Status of Antimicrobial Stewardship Implementation in Some Egyptian Hospitals, a Cross-sectional Study

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Abstract

Background: Antimicrobial stewardship (ASP) aims to stopping or slowing emergence of antimicrobial resistant strains. After initiation of National action plan on antimicrobial resistance (AMR) in Egypt, there were several initiatives by hospitals to implement ASP but no formal assessment was performed.

Objective & setting: This study attempts to assess the extent of ASP application in different Egyptian hospitals; stewardship knowledge & implementation in selected hospitals.

Method: A cross-sectional study was conducted to assess stewardship knowledge & implementation in selected hospitals in Egypt.

Main outcome measure: Core elements of the survey included Hospital Description, ASP committee, ASP Activities (including training, restriction methods and outcome measurement), reporting antibiotic use, antibiogram, information technology (IT) support, ASP restriction methods and ASP Future Application

Results: The study included many aspects regarding hospital description; all types of hospitals were involved. Most of hospitals (61.8%) implemented an ASP program while 38.2% did not; 71.4 % of the later are planning for future Antimicrobial stewardship application. 22 hospitals (48.5%) reported having facility-specific antibiogram on regular basis. 13 hospitals (37.1%) reported receiving antimicrobial reports on regular basis. 15 hospitals (42.9%) reported having one or more computer programs already in use. The monitoring activities included resistance patterns, infection rates, length of stay, mortality rate & reported adverse drug reactions. Only 20% of the hospitals included in this study reported having an ASP training program.

Conclusion: Egyptian hospitals have a fairly good implementation, improvements need to include IT support programs, healthcare members cooperation, monitoring outcomes & infectious disease (ID) consultations.

Introduction

Over the past few decades, the global rates of antimicrobial resistance have greatly increased. It was estimated that over 700000 deaths were reported globally because of antibiotic resistant bacteria infections [1]. The rate of antimicrobial resistance in Eastern Mediterranean & middle east has dramatically increased in both hospital and community acquired infections. This increase endangers the hard-won achievements in health care & sustainable use of antimicrobials in many communicable disease such as tuberculosis, hospital acquired infections, AIDS and pneumonia [2].

As reported, there is a strong correlation between antibiotic use and the rate of multi-drug resistant bacteria isolation. This was attributed to the selective pressure that increases the selection of the drug resistant bacteria because of the increase in antibiotic exposure [3–6].

Several studies showed that dedicated programs that aim at amending antibiotic use, could decrease the antibiotic resistance, reduce its toxicity and lower the treatment cost [7, 8]. Antimicrobial stewardship (ASP) aims at stopping or slowing emergence of antimicrobial resistant strains, and to improve selection, dosing, length of therapy, also ASP goals include reducing the side effects for every patient, and decreasing the morbidity, mortality, length of hospital admission, and lowering the overall health care costs [9–11].

These goals are achieved via setting up a work group responsible for improving and decreasing antimicrobial agents use on the patient level. This could be done as reported by decreasing the quantity and improving the quality of antibiotics prescriptions in all hospitals. Regardless of the difficulty in measuring the outcome of ASP on patients and overall antimicrobial resistance, there is a strong evidence that ASP can succeed in achieving its above-mentioned goals [10, 12].

The World Health Organization (WHO) is urging governments to implement antimicrobial stewardship programs that aims at containing antimicrobial resistance [13].

Aim of the study

In response to growing threat of antimicrobial resistance ,the government initiated of National action plan on antimicrobial resistance (AMR) in 2018 [14]. The aim of this study is to assess the extent of ASP application in different Egyptian hospitals and to highlight weakness points to be able to address in order to achieve rational use of antibiotics & better stewardship applications. The survey aims to map the difference between stewardship programs and antimicrobial use guidelines and the practice in Egyptian hospitals.

Method

A cross-sectional study was conducted to assess stewardship knowledge & implementation in selected hospitals in Egypt.

Assessment was done through a questionnaire developed by the research team which includes experts in infectious disease, stewardship training and clinical pharmacy specialists.

