

Knowledge, attitude, and practice of antibiotics use among primary healthcare physicians, Ministry of Health, Jeddah

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ABSTRACT

Background: Overuse of antibiotics is considered a major public health problem on a global level and leads to existence and spread of antibiotic-resistant bacterial strains in all settings. **Objectives:** To explore the knowledge, attitude, and practice of primary healthcare physicians regarding antibiotic use. **Methods:** A cross-sectional study was conducted at a random sample of primary healthcare centers (PHCCs), belonging to Ministry of Health, in the city of Jeddah, Saudi Arabia. All primary healthcare physicians working at chosen PHCCs were recruited. A self-administered questionnaire was used for data collection. It includes five sections; socio-demographic characteristics of physicians, 11 statements to assess knowledge about antibiotic use, 6 statements to assess attitude toward antibiotic use, 6 statements concerning practice of antibiotic prescription, and 12 statements about factors influencing antibiotic prescription. **Results:** The study included 163 primary care physicians. The age of 58.9% ranged between 31 and 40 years. Approximately two-thirds of them were females (64.4%), and majority were Saudi nationals (98.8%). History of attending training courses in antibiotic use and resistance was reported by 47.9% of the physicians. The median (Interquartile range) of knowledge score percentage was 63.64 (45.45-81.82). It was abnormally distributed (p-value of Shapiro-Wilk test was 0.001). Physicians who reported previous attendance of courses in antibiotic use and resistance were more knowledgeable regarding antibiotics use and resistance compared to those who did not attend such courses (Mean ranks were 91.04 and 73.70, respectively (p = 0.018)). Most of the physicians agreed that taking antibiotics as prescribed minimize its side effects (81.6%), and taking antibiotics without rationale indication increase its side effects (81%). Male physicians were more likely than females to agree that use of antibiotics in case of viral infection prevents secondary bacterial infection (27.6% versus 10.5%), $P < 0.001$. Majority of the participants would increase antibiotic prescription in cases of purulent discharge (83.5%) and to prevent complications (71.1%). **Conclusion:** Knowledge and practice of primary healthcare physicians in Jeddah city regarding antibiotics use and resistance needs improvement. However their attitude toward them was acceptable. Improvement of their knowledge and continuous monitoring of their practice in this regard are warranted.

Keywords: Antibiotics, attitude, knowledge, overuse, physicians, practice, primary care

Introduction

Overuse of antibiotics is considered a major public health problem on a global level and leads to existence and spread of antibiotic-resistant bacterial strains in all settings.^[1-4]

Failure of antibiotic therapy as a result of bacterial resistance results in higher mortality and morbidity rates as well as

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prolonged hospital stay.^[5,6] In most areas of the globe, antibiotics are usually sold to costumers outside the healthcare settings without a medical prescription.^[5]

Numerous factors influence antibiotic prescription including institutional, social, cultural as well as political factors necessitating development of new interventional strategies to overcome the situation.^[1]

Many studies carried out on global basis have demonstrated that physicians often prescribe antibiotics, based on patient request and pressure rather than actual patient need which results in overprescription.^[7-9] It has been documented that the overuse antibiotic prescribing patterns influenced significantly by behavioral characteristics of both patients and physicians.^[10]

Understanding of the knowledge, attitudes, and practices (KAP) of primary care physicians toward antibiotic resistance is essential in changing their antibiotic prescribing behavior.^[11] Several studies on KAP of primary care physicians about antimicrobial resistance have been conducted worldwide, with relatively few studies carried out among primary care physicians in Saudi Arabia.^[12]

Over prescribing of antibiotic use is a common practice in the Kingdom of Saudi Arabia, which represents a major public health challenge. Despite the importance of assessing the knowledge, attitude and practice of primary healthcare physicians regarding antibiotics, it is rarely investigated in Saudi Arabia, with up to our knowledge no cited study from Jeddah. Therefore, this study aims to explore the knowledge, attitude, and practice of primary healthcare physicians regarding antibiotic use to facilitate development of interventional program to improve their practice and attitude.

Materials and Methods

A cross-sectional study was conducted at primary healthcare centres (PHCCs), belonging to Ministry of Health, in the city of Jeddah, Saudi Arabia, where there are 47 PHCCs distributed over five main sectors. These centres provide primary care services to diverse patient population across the city, and are considered the first point of contact between patients and the healthcare system. All PHC physicians working at these centres were eligible for inclusion in the study (estimated number is 240).

By using Epi-info version 7, the calculated sample size was 148 PHC physicians based on the following assumptions: the expected frequency of adequate knowledge regarding antibiotics as 50% (since there is no specific figure), confidence interval (95%, and acceptable margins of error) 5%). The sample was increased by 10% to compensate for the possible drop-out.

