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Research Paper

Antimicrobial stewardship programs: perceptions and practices among Jordanian healthcare practitioners

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Abstract

Objective Antimicrobial stewardship programs are of paramount importance in containing antibiotic resistance and combat the acquisition of multi-drug resistance strains. Healthcare practitioners, specifically physicians and clinical pharmacists are the direct clinical antibiotic prescribing authorities. Therefore, this study aimed to assess Jordanian practitioners' perceptions and practices towards antimicrobial stewardship programs.

Methods This was a cross-sectional study, in which physicians and clinical pharmacists were approached to fill out a previously validated study instrument. A close-ended structured questionnaire comprising 34 questions covering aspects related to antimicrobial stewardship program perceptions, practices and participants' demographic data were used to collect pertinent information.

Key findings A total of 286 participants were enrolled in the study. There was an overall positive perception towards antimicrobial stewardship programs, while practices related to this element was still suboptimal. Additional comparison of the overall perception scores among different demographic characteristics showed that long years of practice, postgraduate studies and practice in academic sectors yielded higher perception scores ($P = 0.0335$, 0.0328 and 0.0007, respectively).

Conclusion There is an imminent need to enhance Jordanian practitioners' knowledge about antimicrobial stewardship programs. Clear recognition of integral antimicrobial stewardship programs' components must be coupled with highlight changes in current practices related to antimicrobials usage and prescription.

Keywords: antimicrobial stewardship program; antibiotics; clinical pharmacist; Jordan; physician

Introduction

Antibiotic resistance is a global threat.[1] The development of multidrug resistance (MDR) bacteria aggravates this problem at a rate exceeding that of the antibiotic development pipeline for resistant infections.[2–7] MDR bacteria encompasses a number of emerging strains with acquired resistance to at least one antimicrobial drug in three antimicrobial categories.[8] Such strains are characterized by resistance to most, if not all, clinically available antibiotic agents; rendering available antibacterials ineffective in treating implicated infectious episodes.[8] Such resistance is precipitated by excessive use of antibiotics coupled with a lack of well constructed antibiotic stewardship programs.[8] It is estimated that around 700,000 people die yearly worldwide secondary to antibiotic resistance. This number is expected to double by 2050 unless effective counteracting efforts are implemented.[9]

Increasing resistance to antibiotics at an alarming rate is further fueled by the widespread misuse of antibiotics.[10, 11] Jordan, part of the Eastern Mediterranean Region (EMR), has a high prevalence

of self-medication with antibiotics; recently reported as 40%.[12] Additionally, it is estimated that 87.8% of all deaths in Jordan are secondary to infectious diseases.[13] EMR was reported by the World Health Organization (WHO) as an area with a high possibility of misuse of antibiotics.[14] The exact prevalence of antimicrobial resistance, which is necessary for quantifying and efficiently addressing the problem, is lacking given the absence of accurate antimicrobial resistance surveillance programs in the region.[14]

As hospital-centred programs devoted to improving antibiotic use, Antibiotic Stewardship Programs (ASPs) have been implemented.[15] ASPs have been defined in a consensus statement from the Infectious Diseases Society of America (IDSA), the Society for Healthcare Epidemiology of America (SHEA) and the Pediatric Infectious Diseases Society (PIDS) as 'coordinated interventions designed to improve and measure the appropriate use of [antibiotic] agents by promoting the selection of the optimal (antibiotic) drug regimen including dosing, duration of therapy and route of administration'.[16] To better acknowledge the need to control antibiotic use in a healthcare setting and given the proven advantages of ASPs, the Centers for Disease Control and Prevention (CDC) recommended that all acute care hospitals enforce ASPs in 2014.[17] Designing ASPs is way far from waving a magic wand to create a 'one-size-fits-all' program, yet it is a set of different complementary strategies with a common ultimate target; to curb the problem of antibiotic resistance.[18]

In Jordan, the implementation of antimicrobial stewardship program core elements, as aligned by the CDC, was evaluated in Jordanian Hospitals.[19] However, there is a lack of data about the current Jordanian practitioner's perceptions and practices towards antimicrobial stewardship programs. Thus, shedding the light on such aspects draws attention to defects in perception and practices related to ASPs, and helps to guide efforts to promote delayed antibiotic prescribing strategies.

