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Original Research Article

Antibiotic stewardship in health care facilities across Gujarat: A cross-sectional descriptive study

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ABSTRACT

Background: Irrational use of antibiotics is the key contributor to antibiotic resistance. To improve the administration of antibiotics, many programs have been designed at national and international levels; and antibiotic stewardship (ABS) is one of them.
The aim of this study was to create awareness and understanding of antibiotic stewardship by estimating its knowledge, attitude and practice (K.A.P) among health care professionals in health care facilities across Gujarat.
Materials and Methods: A cross-sectional descriptive study was carried out among health care professionals in health care facilities across Gujarat. For which a self-administered questionnaire with 15 closed-ended questions with two sections: "Optimal antibiotic use" (no.1-7 questions); and "Responsible antibiotic use" (no.8-15 questions) was disseminated online/ in electronic form.
Results: In Dental practitioners, mean scores of knowledge, attitude, practice (K.A.P) regarding "Optimal antibiotic use" and "Responsible antibiotic use" are 6.3682 ± 0.96, 6.2139 ± 1.07, 4.5672 ± 1.51 and 7.1692 ± 1.09, 6.9104 ± 1.25, 5.1443 ± 1.81 respectively.
In Medical practitioners, mean scores of knowledge, attitude, practice (K.A.P) regarding "Optimal antibiotic use" and "Responsible antibiotic use" are 6.8201 ± 0.41, 6.7090 ± 0.56, 5.1270 ± 1.62 and 7.6032 ± 0.69, 7.4233 ± 0.82, 5.3492 ± 1.94 respectively.
Between the groups, knowledge and attitude regarding "Optimal antibiotic use" and "Responsible antibiotic use" are statistically highly significant (p-value = <0.001).
Conclusions: Health care professionals showed higher knowledge as compared to attitude with least practice (K>A>P) regarding antibiotic stewardship in health care facilities across Gujarat.
Key message: Antibiotic stewardship is fulcrum for the dual face of antibiotics. Equilibrium between individual and societal benefit/risk ratio while making clinical antibiotic decisions will benefit both; individual patients as well as the community.

1. Introduction

Antibiotic resistance (ABR) - a significant global threat is an issue of great significance for healthcare in humans and animals. With few new antibiotics coming onto the market in the foreseeable future, the options for treating resistant infections are becoming increasingly limited. About 50% of antibiotic use has been found to be inappropriate (WHO). Hence, strategies to prevent the emergence and spread of antibiotic resistant organisms are indispensable.

Health care professionals make a significant contribution in routine antibiotic prescribing and dispensing practices. Thus, creating awareness and understanding of antibiotic stewardship is one of the ways to preserve its effectiveness.

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2. Materials and Methods

2.1. Study design and population

After the approval of ethical clearance from the college's ethics committee, a cross-sectional descriptive study was carried out using a self-administered questionnaire among health care professionals in health care facilities across Gujarat. Participation in the survey was fully voluntary with informed consent. Total 390 participants were included in the study.

1. Inclusion criteria: All health care professionals (registered doctors) who were licensed to prescribe medication.
2. Exclusion criteria: Incomplete/ partially filled questionnaires were excluded.

Sampling procedure and minimum sample size

A "snowball" method, non-probability type of sampling method with minimum sample size of 384 was selected.

$$N = \frac{Z^2 \, x \, (p) \, x(1-p)}{d^2}$$
$$= \frac{(1.96)^2 \, x \, 0.5 \, x \, 0.5}{(0.05)^2}$$
$$= 384$$

where:

N = sample size

Z = value corresponding to a given confidence level (confidence level 95%)

p = percentage of the primary indicator, expressed as a decimal (default 0.5).

d = standard error 5%, expressed as a decimal (0.05)

2.2. Data collection

The survey was carried out from Feb 2021 to May 2021. A self-administered questionnaire with 15 closed-ended questions was disseminated online/ in electronic form. Questionnaire [Table 1] was divided into two sections: "Optimal antibiotic use" (no.1-7 questions); and "Responsible antibiotic use" (no.8-15 questions). Participation in the survey was fully voluntary with informed consent.

2.3. Statistical analysis

The collected data was analyzed using STATA-MP 13 software. Continuous variables were presented in mean & standard deviation. Categorical data were presented in the form of frequency and proportion. The difference of means between two groups was assessed using independent t-test whereas one way ANOVA with Post-Hoc was used to compare more than two groups. Level of significance was set at 5% (0.05).

