours of prescription were mandatory for the majority of the hospitals (Hospitals 1, 2 and 3). These hospitals were equipped with facility-specific antibiotic treatment guidelines for specific infections and Hospitals 1, 3 and 4 had guidelines for the de-escalation of broad-spectrum antibiotics. But the hospital guidelines were not readily available at the point of care, except in Hospital 3.

The majority of the hospitals had unit-specific antibiograms (Hospitals 1, 2 and 3). Less than half of the hospitals implemented other aspects, such as monitoring the use of specific antibiotics by days of therapy or defined daily dose (Hospitals 1 and 3 answered yes), antibiotic expenditure (Hospital 3 said yes) and compliance with facility-specific treatment guidelines (Hospitals 2 and 3 answered yes). The hospitals did not regularly publish AMR data and outcome measures associated with AMS or share the results of antibiotic audits or reviews directly with prescribers (Hospitals 1 and 3 said yes).

Nearly all the hospitals had either an in-house microbiology laboratory or access to a timely and reliable microbiology service (Hospitals 1, 2, 4 and 5). However, the hospitals were not appropriately equipped with other infrastructure for AMS, e.g., Information Technology (IT) capabilities to gather and analyse AMS data (only Hospitals 1 and 2 said yes). Hospitals 1, 2 and 5 conducted educational activities for clinicians and other relevant staff on improving antibiotic prescribing; however, these were neither mandatory nor certified (only Hospitals 1 and 2 said yes).

The hospital-wise response to the AMS checklist is depicted in [Table/Fig-1].

Response to Knowledge, Attitude and Practices (KAP) Survey

The 39-point KAP survey questionnaire provided a holistic view of the KAP of different healthcare personnel toward AMR and AMS in hospitals across the country. A total of 32 clinicians, 55 nurses and eight pharmacists participated in the survey and filled in the 39-point questionnaire. However, if the participants had no answer to any particular question, they did not provide any response.

Overall, the clinicians had good knowledge of the contributing factors for AMR. They were aware that irrational prescribing of antimicrobials (n=31, 96.87%) and improper diagnosis of infective conditions (n=27, 84.37%) were important contributing factors for AMR. However, the attitude of the clinicians towards AMR could be improved in some aspects, e.g., role of poor infection control practices in overprescribing of antibiotics (n=6, 18.75% disagreed). The majority of clinicians advocated the need for more education (n=30, 93.75%) on appropriate use of antibiotics and opined that newer antibiotics would tackle the increase in AMR (n=26, 81.25%). Some clinicians did not regularly refer to the local epidemiological data or antibiogram while prescribing antibiotics (n=7, 21.87%). The detailed responses are mentioned in [Table/Fig-2].

The knowledge of nurses on the causes of AMR varied across a wide range. While half of the nurses were aware that the use of antimicrobials for self-limited non bacterial infections (n=30, 54.54%), or administration for a longer (n=35, 63.64%) or shorter than standard duration (n=40, 72.73%) causes AMR, 10 to 12 of them (~18.2%-21.8%) disagreed. Again, while nearly half of the