Survey development

The survey contains eight core elements and 30 items.

Core elements included Hospital Description, ASP committee, ASP Activities (including training, restriction methods and outcome measurement), reporting antibiotic use, antibiogram, Information Technology (IT) support, ASP restriction methods and ASP Future Application.

The survey was developed with the aid of these previously comparable performed studies [15–19]. Survey development was performed by two of the authors from clinical and microbiological background,

and it was reviewed by clinical practice expert specialized in ASP application in Egyptian hospitals to adapt the survey to antimicrobial practice in Egypt.

Local regulations allow surveys to be done as long as they are anonymous.

Setting and participants

Sampling strategy applied was convenience sampling. Hospitals were carefully chosen to include different types of hospitals (general and specialized hospitals); different ownership, governmental (either teaching or non-teaching) in addition to private hospitals. Also, different hospital size (bed capacity) was included.

Healthcare providers were invited to contribute voluntary in this study. Data were collected from physicians & pharmacists in the selected hospitals. Answers not delivered within one week were followed by call reminders. No personal information was recorded. Hospitals data were anonymous to assure confidentiality. The study was conducted from June to July 2020

Results

In this study, 35 healthcare facilities responded to the survey, 20 (57.1%) hospital were located in Alexandria, 3 (8.7%) in Cairo, 6 (17.1%) in Delta region and also 6 (17.1%) in upper Egypt.

The survey was filled by different health care teams' members, from each hospital only one member from the team responded to our questionnaire. The respondents were clinical pharmacists (57%), physicians (11.4%), infection control specialist (8.6%) & other members of the health care team. The respondents had different responsibilities related to ASP policy application, including developing and reviewing antibiotic policy (57.1%), antibiotic prescribing & infectious disease teaching (25.7%), administration (17.1%) and other.

In the current study, hospital specialties varied as following, 18 (51.4%) were community general hospitals, 17 (48.6%) were specialized hospitals. 3 (8.6%) of these hospitals were acute care hospitals.

Hospital ownership could also be divided as follows, 18 (51.4%) were teaching hospital, 12 (34.3%) were Governmental, non-teaching hospital, and 5 (14.3%) were Private, non-teaching. Table 1.

Table 1
Hospital description

Location	
Alexandria	20 (57.1%)
Cairo	3 (8.7%)
Delta region	6 (17.1%)
Upper Egypt	6 (17.1%)
Hospital type	
General	18 (51.4%)
Specialized	17 (48.6%)
Acute care	3 (8.6%)
Hospital ownership	
Teaching hospital	18 (51.4%)
Governmental	12 (34.3%)
Private	5 (14.3%)
Hospital capacity	
Large (more than 300 beds)	14 (40%)
Medium (100–300 beds)	10 (28.6%)
Small (less than 100 beds)	11 (31.4%)

Concerning the hospitals capacity,14 hospitals (40%) were large hospitals with capacity of more than 300 beds, 10 (28.6%) were medium hospitals of more than 100 beds, and 11 (31.4%) were small hospitals with less than 100 beds capacity.

Regarding ASP program implementation, 21 (61.8%) of hospitals reported having a current ASP program, while 14 (38.2%) reported not having an ASP program. Among those 14 hospitals, 10 (71.4%) reported planning for future Antimicrobial stewardship application. Table 2.

Table 2
ASP status, ASP team components& practice

ASP application	
Yes	21 (61.8%)
No	14 (38.2%)
Future ASM application among hospitals with no ASP program	
Yes	10 (71.4%)
No	4 (28.6%)
ASP team	
Critical care physician	47.6%
Physician	33.3%
Clinical pharmacist	81%
Hospital pharmacist	33.3%
Hospital director	61.9%
Department head	47.6%
Clinical microbiologist	52.4%
Infectious disease specialist	47.6%
Nurse	38.1%
Hospital antibiogram availability & reporting intervals	
Every year	6 (17.1%)
Every 6 months	11 (31.4%)
No	18 (51.4%)
Antimicrobial susceptibility testing	
Yes	23 (65.7%)
No	12 (34.3%)
Antibiotics use Reports availability and intervals	
Monthly	6 (17.1%)
Every 3 months	1 (2.9%)
Every 6 months	1 (2.9%)
Every year	1 (2.9%)

