A Questionnaire Based Study to Assess the Antimicrobial Stewardship Practices in the Tertiary Care Hospitals in India

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Abstract

Background: Due to emergence of antimicrobial-resistant healthcare associated infections (HAIs), the implementation of antimicrobial stewardship programs (AMSP) is the need of hour at institutional and national levels. We conducted an assessment of the current status of infrastructure, manpower, and education and training (E&T) in relation to Antimicrobial Stewardship (AMS) in the tertiary care hospitals of India.

Methods: Healthcare professionals from 30 tertiary care hospitals in North-western India (public & private) were invited to participate in online survey from Nov 2022 to Apr 2023 by sending a pre-designed questionnaire about the current existing antimicrobial stewardship (AMS) practices at their hospitals through email. The answers received on various parameters of AMS were analyzed using descriptive statistics.

Results: 72 healthcare professionals from 30 hospitals responded to the survey. 63% of the respondents had received education and training (E&T) on AMS during undergraduate or postgraduate training. 65% had not received any E&T at induction to the hospital. The positive responses were 36%, 47% and 33% for leadership support, accountability and availability of drug expertise in form of pharmacologist/pharmacist respectively. A policy to support optimal antibiotic use was present in 25% of respondents. Broad interventions to improve antibiotic use were scored as 28%, 7% and 6% for antibiotic time out, pre-authorization and prospective audit with feedback respectively.

Conclusion: The findings reveal the enablers and barriers to implementation of antimicrobial stewardship and highlighted the need for establishing a framework for stricter implementation and monitoring of antimicrobial stewardship in Indian tertiary care hospitals. Few key areas which require immediate attention are: need for government level endorsement and leadership support of antimicrobial stewardship (AMS) activities; lack of AMS programs in hospitals; and lack of undergraduate/ postgraduate/at induction education and training in AMS for staff.

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Introduction

Antimicrobial resistance (AMR) and healthcare associated infections has become a great challenge because of irrational high antibiotic use due to poor prescription practices, self-medication, over-the-counter sale of drugs and lack of awareness. The recent trends of antibiotic resistance in India are alarming with increase in cephalosporin and broad-spectrum penicillin consumption from 2000 to 2015 and increasing percentage of resistance to last resort antibiotics carbapenems and colistins (1, 2). In September, 2015, the Center for Disease Dynamics, Economics & Policy published a report into the state of the world's antibiotics, citing evidence that the overall effectiveness of antibiotics has been decreasing globally and calling for strong antibiotic stewardship in its broadest sense- specifically the reduction of antibiotic overuse in human beings (1). A global survey of stewardship activities

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revealed that only 14% of respondents in Africa and 53% in Asia had any form of antimicrobial stewardship programme in place (1). The World Health Organization (WHO) developed a global action plan (GAP) in 2015, which mandates Member States to produce national strategic plans for antimicrobial resistance (AMR) through surveillance and reporting, antibiotic stewardship and preventing infection (3). AMSP is a systematic approach for using antimicrobials rationally to control AMR and to reduce inappropriate use of antimicrobials (4). Implementation of AMSP has been found to reduce excessive antibiotic usage and has resulted in reduced resistance rates in many countries (5). AMS programs have shown 22-36 percent reduction in antimicrobial use and significant cost-savings (4). Effective implementation of the Antimicrobial stewardship programs (AMSP) is the only successful way in diverse country like India for rational and evidence-based antimicrobial therapy with an ultimate aim is to improve patient outcomes, reduce emergence of bacterial resistance and ensure longevity of the existing antimicrobials. The various AMSP strategies include building capacity for stewardship activities, developing policies and guidelines, establishing systems, educating healthcare workers and introducing useful interventions, specifically customized for the national setting (6,7).