Antimicrobial stewardship checklist		Hospital wise response				
		1	2	3	4	5
Hospital leadership support						
C1	Does your Hospital have a formal statement of support for AMS activities to improve antibiotic use?	Yes	Yes	Yes	Yes	No
C2	Does your Hospital allocate any budgeted financial support for AMS activities?	Yes	Yes	Yes	Yes	No
AMS team and infectious disease training						
C3	Does your Hospital have a physician (or other) leader responsible for AMS activities?	Yes	Yes	Yes	Yes	No
S1	Does this leader have specialised infectious disease training?	No	Yes	Yes	Yes	NA
C4	Does your hospital have a pharmacist working on AMS activities?	Yes	NA	Yes	No	No
S2	Is this pharmacist a clinical pharmacist, or does this pharmacist have specialised infectious disease training?	Yes	No	Yes	NA	NA
Do any of the following staff work with physicians or pharmacists to improve antibiotic use?						
C5	Infection control	Yes	Yes	Yes	Yes	Yes
C6	Microbiology	Yes	Yes	Yes	Yes	Yes
S3	Nursing	Yes	Yes	Yes	Yes	Yes
S4	Information Technology (IT)	Yes	Yes	Yes	No	No
AMS program interventions						
C7	Do specific antibiotics need preauthorisation for dispensing and/or prospective audit and feedback for prescription?	Yes	Yes	Yes	No	No
S5	Does your Hospital use computerised decision-support systems for antibiotic prescription?	No	Yes	Yes	No	No
C8	Does your Hospital have facility-specific antibiotic treatment guidelines for commonly treated infections?	Yes	Yes	Yes	No	No
Do you have facility specific antibiotic treatment guidelines for the following infections?						
S6	Community acquired pneumonia	Yes	Yes	Yes	NA	NA
S7	Hospital acquired pneumonia/ventilator-associated pneumonia	Yes	Yes	Yes	NA	NA
S8	Skin and soft tissue infections	Yes	Yes	Yes	NA	NA
S9	Sepsis	Yes	Yes	Yes	NA	NA
S10	Urinary tract infections	Yes	Yes	Yes	NA	NA
S11	Intraabdominal infections	Yes	Yes	Yes	NA	NA
S12	Does your hospital have guidelines for the de-escalation of broad-spectrum antibiotics, including carbapenems?	Yes		Yes	Yes	NA
S13	Does your hospital have guidelines for IV-to oral conversion of antibiotics?	No	Yes	Yes	Yes	NA
S14	Are Hospital guidelines readily available at the point of care?	NA	NA	Yes	No	NA
AMS monitoring and reporting						
C9	Does your Hospital monitor the use of specific antibiotics by DOT or DDD?	Yes	NA	Yes	No	No
S15	Does your Hospital monitor antibiotic expenditure?	No	No	Yes	No	No
S16	Does your hospital monitor compliance with facility specific treatment guidelines?	No	Yes	Yes	No	No
C10	Does your Hospital regularly publish antimicrobial resistance data and outcome measures associated with AMS?	Yes	No	Yes	No	No
S17	Are the results of antibiotic audits or reviews shared directly with prescribers?	Yes	No	Yes	No	No
C11	Is there a hospital antibiogram?	Yes	Yes	Yes	Yes	No
S18	Is the antibiogram regularly updated?	Yes	Yes	Yes	Yes	NA
S19	Is the antibiogram easily accessible?	Yes	Yes	Yes	Yes	NA
S20	Are there unit-specific antibiograms?	Yes	Yes	Yes	No	NA
Hospital infrastructure						
S21	Does your Hospital have IT capabilities to gather and analyse AMS data?	Yes	Yes	NA	No	No
S22	Does your Hospital use electronic health records?	Yes	Yes	NA	No	No
S23	Does your Hospital use computerised physician order entry?	Yes	Yes	NA	NA	No
C12	Does your Hospital have an in-house microbiology laboratory or access to a timely and reliable microbiology service?	Yes	Yes	NA	Yes	Yes
S24	Does your microbiology service make use of rapid diagnostic reporting?	Yes	NA	NA	Yes	Yes
S25	Does your microbiology service use selective susceptibility reporting?	No	NA	NA	Yes	Yes
Education						
S26	Does your Hospital provide educational activities for clinicians and other relevant staff on improving antibiotic prescription?	Yes	Yes	NA	No	Yes
S27	Is this training mandatory and certified?	Yes	Yes	NA	No	No

[Table/Fig-1]: Response from five participating Hospitals to the AMS checklist.
Hospital 1: North zone (Punjab), Hospital 2: South zone (Andhra Pradesh), Hospital 3: South zone (Tamil Nadu), Hospital 4: West zone (Maharashtra), Hospital 5: East zone (Patna).
AMS: Antimicrobial stewardship; IT: Information technology; DOT: Days of therapy; DDD: Defined daily dose; IV: Intravenous; C: Core indicator; S: Supplemental indicator; NA: Not answered

nurses were aware of the role of appropriate infection control practices (n=29, 52.73%) and restrictions on antibiotic usage (n=36, 65.45%) and overuse of antibiotics (n=30, 54.54%) in controlling AMR, others believed that non adherence to antibiotic treatment by patients do not contribute to AMR (n=11, 20%). They also agreed that in case of earlier apparent recovery from symptoms, the antibiotic course should be stopped immediately (n=12, 21.82%) and that antibiotics should be given to speed up recovery from cough and cold (n=21, 38.18%).

According to the pharmacists, the lack of restrictions on antimicrobial usage (n=5, 62.5%) and widespread or overuse of antibiotics (n=6, 75%) were crucial factors for antibiotic resistance. They believed that