ASP application	
Upon appointed	4 (11.3%)
Never	22 (62.9%)
Antimicrobial resistance monitoring	
Antimicrobial resistance patterns	45.7%
Infection rates	31.4%
Patient outcomes	28.6%
Adverse drug reactions	20%
No monitoring for the outcomes	25.7%

Among the 21 hospitals having an active ASP program, 20 (95.2%) hospitals reported presence of ASP team. The team components and members varied among the included hospitals, 81% of the hospitals reported presence of a clinical pharmacist among the team members, 61.9% included a hospital director, 52.4% a clinical microbiologist, 47.6% head of department, a critical care physician & an infectious disease specialist, 38.1% a nurse, 33.3% reported a physician / hospital pharmacist. All hospitals with ASP teams reported the availability of Infectious Disease consultation. 33.3% was via formal request for clinical consultation, 28.6 % reported being available at all times on all wards, 4.8% had daily auditing in intensive care unit and consultation in ward and in 4.8% the consultation was available three days per week. Also, in 23.8% consultation was performed on a face to face basis and in 4.8%, consultation was done by phone.

Among the 35 hospitals included in this study, 22 hospitals (48.5%) reported having facility-specific antibiogram on regular bases. Among these hospitals, 11 (31.4%) had hospital antibiogram report updated every six months & 6 (17.1%) every year. While 18 hospitals (51.5%) reported receiving no facility specific antimicrobial data.

23 hospitals (65.7%) reported that the hospitals labs provide antimicrobial susceptibility data in addition to identifying species in culture results, while 12 hospitals did not report performing a such test.

For monitoring antimicrobial resistance, several parameters were measured in the hospitals. 45.7% monitored antimicrobial resistance patterns as a total resistance indicator, 31.4% monitored infection rates, 28.6% reported patient treatment outcome such as mortality rate & length of stay. Also, 20% of the hospitals reported monitoring the adverse drug reactions, while 25.7% did not take any measures to monitor the antibiotics resistance.

The ASP program should include regular reporting of information on antibiotic use and resistance to physicians, nurses and relevant staff. 13 (37.1%) hospitals included in our study reported receiving

antimicrobial reports on regular basis, 22 hospitals (62.9%) are not issuing such reports at all. The interval for reporting activities varied among the hospitals included in our study between monthly (46.2%) or every 3 months (1.7%), 6 months (1.7%), 12 months (1.7%) or upon appointed (30.8%). The reporting behavior also differed between reporting to a committee (78.9%), or directly to a health care personnel (23.1%). Table 3.

Table 3
Support & other activities related to ASP

IT support	
Present	15 (42.9%)
Absent	20 (57.1%)
Programs available for ASP	
Clinical decision support for antimicrobial prescription/dosing	60%
Electronic medical records (EMRs)	26.6%
Computerized physician order entry (CPOE)	13.3%
Computer-assisted monitoring of antimicrobial prescriptions	13.3%
Hospital specific Computer-based surveillance	6.7%
ASP training availability	
Yes	7 (20%)
No	28 (80%)
Training Methods	
Written guidelines	33.3%
Rounds for students and hospital staff	33.3%
Conferences	33.3%

Regarding IT support, in our study 20 hospitals (57.1%) had no support from IT department regarding ASP application. While 15 hospitals (42.9%) reported having one or more computer programs already in use in their hospitals.

Among the 15 hospitals reported an available IT support, “Clinical decision support for antimicrobial prescription/dosing” was the most reported program used (60%), followed by “Electronic medical records (EMRs)” (26.6%). Other technologies were reported as well such as “Computerized physician order entry (CPOE)” (13.3%), Computer-assisted monitoring of antimicrobial prescriptions (13.3%), hospital specific Computer-based surveillance (6.7%).