3. Results

Total 390 participants were included in the study, out of which 201 were dental practitioners and 189 were medical practitioners [Figure 1].

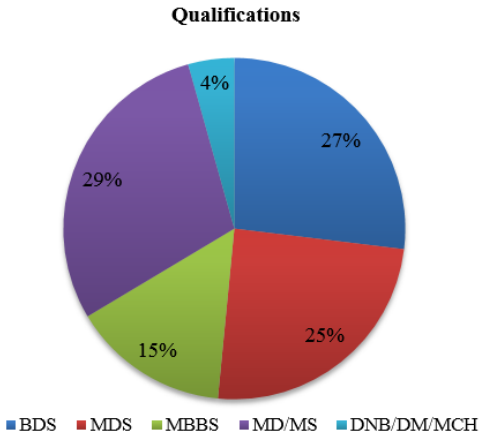

Fig. 1: Based on educational qualifications [BDS: 105 (26.9%), MDS: 96 (24.6%)] and [MBBS: 58 (14.9%), MD/MS: 114 (29.2%), DNB/DM/MCH: 17 (4.4%)].

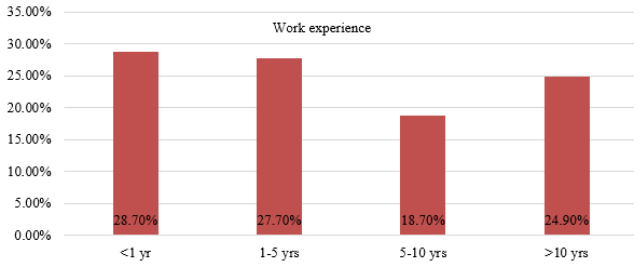

Fig. 2: Based on work experience 112 (29%) participants with <1 year, 108 (27.7%) participants with 1-5 years, 73 (18.7%) participants with 5-10 years, 97 (24.9%) participants with >10 years

Overall Responses for Knowledge, Attitude/Believe and Practice regarding antibiotic use and resistance among health care professionals are shown in [Table 2]

Comparison of Knowledge, Attitude/Believe and Practice regarding antibiotic use and resistance between dental and medical practitioners are shown in [Figure 3].

Mean values of Knowledge, Attitude/Believe and Practice regarding antibiotic stewardship between dental and medical practitioners are shown in [Figure 4].

1. Mean scores of knowledge regarding "Optimal use of antibiotics" among dental and medical practitioners was 6.3682 ± 0.96 and 6.8201 ± 0.41 respectively. Medical practitioners had more