Category	Statement	Strongly agree n (%)	Agree n (%)	No opinion n (%)	Disagree n (%)	Strongly disagree n (%)
For clinicians (N=32)						
Antimicrobial resistance can be caused by:						
Knowledge	Improper diagnosis of infective conditions	17 (53.12)	10 (31.25)	1 (3.12)	-	-
	Irrational prescribing of antimicrobials	22 (68.75)	9 (28.12)	-	-	-
	Infection diagnosis without lab interventions	12 (37.5)	14 (43.75)	3 (9.37)	-	-
	Poor adherence to isolation and contact precautions	12 (37.5)	15 (46.87)	3 (9.37)	-	-
	Poor hand hygiene and infection control	13 (40.62)	15 (46.87)	1 (3.12)	-	-
	Patients' demand for antibiotics	6 (18.75)	14 (43.75)	5 (15.62)	5 (15.62)	1 (3.12)
Attitude	Nonadherence to treatment by patients can be a contributing factor for antimicrobial resistance	9 (28.12)	12 (37.5)	1 (3.12)	-	-
	Overuse of antibiotics leads to antibiotic resistance in my hospital	9 (28.12)	20 (62.5)	2 (6.25)	1 (3.12)	-
	Poor infection control practices lead to overprescribing of antibiotics in my hospital thereby contributing to resistance	6 (18.75)	15 (46.87)	3 (9.37)	6 (18.75)	-
	Restriction on antimicrobial use is a reasonable method for controlling antibiotic use	13 (40.62)	16 (50)	-	-	1 (3.12)
	I would like more education on the appropriate use of antibiotics	14 (43.75)	16 (50)	1 (3.12)	-	-
	New antimicrobial development will keep up with our current resistance needs	11 (34.37)	15 (46.87)	3 (9.37)	-	-
	Antibiotic policy will help to reduce antimicrobial resistance in this institution	20 (62.5)	10 (31.25)	-	-	-
Practice	Microbiology lab results are communicated to me and I refer to them before prescribing	8 (25)	14 (43.75)	2 (6.25)	-	-
	I regularly refer to the susceptibility/sensitivity patterns at this institution (e.g., an antibiogram) when prescribing antibiotics	13 (40.62)	12 (37.5)	7 (21.87)	-	-
	If medically appropriate, I choose to step down patients from IV antibiotics to an oral alternative	11 (34.37)	18 (56.25)	1 (3.12)	-	-
	I prescribe an antibiotic based on the severity of infection	20 (62.5)	11 (34.37)	-	1 (3.12)	-
	I prescribe an antibiotic based on likely infecting organisms	17 (53.12)	11 (34.37)	1 (3.12)	-	-
	I prescribe antibiotics based on the effectiveness of antibiotics for patients typically seen	13 (40.62)	15 (46.87)	-	1 (3.12)	-
For nurses (N=55)						
Antibiotic resistance can be caused by:						
Knowledge	Use of antimicrobials for self-limited nonbacterial infections	16 (29.09)	14 (25.45)	5 (9.09)	3 (5.45)	8 (14.54)
	Use of antimicrobials with a broader than necessary spectrum	12 (21.82)	19 (34.54)	6 (10.91)	10 (18.18)	1 (1.82)
	Use of antimicrobials for shorter than standard duration	13 (23.64)	27 (49.09)	1 (1.82)	10 (18.18)	-
	Empirical antimicrobial therapy	4 (7.27)	17 (30.91)	17 (30.91)	4 (7.27)	4 (7.27)
	Use of antimicrobials for longer than standard duration	21 (38.18)	14 (25.45)	7 (12.73)	8 (14.54)	4 (7.27)
	Lack of restrictions on antimicrobial usage/poor infection control practices	14 (25.45)	17 (30.91)	2 (3.64)	13 (23.64)	5 (9.09)
Attitude	Nonadherence to treatment by patients can be a contributing factor for antimicrobial resistance	9 (16.36)	9 (16.36)	4 (7.27)	11 (20)	-
	Overuse of antibiotics leads to antibiotic resistance in my hospital	16 (29.09)	14 (25.45)	6 (10.91)	8 (14.54)	8 (14.54)
	Poor infection control practices lead to overprescribing of antibiotics in my hospital thereby contributing to resistance	14 (25.45)	15 (27.27)	2 (3.64)	4 (7.27)	12 (21.82)
	Restriction on antimicrobial use is a reasonable method for controlling antibiotic use	18 (32.73)	18 (32.73)	3 (5.45)	8 (14.54)	2 (3.64)
	I would like more education on the appropriate use of antibiotics	21 (38.18)	23 (41.82)	5 (9.09)	5 (9.09)	-
	New antimicrobial development will keep up with our current resistance needs	18 (32.73)	14 (25.45)	11 (20)	4 (7.27)	2 (3.64)
	Essential infection control practices like hand hygiene reduce healthcare-associated infections	30 (54.54)	11 (20)	2 (3.64)	2 (3.64)	5 (9.09)
Practice	I have sufficient knowledge of antibiotics and prefer to ask the prescriber questions about antimicrobial prescriptions	12 (21.82)	25 (45.45)	1 (1.82)	6 (10.91)	-
	I know what is meant by empiric antibiotic therapy and when it should be stopped	(11) (20)	27 (49.09)	9 (16.36)	4 (7.27)	-
	I think the frequent use of antimicrobials will decrease the treatment when using the antimicrobial again	15 (27.27)	8 (14.54)	8 (14.54)	13 (23.64)	2 (3.64)
	Once the symptoms are relieved, I believe antibiotics should be immediately stopped for the patient	6 (10.91)	6 (10.91)	3 (5.45)	13 (23.64)	21 (38.18)
	Antibiotics should be given to speed up the recovery from cold and cough	16 (29.09)	5 (9.09)	7 (12.73)	13 (23.64)	12 (21.82)
For pharmacists (N=8)						
Antibiotic resistance can be caused by:						
Knowledge	Widespread or overuse of antibiotics	3 (37.5)	3 (37.5)	-	-	-
	Inappropriate duration of antibiotic course	2 (25)	3 (37.5)	-	1 (12.5)	-
	Sub-standard quality of antibiotics	2 (25)	2 (25)	-	-	-
	Poor infection control in hospitals	2 (25)	3 (37.5)	-	1 (12.5)	-
	Use of antimicrobials for longer than standard duration	1 (12.5)	5 (62.5)	-	1 (12.5)	-
	Lack of restrictions on antimicrobial usage	3 (37.5)	2 (25)	-	-	-
Attitude	I think the use of broad-spectrum antibiotics leads to increased antibiotic resistance	-	3 (37.5)	-	2 (25)	-
	I come across many self-prescriptions by patients for antibiotics, which promote antimicrobial resistance	1 (12.5)	-	1 (12.5)	2 (25)	1 (12.5)
	I see the promotion of irrational antibiotic prescribing by pharmaceutical representatives, which contribute to antimicrobial resistance	1 (12.5)	2 (25)	1 (12.5)	-	1 (12.5)