In March 2017, the National Health Policy 2017 of Ministry of Health and Family Welfare (MoHFW), Government of India, prioritized AMR in India. In response to the call by 71st UN General Assembly for AMR threat in the meeting of global leaders (September 2016), the Government of India launched the National Action Plan on AMR (2017-2021) in April 2017 with support from WHO India office coordinated by MoHFW. We expect the work on stewardship activities to be accelerated with formulation of ICMR guidelines for stewardship activities and the National Action Plan on Antimicrobial resistance (NAP-AMR). Hence, this study was planned to assess and evaluate the current status of the existing antimicrobial stewardship practices in the tertiary care hospitals of north-western India. The result of the survey will help in understanding the current status and will provide a strong background and rationale for future emplaning the rolling out of an antimicrobial stewardship model plan so as to make it more widespread and effective in containing AMR and improve quality of care.

Methods

This questionnaire based study was conducted over a period of 06 months from Nov 2022 to Apr 2023. The questionnaire was prepared by following recommendations for Indian hospital settings, based on the AMSP guideline published by Indian Council of Medical Research (ICMR), the CDC document on core elements of hospital stewardship programs and other successful AMSP programs (5, 7). The pre-designed questionnaire was send through email to 200 healthcare professionals from 30 tertiary care centers in North-western India (public & private), inviting them to participate in this online survey. The survey data received on various parameters of implementation of AMSP were analyzed using descriptive statistics.

Results

72 healthcare professionals from 30 hospitals responded to the survey. The baseline demographic and characteristics of the participants are given in Table 1. 63% of the respondents had received education and training (E&T) on AMS during undergraduate or postgraduate training. 65% had not received any E&T at induction to the hospital. The responses received from the participants are shown in Table 2 and represented graphically in Figure 1. The positive responses were 36%, 47% and 33% for leadership support, accountability and availability of drug expertise in form of pharmacologist/pharmacist respectively. A policy to support optimal antibiotic use was present in 25% of responses. Broad interventions to improve antibiotic use were scored as 28%, 7% and 6% for antibiotic time out, pre-authorization and prospective audit with feedback respectively. The score for pharmacy driven interventions were as follows: - intravenous (IV) to oral switch (44%), dose adjustments in organ dysfunction (63%), dose optimization (19%), alerts for duplicative therapy (22%), and automatic stop orders for specific antibiotics (14%). Written policies to ensure optimal use of antibiotics to treat common infections were present as follows: - community acquired pneumonia (47%), urinary tract infections (50%), skin and soft tissue infections (16%), methicillin resistant staphylococcus aureus (MRSA) (33%), Clostridioides difficile infection (CDI) (19%) and culture-proven invasive infections (39%). Presence of process measures and outcome measures had an average score of 17% and 23%, respectively, and feedback/ education got a score of 16%.

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Table 1. Baseline demographic and characteristics of study participants.

Characteristics	Results, n=72 (%)
Mean age of participants (years)	44 ± 9
Specialty	
Medicine & allied	38 (53)
Surgery & allied	34 (47)
Received education and training on ASP during UG/PG	Yes- 45 (63)
	No- 27 (37)
Received education and training on ASP at induction to hospital	Yes-25 (35)
	No- 47 (65)
No. of years in healthcare profession	
<5	12 (17)
5-10	20 (28)
10-15	28 (39)
15-20	8 (11)
>20	4 (5)
Hospital type	
Public/Government	48 (67)
Private	24 (33)
Hospital location	
New Delhi	26 (36)
Maharashtra	28 (39)
Gujrat	18 (25)

Table 2. Analysis of responses received from the participants about the current existing antimicrobial stewardship (AMS) practices at tertiary care hospitals.