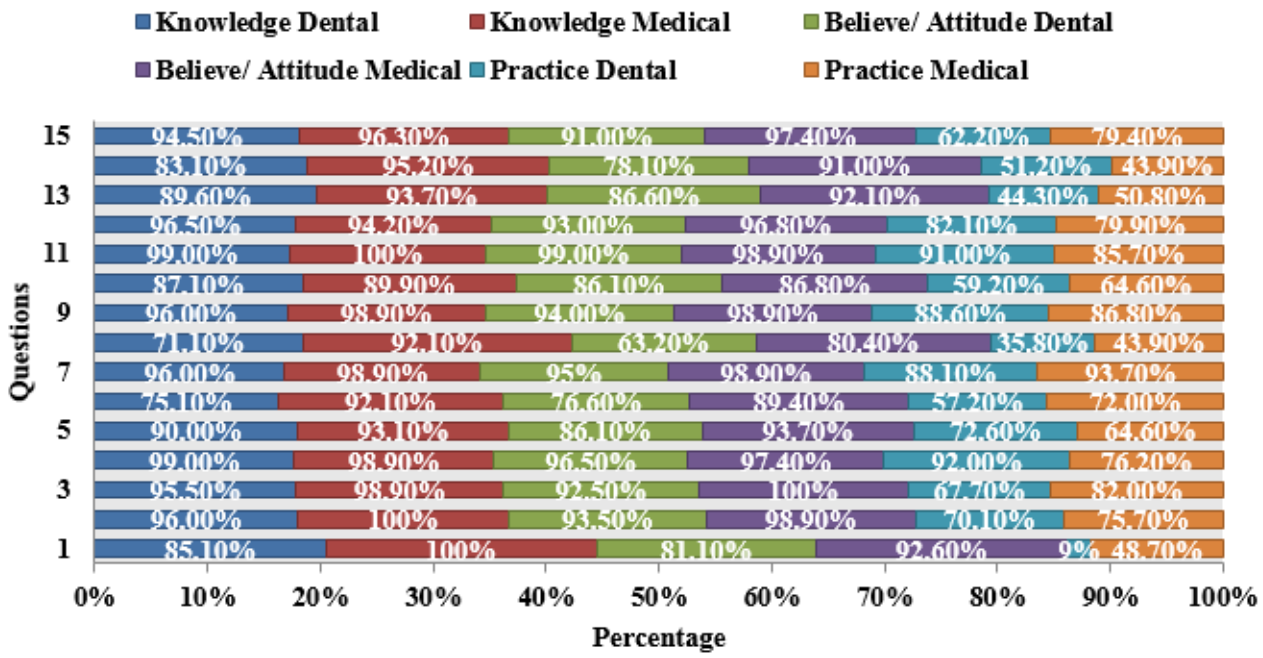

Fig. 3: Comparison of Knowledge, Attitude/Believe and Practice regarding antibiotic stewardship between dental and medical practitioners

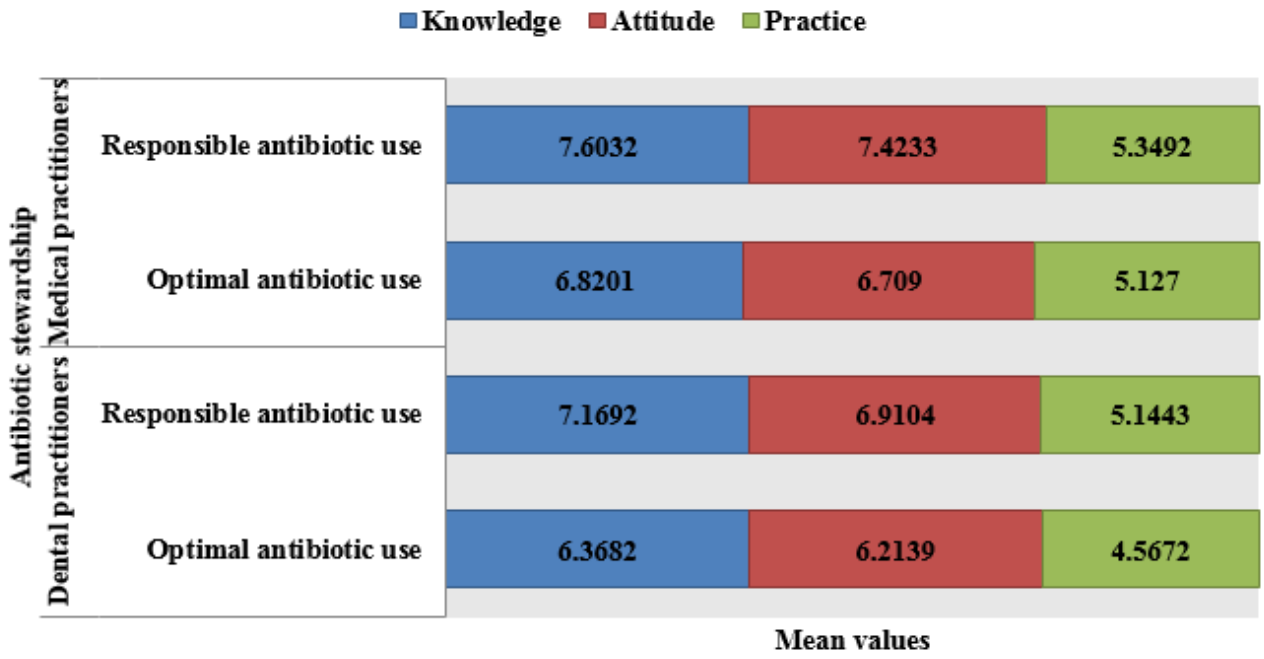

Fig. 4: Mean values of Knowledge, Attitude/Believe and Practice regarding antibiotic stewardship between dental and medical practitioners

Table 1: Questionnaire divided into two sections: "Optimal antibiotic use" (no.1-7 questions); and "Responsible antibiotic use" (no.8-15 questions).