Aim of the study

This study aimed to assess current Jordanian practitioner's perceptions and practices towards ASPs to provide a framework to introduce those programs in Jordanian healthcare facilities. Additionally, perception scores among different demographic characteristics were compared.

Method

Study design

This is a multicentre, cross-sectional study in which face-to-face interviews were conducted with Jordanian practitioners in the major Jordanian hospitals during the period from April 2019 to October 2019. Regarding clinical practice in Jordan, physicians are responsible for the antibiotic prescribing decision. Furthermore, their decision to prescribe certain antibiotics may be influenced by recommendations from peer clinical pharmacists. In the aspect related to antibiotics, nurses' role is limited to administration of dispensed, authorized antibiotics, thus we elected to include major confounders (i.e. physicians and clinical pharmacists) in antibiotic selection process to assess real perception and practice related to core elements of antimicrobial stewardship program. Consequently, both physicians (interns and residents from all specialties) and clinical pharmacists (practicing in hospitals) were approached and asked to fill out the study questionnaire, using a convenient sampling method. A signed informed consent form was obtained from practitioners, and participants' were interviewed privately to obtain the study's pertinent information. As a result, ten general hospitals in major Jordanian cities were included in the study.

The study questionnaire consisted of three main items covering the following areas: (1) Demographics including age, gender, educational degree, number of years of practice, in addition to sector and level of practice, (2) Perceptions of participants towards ASPs, comprised 8 questions and (3) Practices of participants towards ASPs, comprised 16 questions. A five-point Likert scale of the agreement was used to frame responses related to perceptions of practitioners. A score of 1 was given to strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree. A five-point Likert score of the frequency with a score of 1 for never, 2 for rarely, 3 for sometimes, 4 for often and 5 for always was used to assess responses to answers addressing participants' practices towards ASPs. Reverse coding was done for negatively worded statements. A full version of the study questionnaire is provided as a Supplementary File S1.

The study instrument was adopted from the survey conducted by Khan *et al.*[20] and the authors approved to adapt and edit the study questionnaire. The study questionnaire was modified to better suit the local context, and study setting, then it was assessed for face and content validity by a team of peer experts including a consultant infectious disease physician, a colleague from the department of public health, and five peer clinical pharmacists. Then, pilot testing of the edited version was carried out on ten study participants, including working colleagues and peer physicians. The results of pilot testing were excluded from the final analysis. Two research assistants conducted the interviews with all study participants, and periodic meetings with the research assistants were held to ensure a consistent data collection process. Noteworthy, the average interview time was 10 min.

Ethical approval

The study protocol got ethical approval by the Jordan University of Science and Technology Institutional Review Board committee (no. 171202019).

Statistical analysis

Characteristics of participants' variables were described using frequency distribution for categorical variables, while continuous variables were described using the median (interquartile range). A *P*-value of <0.05 was considered as the cutoff point for statistical significance. Shapiro–Wilk test was used to assess normality. Mann–Whitney test and Kruskal–Wallis test were used to compare median scores of perception among different demographic characteristics. Statistical analyses were conducted using JMP software (version 10.0; SAS Institute, Cary, NC).

Results

A total of 400 practitioners were approached to recruit a sample of 286 practitioners, giving a response rate of 71.5%. The majority of participants' ages ranged from 20 to 30 years (72.1 %), and women composed half of the participants (53.3%). Regarding the educational level, 70.1% had a Bachelor's degree, while (29.9%) had a master's degree. The majority of participants were practicing in governmental (48.5%) and military (36.6%) sectors compared to (14.9%) practicing in the private sector. Regarding the number of years of clinical practice, two-thirds of participants (69.8%) had practiced for four years or less, while 30.2% had more experience

with five or more years of practice reported. Finally, 62.7% of recruited participants were physicians leaving behind 37.7% of the pharmacist- participants. The demographic characteristics of the participants are shown in Table 1.