ASP application requires good staff training, only 20% of the hospitals included in this study reported having an ASP training program. In these hospitals, one or more techniques were used for ASP staff education & training. This included written guidelines, rounds for hospital staff and conferences.

Among the obstacles facing ASP application as reported in our hospitals is physician/ prescriber insufficient cooperation (20%) and insufficient support from the hospital administration (22.9%). Despite the antimicrobial resistance crisis in Egypt, many hospitals do not see the importance a formally organized program currently (31.4%). Hospitals mostly did not dedicate enough funds for program application (23%). Also, lack of IT support represented a main obstacle for ASP application (31.4%).

Discussion

The recent study aimed to assess the extent of ASP application in different Egyptian hospitals. The study included many aspects regarding hospital description; all types of hospitals were involved either general or specialized, 8.6 % of them provided acute care services. Hospital ownership was either teaching, governmental or private. Also, there were no restrictions regarding hospital size (large, medium & small) inclusion in this study.

From the questioned hospitals, 61.8% implemented an ASP program while 38.2% did not; 71.4 % of the later are planning for future antimicrobial stewardship application. These results among Egyptian hospitals were similar to those reported in Western United States; which have demonstrated the widespread use of stewardship strategies [15]. Nhan *et al*, reported in a survey that more than 80% of responding US hospitals had an ASP program [19]. China also had a successful implementation of ASP as studied by Zhou & Ma [20].

The presence of ASP dedicated team has been suggested as key factor for having a successful ASP program. 61.8% of tested hospital had a current active ASP program, 95.2% of them had an ASP team. The ASP team consists of clinical or hospital pharmacists, the hospital director, clinical microbiologists, head of departments, critical care physicians, infectious disease specialists, nurses, and physicians. Allenback *et al*, stated that a multidisciplinary team should include an infectious disease physician & a clinical pharmacist with infectious disease training. In addition to a clinical microbiologist, an IT specialist, an infection control professional, and hospital epidemiologist [15]. Kallen *et al* found that the team included at least one hospital pharmacist and one clinical microbiologist, an infectious diseases and IT specialist [17].

The hospital antibiogram is a periodic summary of antimicrobial susceptibilities of local bacterial isolates submitted to the hospital's clinical microbiology laboratory. Antibiograms are often used by clinicians to assess local susceptibility rates, as an aid in selecting empiric antibiotic therapy, and in monitoring resistance trends over time within an institution [21].

In our study, antibiogram was not performed in 51.4% hospitals, 17.1% reported updated antibiogram every year and 31.4% of the hospitals issued antibiogram on a 6 months interval basis. Baubie *et al* also

reported updating hospital antibiogram annually by hospital microbiologist & clinical pharmacists [22].

Despite not having an official antibiogram in more than half of the questioned hospitals, antimicrobial susceptibility testing was performed in 65.7%. Mushtaque *et al* reported 36 % of hospitals produce a cumulative antibiotic susceptibility report based on national guidelines and local susceptibility patterns. He also mentioned that optimizing doses through pharmacokinetics/pharmacodynamics principles, was performed by 68% of the hospitals, in the treatment of organisms with reduced susceptibility [23].

Microbial culture is a crucial component of the diagnostic process & ASP program; it offers useful data on isolates susceptibility profiles to guide antibiotic selection. Antimicrobial resistance monitoring is crucial for an effective ASP program. Despite 25.7% did not take any measure to monitor resistance. Monitoring activities in our study included 45.7% for the antimicrobial resistance patterns, 31.4% for the infection rates, 28.6% for the patient outcome such as length of stay & mortality rate and 20% of the hospitals followed adverse drug reactions. Our research was in concordance with other study, which recommended monitoring the reduction in resistance and the reduction in infection rate; however, they also included the calculation of the lowered cost by applying ASP [15]. In another study performed for hospitals in Karashi, several items like switching from IV to oral route, dose adjustments in organ dysfunction, dose optimization based on Pharmacokinetics/Pharmacodynamics data in treatment of resistant organisms [23]. Also in a practical toolkit issued by WHO for antimicrobial stewardship in low & middle income countries, many items were included in the monitoring and surveillance section. Monitoring the appropriateness of antibiotic use at the facility, the dose and type of antibiotic, antibiotic susceptibility and resistance rates, and committee compliance to interventions were the most important items [24].