Q. No.	Optimal antibiotic use (patient-centered)
1	Using microbiology diagnostic testing (e.g. culture-sensitivity) prior to antibiotic prescribing.
2	Selecting antibiotics based on their antibacterial spectrum (as narrow as possible) and activity.
3	Selecting dose and dosing frequency of the antibiotic regimen based on pharmacokinetics/ pharmacodynamics (to ensure sufficient free concentrations of antibiotic at the site of infection).
4	Selecting antibiotics after considering the possible interactions with other medication(s) and least toxicity possible.
5	Selecting the antibiotics with the lowest risk of secondary infections such as C. difficile diarrhoea.
6	Using the shortest possible evidence-based duration of the antibiotic regimen.
7	Administering antibiotics in timely manner along with proper route (e.g. parenteral/ oral) based on antibiotic, severity or type of infection and patient characteristics.
	Responsible antibiotic use (society-centered)
8	Using local antibiotic resistance surveillance data for guidelines on empirical antibiotic prescribing.
9	Ensuring access and routine availability of quality antibiotics.
10	Fully documenting the antibiotic regimen including indication in the medical record.
11	Ensuring patient compliance with the antibiotic prescription.
12	Safely disposing of unused/ expiry date antibiotics and waste products containing antibiotics to prevent selection in the environment.
13	Ensuring educational programmes on antibiotic use for the public and all relevant professionals, including trainees in healthcare curricula.
14	Stimulating collaboration between different types of healthcare professionals (e.g. nurses, doctors, pharmacists) to limit emergence of antibiotic resistance.
15	Considering alternatives for antibiotics to prevent infections and to conserve its effectiveness for the future (e.g. vaccines, hygiene, infection control).

Table 2: Overall Responses for Knowledge, Attitude/Believe and Practice regarding antibiotic use and resistance among health care professionals

Q.No.	Knowledge	Believe	Practice
1	360 (92.31%)	338 (86.67%)	110 (28.21%)
2	382 (97.95%)	375 (96.16%)	284 (72.83%)
3	379 (97.18%)	375 (96.16%)	291 (74.62%)
4	386 (98.98%)	378 (96.93%)	329 (84.36%)
5	357 (91.54%)	350 (89.75%)	268 (68.72%)
6	325 (83.34%)	323 (82.83%)	251 (64.36%)
7	380 (97.44%)	378 (96.93%)	354 (90.77%)
8	317 (81.29%)	279 (71.54%)	155 (39.75%)
9	380 (97.44%)	376 (96.42%)	342 (87.7%)
10	345 (88.47%)	337 (86.42%)	241 (61.8%)
11	388 (99.49%)	386 (98.98%)	345 (88.47%)
12	372 (95.39%)	370 (94.88%)	316 (81.03%)
13	357 (91.54%)	348 (89.24%)	185 (47.44%)
14	347 (88.98%)	329 (84.36%)	186 (47.7%)
15	372 (95.39%)	367 (94.11%)	275 (70.52%)

knowledge as compared to dental regarding optimal use of antibiotics (p-value = <0.001).

2. Mean scores of attitude regarding "Optimal use of antibiotics" among dental and medical practitioners was 6.2139 ± 1.07 and 6.7090 ± 0.56 respectively. Medical practitioners believed more as compared to dental regarding optimal use of antibiotics (p-value = <0.001).
3. Mean scores of practice regarding "Optimal use of antibiotics" among dental and medical practitioners was 4.5672 ± 1.51 and 5.1270 ± 1.62 respectively. Medical practitioners demonstrated more practice as compared to dental regarding optimal use of antibiotics (p-value = <0.001).
4. Mean scores of knowledge regarding "Responsible use of antibiotics" among dental and medical practitioners was 7.1692 ± 1.09 and 7.6032 ± 0.69 respectively. Medical practitioners had more knowledge as compared to dental regarding responsible use of antibiotics (p-value = <0.001).

5. Mean scores of attitude regarding "Responsible use of antibiotics" among dental and medical practitioners was 6.9104 ± 1.25 and 7.4233 ± 0.82 respectively. Medical practitioners believed more as compared to dental regarding responsible use of antibiotics (p-value = <0.001).
6. Mean scores of practice regarding "Responsible use of antibiotics" among dental and medical practitioners was 5.1443 ± 1.81 and 5.3492 ± 1.94 respectively. Medical practitioners demonstrated more practice as compared to dental regarding responsible use of antibiotics (p-value = 0.282). There was statistically no significant difference between the groups.

Mean values of Knowledge, Attitude and Practice (K.A.P) regarding antibiotic stewardship based on work experience:

1. Practice of "Optimal use of antibiotics" increases with increase in work experience (p-value = <0.001).
2. Knowledge, Attitude and Practice (K.A.P) of "Responsible use of antibiotics" decreased after 5 years of work experience; followed by increase after >10 years of work experience (p-value = <0.001).