Questions	Responses received (n=72)		
	Yes (%)	No (%)	Can't say (%)
Accountability			
Is there a physician leader currently responsible for program outcomes of stewardship activities at the facility?	34 (47)	20 (28)	18 (25)
Leadership support			
Does the facility have a formal, written statement of support from leadership that supports efforts to improve antibiotic use (antibiotic stewardship)?	26 (36)	24 (33)	22 (31)
Drug Expertise			
Is there a pharmacology / pharmacist leader responsible for working to improve antibiotic use at the facility?	24 (33)	26 (36)	22 (31)
Does any of the staff below work with the stewardship leaders to improve antibiotic use?			
Clinicians	44 (61)	20 (28)	8 (12)
Infection Prevention and Healthcare Epidemiology	10 (14)	52 (72)	10 (14)
Quality Improvement team	34 (47)	22 (31)	16 (22)
Microbiology (Laboratory)	40 (56)	20 (28)	12 (16)
Information Technology (IT)	24 (33)	33 (46)	15 (21)

Table 2. Continued

Questions	Responses received (n=72)		
	Yes (%)	**No (%)**	**Can't say (%)**
Policies			
Does the facility have a policy that requires prescribers to document in the medical record or during order entry a dose, duration, and indication for all antibiotic prescriptions?	18 (25)	10 (14)	44 (61)
Does the facility have facility-specific <u>treatment recommendations</u>, based on national guidelines and local susceptibility, to assist with antibiotic selection for common clinical conditions?	34 (47)	20 (28)	18 (25)
Are the following actions to improve antibiotic prescribing conducted in the facility?			
Broad interventions:			
Is there a formal procedure for all clinicians to review the appropriateness of all antibiotics 48 hours after the initial orders (e.g. antibiotic time out)?	20 (28)	46 (64)	6 (8)
Do specified antibiotic agents need to be approved by a physician or pharmacologist prior to dispensing (i.e., pre-authorization)?	5 (7)	55 (77)	12 (16)
Does a physician or pharmacologist review courses of therapy for specified antibiotic agents (i.e., prospective audit with feedback)?	4 (6)	60 (83)	8 (11)
Pharmacy driven interventions:			
Automatic changes from IV to oral antibiotic therapy in appropriate situations?	32 (44)	36 (50)	4 (6)
Dose adjustments in cases of organ dysfunction?	45 (63)	10 (14)	17 (23)
Dose optimization (Pk/Pd) to optimize the treatment of organisms with reduced susceptibility?	14 (19)	30 (42)	28 (39)
Automatic alerts in situations where therapy might be unnecessarily duplicative?	16 (22)	30 (42)	26 (36)
Time-sensitive automatic stop orders for specified antibiotic prescriptions?	10 (14)	50 (70)	12 (16)
Does our facility have specific interventions in place to ensure optimal use of antibiotics to treat the following common infections?			
Community-acquired pneumonia	34 (47)	20 (28)	18 (25)
Urinary tract infection	36 (50)	14 (19)	22 (31)
Skin and soft tissue infections	12 (16)	30 (42)	30 (42)
Empiric treatment of Methicillin-resistant *Staphylococcus aureus* (MRSA)	24 (33)	21 (29)	27 (38)
Non-*C. Difficile* infection (CDI) antibiotics in new cases of CDI	14 (19)	26 (37)	32 (44)
Culture-proven invasive (e.g., blood stream) infections	28 (39)	20 (28)	24 (33)
Tracking: Monitoring antibiotic prescribing use			
Process measures:			
Does the stewardship program currently monitor adherence to a documentation policy (dose, duration, and indication)?	20 (28)	30 (42)	22 (30)
Does the stewardship program currently monitor adherence to facility-specific treatment recommendations?	12 (16)	40 (56)	20 (28)
Does the stewardship program currently monitor compliance with one of more of the specific interventions in place?	10 (14)	40 (56)	22 (30)
Does the facility track rates of *C. difficile* infection?	6 (9)	34 (47)	32 (44)
Does the facility produce an antibiogram (cumulative antibiotic susceptibility report?	34 (47)	10 (14)	28 (39)