In assessing perception towards ASPs reported in Table 2, almost all study participants strongly agreed/agreed (86.1%) that ASPs are essential to improve patient care and contain antimicrobial resistance (89.7%). Many participants strongly agreed/agreed that pharmacists could play a prominent role in the development and implementation of ASPs (86.1%). Additionally, participants strongly agreed/agreed that educational activity (90.4%) and adequate training (94.8%) are important to enhance their understanding and practice related to ASPs. Moreover, (90.6%) of participants strongly agreed/agreed that ASPs should be incorporated at all clinical practice levels. More than half of practitioners (66.3%) strongly agreed/agreed that ASPs is a trans-sectoral approach that must extend beyond physicians and pharmacists to include all professionals involved in patient care. However, answers to a similar question were contradictory to this fact, with almost one-third of all study participants strongly agreed/agreed (32.2%) that only prescribing physicians and pharmacists are the only professionals that should understand ASPs, indicating a potential need to further improve this aspect of perception.

Regarding participants' ASPs practices, shown in Table 3, almost half of participants indicated that they always (18.6%) or often (37.9%) consult local guidelines and resistance patterns before they recommend antibiotics. Complete clinical information always (30.4%) or often (51.1%) guided antibiotic selection participants. However, microbiological data were always (21.2%) or often (42.0%) sought by a lower percentage of participants before selecting antibiotic therapy. Evidence-based practice guidelines for specific antibiotics were always (24.0%) or often (46.4%) reviewed by participants to guide their chosen antimicrobial agents. Concerning patient education and counseling, the participants always (20.4%) or often (37.4%) took the time to educate patients about resistance related issues and antimicrobials use. Similarly, assessment of patients' knowledge about prescribed antibiotics was checked by only half of the participants [always (14.4%) or often (35.6%)]. Additionally, measures to reduce the transmission of infections in practice settings were always (23.3%) or often (43.3%) implemented by study participants. Participants had a scarce involvement in local awareness campaigns, with reported activity in almost one-fourth of participants (28.5%), and this underlines a potential area of practice improvement. Finally, consultation with other healthcare team members was considered always (25.9%) or often (43.0%) by participants to select the most appropriate antimicrobial regimen. Antimicrobial prescription uncertainties were resolved through communication with a peer pharmacist or an infectious disease specialist always (31.6%) or often (40.0%) by participants.

Further, we compared the overall perception scores among different demographic characteristics (Table 4). Women had a higher perception of ASPs when compared to men ($P = 0.0028$). Healthcare providers who had an experience of five years and more and holding master's degrees had statistically significantly higher perception scores ($P = 0.0335$ and 0.0328, respectively). Practitioners working in an academic setting had the highest perception level compared to governmental and private sectors ($P = 0.0007$).

Table 1 Demographic characteristics of study respondents (Total $n = 268$)

Variable	Frequency (*N*)	Percentage
Gender		
Female	143	53.3
Male	125	46.7
Age group, years		
20–30	193	72.1
≥31	75	27.9
Education		
Bachelor degree	188	70.1
Master degree	80	29.9
Level of medical practice		
Medical Doctor (MD)	168	62.7
Pharmacist	100	37.7
Years of practice		
1–4 years	186	69.8
≥5 years	78	30.2
Sector		
Private	40	14.9
Government	130	48.5
Military	95	36.6

Discussion

This study evaluated the perception and practices of healthcare providers towards antimicrobial stewardship programs.

CDC emphasized the importance of improved antibiotic use as a strategy to address the problem of antibiotic resistance.[21] Healthcare practitioners, including physicians and pharmacists, are key players in controlling the misuse of antibiotics and minimize the consequent antibiotic-resistance.[17]

The findings of our study showed overall positive perceptions of ASPs. The majority of participants agreed upon the importance of ASPs in patient care, pharmacists' critical role in ASPS development and implementation, the importance of ASPs in reducing the risk of antibiotic resistance, and the multidisciplinary approach needed for optimal ASPs implementation. A cross-sectional study conducted by Alkhuzaei in Qatar showed similar positive antibiotic misuse perceptions by primary healthcare centres' pharmacists and physicians.[22]