	Restriction on antimicrobial use is a reasonable method for controlling antibiotic use	3 (37.5)	2 (25)	-	-	-
	Prescribers' poor awareness promotes antimicrobial resistance	-	4 (50)	-	-	-
	I think patient's poor adherence to prescribed antibiotics promotes antimicrobial resistance	-	4 (50)	2 (25)	-	-
	Antimicrobial Stewardship (AMS) programs can improve patient care	4 (50)	3 (37.5)	-	-	-
Practice	I have sufficient knowledge of antibiotics and prefer to ask the prescriber questions about antimicrobial prescriptions	2 (25)	2 (25)	1 (12.5)	-	-
	I know what is meant by empiric antibiotic therapy and when it should be stopped	-	3 (37.5)	1 (12.5)	-	-
	I think antimicrobials can be dispensed as over-the-counter drugs	1 (12.5)	1 (12.5)	1 (12.5)	-	-
	Once the symptoms are relieved, I believe antibiotics should be immediately stopped for the patient	1 (12.5)	4 (50)	-	2 (25)	-
	I dispense antibiotics for viral infections	-	1 (12.5)	-	3 (37.5)	-
	I dispense antibiotics to the patient when asked for common cold and cough	2 (25)	1 (12.5)	-	4 (50)	3 (37.5)

[Table/Fig-2]: Response of clinicians, nurses and pharmacists to the KAP survey.
KAP: Knowledge, attitude and practices
Note: Some questions were left unanswered in all the three categories

AMS programs can improve patient care (n=7, 87.5%) and three of them strongly agreed (37.5%) that restriction of antimicrobial use can control AMR. Only a quarter of the pharmacists had sufficient knowledge of antibiotics (n=2, 25%). The responses of clinicians, nurses and pharmacists to the KAP survey are depicted in [Table/Fig-2].

DISCUSSION

The increasing rate of AMR has become a global concern, but nowhere is it as alarming as in India. Multiple factors, such as poor infection prevention and control guidelines, high prevalence of infections and over-the counter and irrational use of antibiotics, contribute to the worsening AMR rates in India [1]. Since the frontline people associated with AMR control are HCPs, understanding the KAP of these HCPs regarding AMR is a key step in formulating effective AMS measures [2]. However, literature is limited on the implementation of AMS and the KAP of HCPs regarding AMR across Indian hospitals. The present study sought to assess the implementation of AMS and the KAP of HCPs, i.e., clinicians, nurses and pharmacists, in Indian hospitals regarding AMR and AMS.

Despite the implementation of the AMS program in all the participating hospitals, the study revealed that Indian hospitals need improved infrastructure along with mandatory and certified training for AMS practices and antibiotic usage. Similar findings have been described by Singh S et al., [3]. This study revealed that although awareness of AMS has been increasing in India, several lacunae exist in its effective implementation [3], which is also reflected in the present study. For example, although infection control practices were followed and microbiologists and nursing staff were involved in the AMS programs of all the five hospitals studied, the involvement of IT staff was observed in only three hospitals. Health IT interventions comprehensively support AMS programs by providing opportunities such as access to relevant personal and local AMR pattern data, documentation of diagnoses, antimicrobial guidelines, selection of empirical treatment, review, audit, monitoring and feedback [29]. In low and middle income countries, the lack of IT infrastructure is quite common. The implementation of appropriate IT infrastructure for AMR surveillance and antibiotic usage programs has been emphasised by the WHO [30,31].

More than 90% of the clinicians had good knowledge regarding AMR. This indicated that the clinicians were highly aware of and concerned about the growing AMR rates in their hospitals. The availability of local epidemiological data and AMR rates is an integral component of the clinical decision-making process since they reflect the trends of AMR rates and guide the clinicians regarding the optimal use of antibiotics. Studies had shown that clinicians provided with periodic reports on local AMR data have a better knowledge of local microbiology and higher awareness of AMR and vice versa [32-35]. But the present study revealed that nearly one-fourth proportion of the doctors did not refer to local epidemiological data or antibiogram regularly, similar to previous reports from Southern India [36]. Moreover, the practice of consulting local epidemiological data before prescribing antibiotics should be encouraged and its importance should be emphasised among the clinicians.

As observed in earlier studies involving physicians, conducted in South India or multiple centres across India, good knowledge regarding AMR and the rational use of antimicrobials was observed [35,37]. Here, the clinicians perceived that knowledge is important to improve the judicious use of antibiotics and desired further education on the appropriate use of antibiotics, similar to previous reports [38-41]. Higher knowledge among clinicians is associated with lower antibiotic prescription rates [7].