Table 2. Continued

Questions	Responses received (n=72)		
	Yes (%)	No (%)	Can't say (%)
By counts of antibiotic(s) administered to patients per day (Days of Therapy; DOT)?	10 (14)	40 (56)	22 (30)
By number of grams of antibiotics used (Defined Daily Dose, DDD)?	10 (14)	40 (56)	22 (30)
By direct expenditure for antibiotics (purchasing costs)?	30 (42)	10 (14)	32 (44)
Reporting information to staff on improving antibiotic use and resistance			
Do the stewardship program share facility-specific reports on antibiotic use with prescribers?	10 (14)	40 (56)	22 (30)
Has a current antibiogram been distributed to prescribers at the facility?	5 (7)	50 (70)	17 (23)
Do prescribers ever receive direct, personalized communication about how they can improve their antibiotic prescribing?	2 (2)	50 (70)	20 (28)
Does the current stewardship program provide education to clinicians and other relevant staff on improving antibiotic prescribing?	28 (39)	34 (47)	10 (14)

Discussion

Antimicrobial resistance is on the rising trend worldwide and there is an urgent need to prioritize antimicrobial stewardship (8). The core elements for setting up effective antimicrobial stewardship in hospitals require a structure and resources that may not be readily available in hospitals (9). In the Indian scenario, work on stewardship activities are expected to be accelerated with formulation of ICMR guidelines for stewardship activities and the National Action Plan on Antimicrobial resistance (NAP-AMR) (4). Since 2017, the Indian Council of Medical Research is supporting the hospitals to set up a framework for implementing antimicrobial stewardship by providing funding and the necessary training and guidance. Nearly all participants in the study have appreciated the importance of implementation of antimicrobial stewardship strategies, but our study findings are not encouraging as per current status of AMSP implementation is concerned. The results of this study clearly indicate that implementation of AMSP activities in India needs further strengthening and there is an urgent need to develop adequate infrastructure for proper implementation and monitoring of all the components of AMSP. On literature review, we found very few research studies that have been conducted to evaluate the evidence of the effectiveness of the implementation of ASP in India (10, 11). AMSP capacities in Indian healthcare institutions (HCIs) are rudimentary or rather non-existent and this has been well documented in one of the surveys carried out by ICMR in 2013 among 20 tertiary HCIs about AMSP components, implementation and outcome (12). It showed that only 40 per cent of HCIs had AMSP written documents, 75 per cent of HCIs had HIC guidelines and 65 per cent had AMAs prescription guidelines. Moreover, only 30 per cent of HCIs had AMSP implementation strategies (12). Akin to our studies, these studies also concluded that components such as antimicrobial cycling, computerized data collection for surveillance, appropriate use of microbiology labs and use of information technology in stewardship activities are required to further consolidate the implementation of AMSP and will also assist in measuring the effect of the program (13). Hospitals in the USA have adopted computer surveillance and decision support systems related to antimicrobial prescribing. The developed program is linked to electronic records and makes recommendations for antimicrobial regimen and assists with dosage and interval along with potential drug interactions based on patient's hepatic and renal function. This system also helps in generating recommendations and warnings regarding allergies in specific patients. Adaptation of such computer-based system are not only cost-effective as it helps in the reduction of hospital stay lengths but also increase the adherence to practice guidelines, which lead to timely and appropriate use of antimicrobials which increased to 99.1% from 40% in the case of hospitals in the USA (14). To improve the overall uptake of AMSP in India, there is a need to actively involve, sensitize, and support the entire health-care facility staff in curbing AMR by clearly indicating the roles and responsibilities of each of the staff members. In this aspect, nurses have a crucial role to play (15). AMSP implementation activities highly complement the workload of nurses. For example, during admitting the patients, nurses can perform initial triage and take necessary steps to identify medications, allergy reactions, and history in a documented form. Moreover, nurses monitoring patients 24 × 7 can contribute in restraining AMR by ensuring that patients are given appropriate dose of prescribed medications in a timely manner and be gradually moved from intravenous to oral therapy (15).