In assessing multivariate analysis, women were more cognizant of ASPs perception as compared to the opposite gender. Such gender-based association between better perception of clinical elements related to patient safety and improvement in the quality of care was also reported by a New Zealander survey conducted by Gauld et al.[23] Furthermore, healthcare providers practicing in an academic setting had more perceptual ASPs cognition as compared to peers in other sectors. In Jordan, practicing/supervising healthcare providers in academic settings comprise academic staff; holders of higher educational degrees. This finding goes in line with those reported by Tsuzuki *et al.* where a higher educational level was a major contributor to sufficient knowledge about antibiotics and antimicrobial resistance.[24] Finally, years of clinical practice were predictors of better ASPs perception. The contradictory result was reported by Liu *et al.* where the number of years of clinical practice and experience was not significant predictors of knowledge, attitudes and practices related to antibiotic prescribing.[25]

Despite the fact that having an infectious disease specialist physician patrolling all in-hospital antibiotic use is reported to benefit patients and antibiotic resistance containment,[26] reported ID specialist consultation in this study was still suboptimal. In the current study, ID specialists or clinical pharmacists were frequently consulted in cases of antibiotic-use ambiguity. Yet, rare or occasional collaboration with peer healthcare providers was also reported by one-fourth of participants. One of the potential barriers that

Table 2 Perception of participants toward ASPs[1]

Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
ASPs improve patient care and outcomes	6 (2.2)	1 (0.5)	30 (11.2)	94 (35.2)	136 (50.9)
ASPs should be incorporated at all clinical practice levels	3 (1.1)	1 (0.4)	21 (7.9)	87 (32.7)	154 (57.9)
ASPs can decrease antimicrobial resistance	2 (0.7)	4 (1.5)	22 (8.1)	102 (37.8)	140 (51.9)
Adequate training to physicians/pharmacists on appropriate antimicrobial prescribing/recommending is essential	1 (0.4)	2 (0.7)	11 (4.1)	71 (26.3)	185 (68.5)
ASPs-related conferences, workshops and other educational activity can enhance physicians\pharmacists understanding of ASPs	3 (1.1)	3 (1.1)	20 (7.4)	104 (38.5)	140 (51.9)
Individual efforts in improving antimicrobial use are less efficacious than ASPs in containing antimicrobial resistance	7 (2.6)	24 (8.9)	60 (22.2)	105 (38.9)	74 (27.4)
I think that the prescribing physicians/recommending pharmacists are the only professionals who need to understand ASPs	28 (10.4)	114 (42.2)	41 (15.2)	61 (22.6)	26 (9.6)
Pharmacists have a responsibility to take prominent role in ASPs in health system.	11 (4.1)	46 (17.1)	29 (10.7)	107 (39.6)	77 (28.5)

[1]Note: perceptions were assessed by giving 1 to strongly disagree, 2 to disagree, 3 to neutral, 4 to agree and 5 to strongly agree.

Table 3 Practices of participants toward ASPs[1]

Item	Never	Rarely	Occasionally	Often	Always
I prescribe/recommend antimicrobials based on complete clinical information.	2 (0.7)	7 (2.6)	41 (15.2)	138 (51.1)	82 (30.4)
I use microbiology test results when selecting/recommending antimicrobial therapy.	8 (2.9)	30 (11.1)	71 (26.3)	86 (32.0)	74 (27.5)
I screen the local guidelines and pathogens resistance patterns before prescribing/ recommending antimicrobials.	8 (2.9)	40 (14.9)	69 (25.7)	102 (37.9)	50 (18.6)
I collaborate with other health professionals to select the most appropriate antimicrobial regimen.	8 (2.9)	21 (7.8)	55 (20.4)	116 (43.0)	70 (25.9)
I communicate with other pharmacist/clinical pharmacist or Infectious Disease (ID) specialist, if I am unsure about the appropriateness of an antibiotic prescription.	10 (3.7)	23 (8.6)	43 (16.0)	108 (40.0)	85 (31.6)
I sought additional clinical information (e.g. drug interaction, ADRs, allergy, etc.) before deciding to prescribe an antibiotic.	4 (1.5)	14 (5.2)	46 (17.0)	124 (45.9)	82 (30.4)
I take part in local antimicrobial awareness campaigns to promote the optimal use of antimicrobials.	43 (16	89 (33.0)	61 (22.6)	51 (18.9)	26 (9.6)
I educate patients on the use of antimicrobials, and resistance-related issues.	10 (3.7)	22 (8.1)	82 (30.4)	101 (37.4)	55 (20.4)
I make efforts to prevent or reduce the transmission of infections within the setting of my practice.	3 (1.1)	16 (5.9)	71 (26.3)	117 (43.3)	63 (23.3)
I ask the patients about their knowledge of prescribed/recommended antimicrobials and its usage.	11 (4.1)	40 (14.8)	84 (31.1)	96 (35.6)	39 (14.4)
I review the results of microbiology cultures daily and de-escalate as needed	10 (3.7)	38 (14.1)	51 (19.0)	113 (42.0)	57 (21.2)
I review the status of the patient and switch IV antimicrobials to PO as needed.	6 (2.2)	10 (3.7)	52 (19.3)	103 (38.1)	99 (36.7)
I am aware of the list of antibiotics that need preauthorization before prescribing in my practice setting.	8 (2.9)	17 (6.3)	52 (19.3)	87 (32.2)	106 (39.3)
I optimize the prescribed/recommended dosage of antimicrobials for organisms with reduced susceptibility.	2 (0.7)	19 (7.0)	52 (19.3)	125 (46.3)	72 (26.7)
I adjust antimicrobials dosage based on current organ (e.g. liver, kidney) functions.	2 (0.8)	9 (3.4)	18 (6.7)	85 (31.8)	153 (57.3)
I review evidence-based practice guidelines for specified antibiotic agent.	3 (1.1)	29 (10.9)	47 (17.6)	124 (46.4)	64 (24.0)