An earlier report indicated a lack of infection control policy in Indian hospitals and over-prescription of antibiotics by the physicians [18]. Poor hygiene and infection control practices have been associated with increased antibiotic prescriptions by physicians for 'preventive purpose' [42]. Here, nearly 20% of the physicians disagreed to the fact that poor infection control practices could lead to antibiotic overuse, which indicated that physicians required formal training on infection control policy to promote the judicious use of antibiotics.

In the era of AMR, the development of newer antibiotics plays a major role in controlling AMR [43,44]. Thus, clinicians need to be aware of the importance of newer antimicrobial drugs in tackling AMR. In line with these, the clinicians in the present survey were aware of the need for newer antibiotics to keep resistance in check. These findings indicate that having good knowledge and attitude regarding AMR and AMS among the clinicians does not necessarily imply good antibiotic-usage practices. Similar to the present findings, a KAP survey from Eastern India reported that despite having good knowledge and attitude regarding AMR and AMS, clinicians performed poorly in practice, thereby implying that their knowledge did not translate into practice [2]. Therefore, efforts should be made to bridge the gaps between AMS-related KAP among HCPs, such that good knowledge on AMS could be translated into good AMS practices for restraining AMR. It could be plausibly achieved through the successful implementation of AMS, along with regular training and education of the HCPs.

Nurses at the point of care have a critical role in AMS activities and containment of AMR [45]. However, their role in AMS is suboptimal and largely unexplored [16,46]. In this study, the responses of nurses towards causes of AMR varied across a range, which emphasised the need for formal AMS education and training. Earlier studies also reported low awareness of AMS among nurses and highlighted the need of educating them for filling the gaps in their knowledge [16,46,47]. Nearly one-third of the nurses participating in the present survey did not consider poor infection control practices, lack of antimicrobial restriction and overuse of antibiotics as contributing factors to AMR. Therefore, AMS education of nurses needs to emphasise the importance of hand hygiene and infection control practices and the contribution of antibiotic overuse to AMR.

Various factors, such as inappropriate dosage and duration of antibiotic treatment and lack of compliance, also contribute to AMR [36]. However,

several nurses in this survey did not agree on these factors. Many nurses believed that in case of apparently early recovery from disease symptoms, dispensing antibiotics should be stopped immediately and antibiotics should be given to speed up recovery from cough and cold. These findings highlight the need for proper training for the nurses, where knowledge on the appropriate use of antibiotics, including treatment adherence and duration, should be stressed upon. Also, approximately 80% of the nurses wanted to have more education on the appropriate use of antibiotics. Though there is limited data available on the awareness of nurses on AMS across Indian hospitals, the present survey revealed that there is an unmet need for formal education and training among the nurses on AMS practices.

Of the total number of pharmacists involved in the present survey, although few, only 25% had adequate knowledge of good antibiotic usage practices. Another survey from South India reported that as compared to other paramedical staff, nurses and pharmacists had four times better knowledge regarding antibiotics [12]. A qualitative study from North India evaluating antibiotic dispensing practices and knowledge on AMR among community pharmacists revealed inappropriate antibiotic dispensing practices and a lack of knowledge on AMR and the use of antibiotics [48]. Another study conducted across 261 pharmacies in an urban setting in South India reported that over-the-counter dispensing of antibiotics in the private sector was unacceptably high [49]. Poor antibiotic usage practices among the pharmacists could be potentially improved by the implementation of mandatory and certified training courses similar to nurses, which is lacking in Indian hospitals, as evident from the present survey. Apart from more education and training, changes in attitude and practice could be achieved through robust implementation, evaluation and demonstration of AMS program outcomes, which will serve to instill confidence in different types of HCPs.

Limitation(s)

The limitations of the study include large differences in the number of participants between different categories of healthcare personnel. Moreover, the number of pharmacists was too low to reach any conclusion.

CONCLUSION(S)

The study revealed that the implementation of AMS was not adequate in Indian hospitals. Improved infrastructure, antibiotic policy implementation and proper education are essential for improving AMR and AMS. Although clinicians had overall good knowledge, their attitude about antibiotic use and their practices were not equally satisfactory. As compared to the clinicians, the nurses and pharmacists did not catch up well in terms of KAP on antibiotic usage. Therefore, cumulatively, the findings of the survey reinforce the need for mandatory training for HCPs in Indian hospitals for improved AMS outcomes. Besides training, the successful implementation of the AMS program in Indian hospitals would also require improvement in infrastructural facilities, including effective IT solutions.

Acknowledgement

Authors would like to thank BioQuest Solutions Pvt., Ltd., Bengaluru for providing medical writing assistance and editorial support in the preparation of this manuscript, funded by Pfizer India.

REFERENCES

[1] Rajni E, Rathi P, Malik M, Sonali M, Ved Prakash M. Impact of hospital-acquired infection and antibiotic resistance awareness campaign on knowledge attitude and practices of medical undergraduates in a tertiary care teaching hospital, India. J Clin Diagn Res. 2020;14(9):DC23-27.