4. Discussion

Antibiotic stewardship (ABS) is described as a systematic and coordinated approach to optimizing antimicrobial use with the goals of improving patient outcomes, ensuring cost-effective therapy and reducing adverse consequences of antimicrobial use, including ABR.[1–4] It is an integral component of patient safety.

Effective ABS requires a suite of coordinated strategies to promote the use of antimicrobials in a way that maximises their benefit, while causing the least harm. The aim is to reduce unnecessary use and improve the appropriate use of antimicrobials by prescribing according to evidence-based guidelines, with medicine choice, dose and duration selected to optimise clinical outcomes and minimise adverse consequences such as drug toxicities, C. difficile infection or the selection of resistance.[5] The antibiotic stewardship establishes a balance between societal and individual interests in the dual aspect (i.e. optimal and responsible use) of antibiotic strategy.

Optimal use refers to the conditions, which must be fulfilled so that antibiotics exert their best possible effect on the outcome of the individual patient. This means that they limit or avoid attributable mortality of the infection, prevent complications, shorten the duration of illness and cause no harm because of toxicity, allergy or microbiome disruption. Responsible use refers to the societal aspects of antibiotic therapy, in which the ecological selection pressure is kept to a minimum and the antibiotic potential for future patients is preserved as much as possible. Optimal and responsible aspects of antibiotic therapy, as well as individual and societal aims, will often coincide.[6]

Monnier et al. developed a consensus-driven definition of responsible antibiotic use considering different perspectives. Patient-level elements reflect individual care parameters whereas societal-level elements typically affect large populations. In conclusion, a global list of elements key to the definition of responsible antibiotic use was developed considering the perspectives of a wide range of stakeholders involved with antibiotics.[7]

In low- and middle-income countries, ABS consistently shows the failure to translate evidence into practice which is mainly due to limited evidences and numerous challenges for its implementation.

Cox et al. focused on antimicrobial stewardship in low- and middle-income countries, highlighting the differences with high-income countries. He illustrated the most prominent challenges for implementation of ABS interventions. Apart from limited resources in terms of well-equipped clinical laboratories, trained healthcare personnel, drugs, policies and formal programs; lack of up-to-date knowledge and awareness regarding ABR among healthcare professionals is of particular concern. A comprehensive approach of better knowledge and awareness regarding ABR among healthcare professionals and the general public, the need of surveillance and research, infection prevention and control measures including vaccination is required for implementation of ABS.[8]

Meher et al. carried out the study to assess the knowledge and attitude of undergraduate medical students toward antimicrobial resistance (AMR) and stewardship. Their study revealed that respondents possessed inadequate knowledge about antimicrobial resistance and antimicrobial stewardship. They also suggested the existence of knowledge gap among the students which could be filled with proper knowledge and training about the principles of rational antibiotic prescribing practice and ABS.[9]

Higuita-Gutiérrez et al. designed study to describe the knowledge, attitude, and practice regarding antibiotic use and resistance among medical students in Medellín, Colombia. Knowledge, attitude, and practice differ widely depending on the university, training cycle, and socioeconomic status, and a significant proportion of students consider that the standard of training received at the university on antibiotics and bacterial resistance is poor or mediocre. These findings show that there is a need to strengthen the medical students' curriculum on antibiotics, mechanisms of antibiotic resistance, and the prudent use of antibiotics as an important strategy to combat problem-resistant public health, primarily in endemic countries.[10]

In present study, healthcare professionals demonstrated comparatively more knowledge as compared to attitude with least practice (K>A>P) regarding antibiotic stewardship in health care facilities. Also, medical

practitioners demonstrated better knowledge, attitude and practice (K.A.P) regarding "Optimal antibiotic use" and "Responsible antibiotic use" as compared to dental practitioners.

Also practice of "Optimal use of antibiotics" increased with increase in work experience whereas knowledge, attitude and practice (K.A.P) of "Responsible use of antibiotics" decreased after 5 years of work experience; followed by increase after >10 years of work experience.

5. Limitations

A multi-centric study with large sample size comparing community based access and consumption practices will provide a standardized framework for appraising current antibiotic use patterns, demand and access.

6. Conclusion

A global coordinated efforts including implementation of antimicrobial stewardship programmes in all settings, with significant and sustainable funding is need of the hour to curb the rise of ABR. Moreover, to actually change and improve drug prescription behaviour, emphasis should be on issuing of guidelines and education that is sustained in time.

7. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

8. Source of Funding

None.

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