[1]Note: practices were assessed by giving 1 to never, 2 to rarely, 3 to occasionally and 5 to always.

hinder effective collaboration with healthcare peers includes poor staff cooperation in implementing recommendations targeting improved antibiotic utilization.[19] The limited number of ID specialists in Jordan increases the burden on the specialists, making it overwhelming to accept in-hospital as well as tele-ASPs consultations.

In our study, a large proportion of practitioners realized the importance of educational activity in enhancing ASPs understanding. Similarly, comprehensive ASP training and education was sought by clinicians in a cross-sectional study conducted in Saudi Arabia, another developing country.[27] Likewise, fruitful improvement in healthcare practitioner's knowledge, attitude and practice was attained after an interventional ASP educational activity delivered to practitioners and pharmacists in Egypt (part of EMR).[28] Education is an integral part of ASP since it involves changes in practices and behaviours towards antibiotics.[26] ASPs awareness campaigns and integrations of ASPs educational modules to under and postgraduate levels of study are part of the Jordanian national plan to combat antibiotic resistance.[13] This was validated by our results as we showed healthcare providers with more years of experience, a higher level of education and those working in academic settings to have a higher level of perception towards ASP.

In terms related to ASPs practices, this study also revealed that patient counseling regarding the prescribed antibiotics was not optimal. This finding further highlights those reported by Chen et al where knowledge and education about prescribed antibiotics was a major predictor of adherence to prescribed antibiotics.[29] In addition, proper adherence to the prescribed antibiotic was reported in another study as one of several recommended measures to limit

Table 4 Comparing factors affecting ASP perception scores

Variable	Median [IQR]	*P*-value
Gender		**0.0028**
Male	32 [30–34.5]	
Female	34 [31–35.75]	
Age (year)		0.9961
20–30	33 [30–35]	
>30	33 [31–35]	
Education		**0.0328**
Bachelor	33 [30–35]	
Masters	34 [31–36]	
Level of practice		**0.0159**
MD	33 [30–34.25]	
Pharmacist	34 [31–36]	
Years of experience		**0.0335**
1–4 years	33 [30–35]	
≥ 5 years	34 [32–36]	
Practice setting		**0.0007**
Academic	35 [30.25–36.75]	
Governmental	32 [30–34]	
Private	34[32–35]	

antibiotic resistance.[30] The reasons behind poor antibiotic education must be fully understood to design intervention strategies targeting this problem. Based on the current understanding of the EMR healthcare situation, this issue can be partially explained by a lack of national training on antimicrobial resistance and occupational pressure due to higher patient to staff ratios.[13]

Results of the current study also revealed potential ASPs misconceptions among participants. While more than half of participants believed that ASPs is a multidisciplinary approach that extends to include other healthcare professionals beyond physicians and pharmacists, one-third of participants signified that pharmacists and physicians are the only healthcare providers that should understand ASPs. The results of a study conducted by Cotta *et al.* concluded that implementation of effective ASP requires engagement with all healthcare professionals involved in antimicrobial use.[31]