Infectious disease consultations were available in all hospitals with ASP included in our study either through formal request for clinical consultation, daily availability, daily auditing or three times a week. Face to face consultation was performed more than phone call requests. In a study performed in two teaching hospitals, in Nice (France) and Dundee (Scotland, UK), they also reported face-to-face or by phone, consultations & available at all times, on all wards in the French hospital. The Scottish hospital had infectious disease advice mainly through request for consultation but also some advice were done by phone; only during working hours [18].

For the successful implementation of ASP, regular reporting is mandatory. Antibiotic use & resistance was reported in only 37.1%. The interval for reporting was performed monthly in almost half the studied hospitals and mostly through a committee either Pharmacy & Therapeutics or Infectious disease committee. These results disagreed with a study in 116 tertiary hospitals in China, where 98.3% provided reports on susceptibility data and these reports were updated every 3 months in 70% of the tested hospitals, every 6 months in 12% of the hospitals and once per year in 9 of the hospitals [20].

ASP needs a large amount of “timely” information. IT support is improving antibiotic use and thus patient care, by allowing efficient, up-to-date review and effective prioritization of patients receiving antibiotics. Computer-based surveillance and IT support has been best prescribed to facilitate the ASP program. In

our study, 57.1% of the hospital did not have IT support may be due to the lack of computerized system in our governmental hospitals. Electronic Medical Record (EMR), Computerized Physician Order Entry (CPOE), Computer-assisted monitoring of antimicrobial prescriptions & hospital surveillance are among the IT activities performed. In agreement with our study, Baubie *et al* found that electronic medical record is an effective tool in an ASP [22].

Unfortunately, 80% of the hospitals did not receive any official training. However, they got their information through Newsletter/Written guidelines, Grand Rounds for students/house staff or Conference presentations. In 101 United States studied hospitals, 80% among them got support for training & education [19].

Finally, ASP had several barriers for implementation including good staff training, physician/ prescriber insufficient cooperation, and insufficient support from the hospital administration. Lack of funds for program application & IT support were also among the important barriers for implementation. Our study came in agreement with Allenback *et al* which stated the most important barriers is staffing constraints, inadequate administration and prescriber support, and ASP were not considered a clinical priority. Among difficulties also, inadequate information technology support, lack of funding, and not having volunteers to lead [15].

Conclusion

Most of the hospitals included in our study reported having a current ASP or planning for future application. ASP should be managed by a specific team trained & updated by recent guidelines. The presence of an ASP as such is important but the ASP activities performed are the most crucial. Activities include training, restriction methods and outcome measurement. This should be performed in light of reporting antibiotic use and issuing antibiogram on a routine base. For an organized program, IT support is very helpful and should be established in healthcare institution.

Still ASP application needs cooperation from all the members of the healthcare team. The continuity of these stewardship activities, including monitoring outcomes, and daily ID consultations, could be a turning point in maintaining a successful antimicrobial resistance-free healthcare setting.

Impact Statements:

- This cross-sectional study assesses the current stewardship application in many hospitals in Egypt
- Most of the hospitals included in our study reported having a current ASP or planning for future application. Hospital labs provide antimicrobial susceptibility data in addition to identifying species in culture results
- Activities include training, restriction methods and outcome measurement. Reporting antibiotic use and issuing antibiogram on a routine base still needs improvement.

- The study highlights weakness points in ASP activities to be able to address in order to achieve rational use of antibiotics & better stewardship applications
- Improvements need to include IT support programs, healthcare members cooperation, monitoring outcomes & infectious disease (ID) consultations.

Declarations

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Authors' contributions:

All authors participated in designing the study, performing the research, and preparing the article.

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Conflict of Interest:

The authors have declared that no conflict of interest exists.

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