[2] Nair M, Tripathi S, Mazumdar S, Maharajan R, Harshana A, Pereira A, et al. Knowledge, attitudes, and practices related to antibiotic use in Paschim Bardhaman District: A survey of healthcare providers in West Bengal, India. PLoS One. 2019;14(5):e0217818. Doi: 10.1371/journal.pone.0217818. eCollection 2019.

[3] Singh S, Charani E, Wattal C, Arora A, Jenkins A, Nathwani D. The state of education and training for antimicrobial stewardship programs in Indian hospitals-A qualitative and quantitative assessment. Antibiotics (Basel). 2019;8(1):pii: E11. Doi: 10.3390/antibiotics8010011.

[4] Mo Y, Seah I, Priscilla S, Jamie Kee XL, Michael Wong KY, Karrie Ko KK, et al. Relating knowledge, attitude and practice of antibiotic use to extended-spectrum beta-lactamase-producing Enterobacteriaceae carriage: Results of a cross-sectional community survey. BMJ Open. 2019;9:e023859. http://dx.doi.org/10.1136/bmjopen-2018-023859.

[5] World Health Organization. Antimicrobial resistance, Key facts. Available at: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance. Accessed on: 3 March 2021.

[6] Walia K, Ohri VC, Madhumathi J, Ramasubramanian V. Policy document on antimicrobial stewardship practices in India. Indian J Med Res. 2019;149(2):180-84. doi: 10.4103/ijmr.IJMR_147_18.

[7] Kumar R, Indira K, Rizvi A, Rizvi T, Jeyaseelan L. Antibiotic prescribing practices in primary and secondary health care facilities in Uttar Pradesh, India. J Clin Pharm Ther. 2008;33(6):625-34. Doi: 10.1111/j.1365-2710.2008.00960.x.

[8] Landstedt K, Sharma A, Johansson F, Stålsby Lundborg C, Sharma M. Antibiotic prescriptions for inpatients having non-bacterial diagnosis at medicine departments of two private sector hospitals in Madhya Pradesh, India: A cross-sectional study. BMJ Open. 2017;7(4):e012974.

[9] Sulis G, Daniels B, Kwan A, Gandra S, Daftary A, Das J, et al. Antibiotic overuse in the primary health care setting: A secondary data analysis of standardised patient studies from India, China and Kenya. BMJ Glob Health. 2020;5(9):e003393.

[10] Walia K, Ohri VC, Mathai D, Antimicrobial Stewardship Programme of ICMR. Antimicrobial stewardship programme (AMSP) practices in India. Indian J Med Res. 2015;142(2):130-38. Doi: 10.4103/0971-5916.164228.

[11] Sahni A, Bahl A, Martolia R, Jain SK, Singh SK. Implementation of antimicrobial stewardship activities in India. Indian J Med Spec. 2020;11:05-09.

[12] Sadasivam K, Chinnasami B, Ramraj B, Karthick N, Saravanan A. Knowledge, attitude and practice of paramedical staff towards antibiotic usage and its resistance. Biomed Pharmacol J. 2016;9(1):337-43. Doi: https://dx.doi.org/10.13005/bpj/944.

[13] Wushouer H, Wang Z, Tian Y, Zhou Y, Zhu D, Vuillermin D, et al. The impact of physicians' knowledge on outpatient antibiotic use: Evidence from China's county hospitals. Medicine (Baltimore). 2020;99(3):e18852.

[14] Trikha S, Dalpath SK, Sharma M, Shafiq N. Antibiotic prescribing patterns and knowledge of antibiotic resistance amongst the doctors working at public health facilities of a state in northern India: A cross sectional study. J Family Med Prim Care. 2020;9:3937-43.

[15] Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. Available at: https://www.cdc.gov/antibiotic-use/healthcare/pdfs/core-elements.pdf. Accessed on: 13 October 2020.

[16] Abbas S, Lee K, Pakyz A, Markley D, Cooper K, Vanhoozer G, et al. Knowledge, attitudes, and practices of bedside nursing staff regarding antibiotic stewardship: A cross-sectional study. Am J Infect Control. 2019;47(3):230-33. Doi: 10.1016/j.ajic.2018.09.008.

[17] Khan AKA, Banu G, Reshma KK. Antibiotic resistance and usage-a survey on the knowledge, attitude, perceptions and practices among the medical students of a Southern Indian teaching hospital. J Clin Diagn Res. 2013;7(8):1613-16. Doi: 10.7860/JCDR/2013/6290.3230.

[18] Thakolkaran N, Shetty AV, D'Souza NDR, Shetty AK. Antibiotic prescribing knowledge, attitudes, and practice among physicians in teaching hospitals in South India. J Family Med Prim Care. 2017;6(3):526-32. Doi: 10.4103/2249-4863.222057.

[19] Dutt HK, Sarkhil MZ, Hasseb AM, Singh G. A comparative knowledge, attitude, and practice study of antimicrobial use, self-medication and antimicrobial resistance among final year students of MBBS, BDS, and BSc Nursing at a tertiary care hospital at Kannur. Natl J Physiol Pharm Pharmacol. 2018;8(9):1305-11.