Noteworthy, the results of our study are in line with those of a study conducted in a hospital setting. In a retrospective study that assessed hospital pharmacist ASPs perceptions and practices, most respondents agreed that ASP improves patient care, yet active involvement in ASP activity was sub-optimal.[32] Similar results were retrieved from multiple other studies that included community rather than hospital pharmacists.[20, 33, 34] Implementation of well-established ASPs requires a liberal financial budget, however, no single Jordanian hospital was found to have ASPs dedicated budget to improve antibiotic utilization.[19] Jordan is a developing country with limited finical resources. As reported by the WHO, low income, internal conflicts and receiving a large number of refugees complicate antibiotic-resistance control efforts in EMR.[14] The lack of financial support for ASPS activity is another obstacle.

The complexity of medical decision making regarding antibiotic use requires flexibility in ASP implementation. Recent experience demonstrates that ASP can be successfully implemented in different healthcare settings, assuming that it is led by competent, synergistic professionals.[16] Implementing the antimicrobial stewardship program in hospitals was found to improve the appropriateness of antibiotic use, decrease treatment failure rates and reduce healthcare-related costs.[18] All those benefits are used as an example in support of this multifaceted and multidisciplinary approach.[17, 35] The involvement of healthcare professionals as facilitators in planning and implementing ASPs in clinical practice is of paramount importance to ensure the applicability, and identify potential challenges against adherence to such programs.[36–38]

According to the CDC, in the USA, one out of every three antibiotic prescriptions is unnecessary.[39] In Jordan, self-medication with antibiotics reaches a high percentage of 39.5% within the population.[40] Antibiotics are bought over the counter, given the lack of enforced regulatory policies and unfair access to the healthcare system.[14] Other common practices that can enhance the development of antibiotic resistance include: prescribing multiple courses of antibiotics, using extended durations of antimicrobial treatment, empiric coverage of simple infections with broad-spectrum antibiotics and using antibiotics in treating viral infections.[13] Culture related issues coupled with the lack of enforced regulatory laws, drive such practices by Jordanian healthcare practitioners.[41] Combating antimicrobial resistance was not a high priority in the EMR, as reported by WHO.[14]

The strengths of our study lied in providing novel evidence of Jordanian practitioners' perceptions and practices with regard to antimicrobial stewardship programs in the healthcare system of Jordan. Additionally, the recruited sample size adds to the strength of the current study. Moreover, the antibiotic prescribing process was investigated from the perspective of both physicians and pharmacists. However, our study has some limitations. Firstly, the practice patterns reported by practitioners were not validated in the light of their affiliated institutions as such policy forced practice may influence overall ASPs perception and practices. Furthermore, the conduction of face-to-face interviews could have induced bias in answering some questions as such collection method may induce stigmatization related to suboptimal perception and practices related to different aspects of ASPs.

Conclusion

This study revealed overall positive ASPs perceptions along with some poor ASPs practices by Jordanian practitioners in hospital settings. Regulatory authorities are urged to reverse the trend of antibiotic resistance through rigorous enforcement of antibiotic-related regulations to help improve current practices related to antibiotic use. An educational intervention to promote prescribers' knowledge about ASPs is the foremost step in improving healthcare provider's perception regarding antimicrobial stewardship programs. Thus, an ultimate improvement in antimicrobial prescribing practices to better align with those dictated by the CDC is an expected reflection to the initial improvement in perceptual knowledge achieved through ASPs educational campaigns. Resilient ASPs strategies, as aligned by the Jordanian national plan to combat antibiotic resistance, must be activated.

Supplementary Material

Supplementary data are available at *Journal of Pharmaceutical Health Services Research* online.

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Authors Contributions

RK conceived and designed the work, and was a major contributor in writing the manuscript. MA analyzed and interpreted participants' data regarding ASP

perceptions, practices, and factors affecting perception scores. SA contributed to interpretation of data, and critically revised the manuscript. All authors read and approved the final manuscript.

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Conflicts of Interest

There are no conflicts of interest to declare.

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