The available guidelines on antimicrobial stewardship from high-income countries clearly specify that infectious disease specialists and clinical pharmacists are the pillars of hospital antimicrobial stewardship (12, 16). In our study, only 36% have the leadership role in implementation of AMSP. Indian hospitals have a shortage of both professions, as highlighted in the previous study (4). This challenge can be addressed by choosing intensive care physicians and clinicians (pediatricians and surgeons) to lead this initiative in their respective hospitals as these professions are likely to be the most committed to antimicrobial stewardship. Capacity-building is one of the key components for instituting antimicrobial stewardship programs in low- and middle-income countries (17). Reluctance to accept formulary restrictions and de-escalation of therapy in some hospitals was also among the key challenges that we identified.

It is encouraging to note that most of the hospitals were able to initiate the activities to measure the process and outcome indicators, although no trend could be documented. For this phase, hospitals will measure the impact of stewardship on (18). Capturing performance indicators such as adherence to guidelines, multidrug resistance rates, clinical outcomes and antimicrobial consumption are important not only for evaluating the success of the antimicrobial stewardship at an individual hospital level but also for identifying areas for further improvement (18-20). Administrative support for antimicrobial stewardship within the hospital and the availability of clinical pharmacologist/ pharmacists exclusively for antimicrobial stewardship would be crucial for sustaining this activity in Indian hospitals. Optimizing and reducing the use of antimicrobials (strategic priority No. 4 of India's national action plan) needs to be achieved through implementation of mandatory national antimicrobial stewardship at least in all tertiary and secondary level hospitals. The tertiary care hospitals included in this study offer the advantage of having multidisciplinary teams, which are crucial for implementation of antimicrobial stewardship.

Our study has some limitations. As the study involved an online survey through predesigned questionnaire, we relied on the responses of the participants as physical verification of the facility was not feasible due to the short duration of the study. Also, responses from only 72 participants were obtained. Despite these limitations, we believe that our study highlights the current status and issues related to implementation of antimicrobial stewardship in country like India. Hence, there is an urgent need to conduct a large scale research studies on the progress made on AMSP activities and to check the progress made to achieve the targets enlisted in NAP-AMR.

From the study experience, we envision that implementing an effective antimicrobial stewardship programme in hospitals is a challenging task, in terms of infrastructure constraints, financial constraints, lack of trained manpower and lack of higher-level support. Besides that, microbiology laboratories in low-resource settings do not have quality control systems, infrastructure and trained manpower (21). The key for the successful implementation of antimicrobial stewardship programs include fostering the political willpower, involvement of clinical leadership, organizational commitment and creation of mandatory national guidelines for implementation of antimicrobial stewardship. The Indian National Medical Commission has made it mandatory for all medical colleges to have a functional antimicrobial stewardship committee (22). These developments are encouraging and, if implemented effectively, would be valuable for establishing antimicrobial stewardship as a permanent activity in medical colleges. As establishing an antimicrobial stewardship framework in any hospital is the first step towards the larger goal of rational antimicrobial prescribing, we hope that challenges cited in the study results will hold the attention of policy-makers and health administrators to prioritize antimicrobial stewardship so that the resources necessary for its implementation are made available across the health-care systems.

AMR is a global threat which is accelerating in India; to tackle this issue, it is paramount that there is an uptake of stewardship activities in the country. The results of this review clearly indicate that there is a lot of scope of improvement as the ICMR guidelines are not uniformly implemented throughout the hospitals. Healthcare institutions should create structure and processes for implementation of AMSP by providing adequate funds and human resources for this activity. Availability of physicians, pharmacists trained in IDs and documentation such as antibiograms and treatment guidelines is crucial for implementation of an AMSP. Moreover, to accelerate the stewardship program, it is essential that all the components of AMSP are implemented. It is the need of the hour that all hospitals in India initiate AMS strategies and start implementing to benefit patients and also for spill over benefits to community by reducing AMR.