[20] Khajuria K, Kaur S, Sadiq S, Khajuria V. KAP on antibiotic usage and resistance among second professional medical students. Int J Basic Clin Pharm. 2018;8(1):68-73.

[21] Transatlantic Taskforce on Antimicrobial Resistance (TATFAR): Hospital Antimicrobial Stewardship Program Assessment Checklist. Available at: https://static.cambridge.org/content/id/urn:cambridge.org:id:article:S0899823X19001855/resource/name/S0899823X19001855sup001.pdf. Accessed on: 28 September 2020.

[22] Pollack LA, Plachouras D, Gruhler H, Sinkowitz-Cochran R. Transatlantic Taskforce on Antimicrobial Resistance (TATFAR). Summary of the modified Delphi process for common structure and process indicators for hospital antimicrobial stewardship programs. June 12, 2015. Available at: https://www.cdc.gov/drugresistance/pdf/summary_of_tatfar_recommendation_1.pdf. Accessed on: 13 October 2020.

[23] Burger M, Fourie J, Loots D, Mnisi T, Schellack N, Bezuidenhout S, et al. Knowledge and perceptions of antimicrobial stewardship concepts among final year pharmacy students in pharmacy schools across South Africa. S Afr J Infect Dis. 2016;31(3):84-90. Doi: 10.1080/23120053.2016.1192808.

[24] Tamboli TJ, Pundarikaksha HP, Ramaiah M, Bhatt KA, Prasad SR. Impact of educational session on knowledge and attitude towards antimicrobial prescribing and awareness about antimicrobial resistance among undergraduate medical, dental and nursing students: A comparative study. Int J Basic Clin Pharmacol. 2016;5:1544-50. Doi: http://dx.doi.org/10.18203/2319-2003.ijbcp20162469.

[25] Tafa B, Endale A, Bekele D. Paramedical staffs knowledge and attitudes towards antimicrobial resistance in Dire Dawa, Ethiopia: A cross sectional study. Ann Clin Microbiol Antimicrob. 2017;16(1):64. Doi: 10.1186/s12941-017-0241-x.

[26] Badar V, Parulekar VV, Garate P. Study of knowledge, attitude and practice amongst medical professionals about antimicrobial stewardship in tertiary care teaching hospital in India: A questionnaire based study. Int J Basic Clin Pharmacol. 2018;7:511-17. Doi: http://dx.doi.org/10.18203/2319-2003.ijbcp20180666.

[27] Rehman IU, Asad MM, Bukhsh A, Ali Z, Ata H, Dujaili JA, et al. Knowledge and practice of pharmacists toward antimicrobial stewardship in Pakistan. Pharmacy (Basel). 2018;6(4):116. doi: 10.3390/pharmacy6040116.

[28] Firouzabadi D, Mahmoudi L. Knowledge, attitude, and practice of health care workers towards antibiotic resistance and antimicrobial stewardship programmes: A cross-sectional study. J Eval Clin Pract. 2020;26:190-96. https://doi.org/10.1111/jep.13177.
[29] King A, Cresswell KM, Coleman JJ, Pontefract SK, Slee A, Williams R, et al. Investigating the ways in which health information technology can promote antimicrobial stewardship: A conceptual overview. J R Soc Med. 2017;110(8):320-29. Doi: 10.1177/0141076817722049.
[30] Vong S, Anciaux A, Hulth A. Using information technology to improve surveillance of antimicrobial resistance in South East Asia. BMJ. 2017;358:j3781. Doi: https://doi.org/10.1136/bmj.j3781.
[31] World Health Organization. Antimicrobial stewardship programmes in health-care facilities in low-and middle-income countries. A WHO practical toolkit. Available at: https://apps.who.int/iris/bitstream/handle/10665/329404/9789241515481-eng.pdf. Accessed on: 3 March 2021.
[32] Labricciosa FM, Sartelli M, Correia S, Abbo LM, Severo M, Ansaloni L, et al. Emergency surgeons' perceptions and attitudes towards antibiotic prescribing and resistance: A worldwide cross-sectional survey. World J Emerg Surg. 2018;13:27.
[33] Kheder SI. Physicians' knowledge and perception of antimicrobial resistance: A survey in khartoum state hospital settings. J Pharm Res Int. 2013;3(3):347-62.
[34] Abera B, Kibret M, Mulu W. Knowledge and beliefs on antimicrobial resistance among physicians and nurses in hospitals in Amhara Region, Ethiopia. BMC Pharmacol Toxicol. 2014;15:26.
[35] Teja NK, Hazra P, Padma L. A cross-sectional observational study on knowledge, attitude and practices about indiscriminate use of antibiotics and antibiotic resistance among medical doctors at Sapthagiri Hospital, Bangalore. IJBCP. 2019;8(12):2609-13.
[36] Sivagnanam G, Thirumalaikolundusubramanian P, Mohanasundaram J, Raaj AA, Namasivayam K, Rajaram S. A survey on current attitude of practicing physicians upon usage of antimicrobial agents in southern part of India. Med Gen Med. 2004;6(2):1.
[37] Chatterjee S, Hazra DA, Chakraverty R, Shafiq N, Pathak A, Trivedi DN, et al. The knowledge, attitude and practice of clinicians about antimicrobial use and resistance: A multicentric survey from India. 2020. International Journal of Infectious Diseases. 2020;101(S1):08-119.
[38] Salsgiver E, Bernstein D, Simon MS, Eiras DP, Greendyke W, Kubin CJ, et al. Knowledge, attitudes, and practices regarding antimicrobial use and stewardship among prescribers at acute-care hospitals. Infect Control Hosp Epidemiol. 2018;39(3):316-22. Doi: 10.1017/ice.2017.317.
[39] Lévin C, Thilly N, Dousak M, Beraud G, Klesnik M, Uhan S, et al. Perceptions, attitudes, and practices of French junior physicians regarding antibiotic use and resistance. Med Mal Infect. 2019;49(4):241-49. Doi: 10.1016/j.medmal.2018.09.003.
[40] Navarro-San Francisco C, Del Toro MD, Cobo J, Gea-García JHD, Vañó-Galván H, Moreno-Ramos F, et al. Knowledge and perceptions of junior and senior Spanish resident doctors about antibiotic use and resistance: Results of a multicenter survey. Enferm Infecc Microbiol Clin. 2013;31(4):199-04. Doi: 10.1016/j.eimc.2012.05.016.
[41] Chatterjee D, Sen S, Begum SA, Adhikari A, Hazra A, Das AK, et al. A questionnaire-based survey to ascertain the views of clinicians regarding rational use of antibiotics in teaching hospitals of Kolkata. Indian J Pharmacol. 2015;47(1):105-08. Doi: 10.4103/0253-7613.150373.
[42] Om C, Daily F, Vlieghe E, McLaughlin JC, McLaws ML. "If it's a broad spectrum, it can shoot better": Inappropriate antibiotic prescribing in Cambodia. Antimicrob Resist Infect Control. 2016;5:58. Doi: 10.1186/s13756-016-0159-7.
[43] Voidăzan S, Moldovan G, Voidăzan L, Zazgyva A, Moldovan H. Knowledge, attitudes and practices regarding the use of antibiotics: Study on the general population of Mureş County, Romania. Infect Drug Resist. 2019;12:3385-96. Doi: 10.2147/IDR.S214574.
[44] Sakr S, Ghaddar A, Hamam B, Sheet I. Antibiotic use and resistance: An unprecedented assessment of university students' knowledge, attitude and practices (KAP) in Lebanon. BMC Public Health. 2020;20(1):535.
[45] Merrill K, Hanson SF, Sumner S, Vento T, Veillette J, Webb B. Antimicrobial stewardship: Staff nurse knowledge and attitudes. Am J Infect Control. 2019;47(10):1219-24. Doi: 10.1016/j.ajic.2019.03.022.
[46] Monsees E, Goldman J, Popejoy L. Staff nurses as antimicrobial stewards: An integrative literature review. Am J Infect Control. 2017;45(8):917-22. Doi: 10.1016/j.ajic.2017.03.009.
[47] Olans RD, Nicholas PK, Hanley D, DeMaria Jr A. Defining a role for nursing education in staff nurse participation in antimicrobial stewardship. J Contin Educ Nurs. 2015;46(7):318-21. Doi: 10.3928/00220124-20150619-03.
[48] Kotwani A, Wattal C, Joshi PC, Holloway K. Irrational use of antibiotics and role of the pharmacist: An insight from a qualitative study in New Delhi, India. J Clin Pharm Ther. 2012;37(3):308-12.
[49] Shet A, Sundaresan S, Forsberg BC. Pharmacy-based dispensing of antimicrobial agents without prescription in India: Appropriateness and cost burden in the private sector. Antimicrob Resist Infect Control. 2015;4:55.

PARTICULARS OF CONTRIBUTORS:
1. Medical Advisor, Department of Medical Affairs, Pfizer Ltd. Pfizer Biopharmaceuticals (Emerging Markets), Bandra East, Mumbai, Maharashtra, India.
2. Medical Lead, Department of Medical Affairs, Pfizer Ltd. Pfizer Biopharmaceuticals (Emerging Markets), Bandra East, Mumbai, Maharashtra, India.
3. Medical Advisor, Department of Medical Affairs, Pfizer Ltd. Pfizer Biopharmaceuticals (Emerging Markets), Bandra East, Mumbai, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Akshata Mane,
Medical Advisor, Medical Affairs, Pfizer Ltd. Pfizer Biopharmaceuticals (Emerging Markets), Bandra East, Mumbai-400051, Maharashtra, India.
E-mail: akshata.s.mane@pfizer.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Nov 12, 2021
- Manual Googling: Mar 17, 2021
- iThenticate Software: Apr 30, 2021 (6%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? No
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Nov 11, 2020**
Date of Peer Review: **Jan 20, 2021**
Date of Acceptance: **Apr 05 , 2021**
Date of Publishing: **Aug 01, 2021**