Conflict of interest
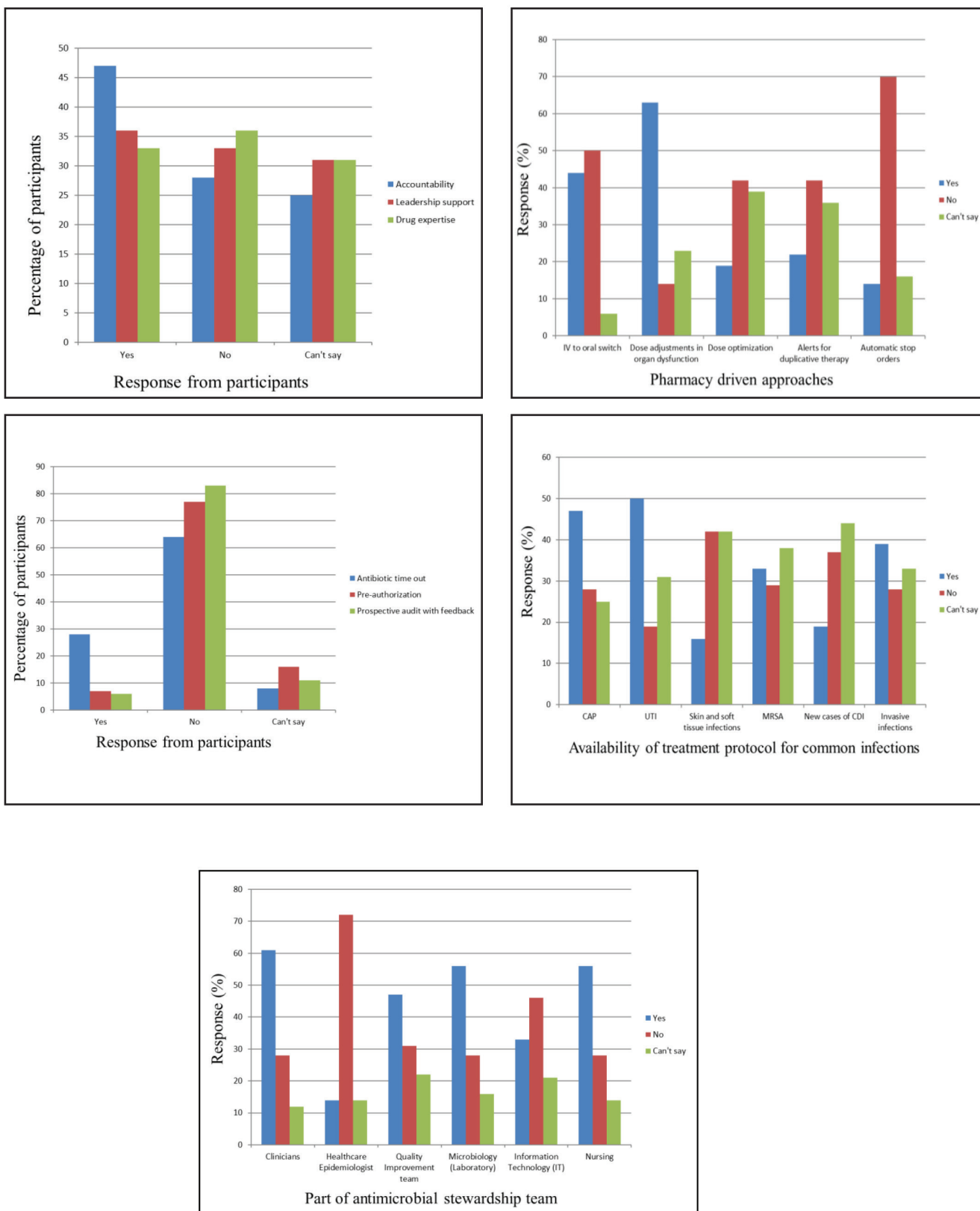The authors declare no conflict of interest, financial or otherwise.

Figure 1. Response of participants related to (a) Accountability, leadership support and availability of drug expertise in antimicrobial stewardship programme (ASP). (b) Antibiotic time out, pre-authorization and prospective audit with feedback. (c) ASP team members. (d) Pharmacy driven approaches. (e) Availability of treatment protocol for common infections.

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