A self-administered questionnaire was used for data collection. It is adopted from previous studies carried out in China,^[11] Saudi Arabia^[12] and India.^[13] The questionnaire includes five sections. The first section: Sociodemographic characteristics. The second

section includes 11 statements to assess knowledge, previously used in a study carried out by Liu *et al.*^[11] in China. The third section include six statements to assess attitude toward antibiotic use with three likely responses (Agree, neutral, and disagree), and the forth section includes six statements concerning practice of antibiotic prescription with three responses (yes, no, and not sure). They were adopted from another Saudi study.^[12] The fifth section include 12 statements about factors influencing antibiotic prescription, with 3 possible responses (would increase prescription, would decrease prescription and no change), this part was taken from an Indian study.^[13]

Stratified random sampling technique with proportional allocation was adopted to select primary healthcare centres, representing all the five sectors in Jeddah. Consequently, all physicians in the selected PHCCs were invited to fill the study questionnaire.

Approval of the regional research and ethics committee was obtained and also written consent from PHC, MOH administration. The researcher asked written consents from all participants. The confidentiality of personal data was granted for all participants in the study.

Statistical package for social sciences (SPSS) program, version 26 was utilized for the statistical analysis. Level of significance was determined at *P* values (equal or <0.05). Descriptive statistics were presented in the form of frequency and percentage for categorical variables and mean \pm Standard deviation (SD) for continuous variables. Chi-square test was utilized for statistical analysis to test for association between categorical variables.

Results

Sociodemographic characteristics

The study included 163 PHC physicians. Table 1 presents their sociodemographic characteristics. The age of 58.9% ranged between 31 and 40 years. Approximately two-thirds were females (64.4%), married (69.9%), and majority were Saudi nationals (98.8%). Almost half (49.2%) were MBBS holders and 42.3% were Family Medicine Board certified. More than one-third (39.8%) of them had <5 years of experience.

History of attending training courses in antibiotic use and resistance was reported by 47.9% of the primary healthcare physicians.

Antibiotic-related practice

Most (75.5%) of the physicians have seen more than 20 patients per day in their practice. Majority (81.6%) of them have prescribed less than five antibiotics per day on the average.

Knowledge of antibiotic use

Majority of the physicians agreed that Amoxicillin is a safe antibiotic product for pregnant patients (92.7%) whereas almost three-quarters of them agreed that Metronidazole has the best

activity against anaerobes (76.7%), and antibiotics should not be prescribed for non-febrile diarrhea (75.4%). On the other hand, 30.1% of them agreed that Aminoglycosides are very active if they are administered as parenteral once daily Table 2.

The median (Interquartile range) of the knowledge score of antibiotic use was 63.64 (45.45-81.82). It was abnormally distributed (p-value of Shapiro–Wilk test was 0.001).

Physicians who reported previous attendance of courses in antibiotic use and resistance were more knowledgeable regarding antibiotics use and resistance compared to others (Mean ranks were 91.04 and 73.70, respectively (p = 0.018) Table 3.

Table 1: Sociodemographic characteristics of primary healthcare physicians, Ministry of Health, Jeddah

	Frequency	Percentage
Age in years		
25-30	43	26.4
31-40	96	58.9
>40	24	14.7
Gender		
Male	58	35.6
Female	105	64.4
Nationality		
Saudi	161	98.8
Non-Saudi	2	1.2
Marital status		
Single	41	25.2
Married	114	69.9
Divorced/widowed	8	4.9
Educational level		
MBBS	80	49.2
Diploma	11	6.7
Master	3	1.8
Family Medicine Board	69	42.3
Experience in years		
<5	65	39.8
5-10	57	35.0
>10	41	25.2

Attitude toward antibiotic use

Most of the physicians agreed that taking antibiotics as prescribed, minimize its side effects (81.6%), taking antibiotics without rationale indication increase its side effects (81%) whereas only 16.6% agreed that use of antibiotics in case of viral infection prevents secondary bacterial infection.

Male physicians were more likely than females to agree that use of antibiotics in case of viral infection prevents secondary bacterial infection (27.6% versus 10.5%), $P < 0.001$. Almost two-thirds (62.8%) of young physicians (25–30 years) compared to 37.5% of those aged over 40 years agreed that patient’s economic status affects selection of antibiotic prescription, $P = 0.008$. Most (75.6%) of highest experience physicians (>10 years) compared to 64.9% of moderate experienced physicians (5–10 years) agreed that use of antibiotics leads to decline in morbidity and mortality of infectious diseases, $P = 0.030$. Physicians who reported attendance of courses in antibiotic use and resistance were less likely to disagree that taking antibiotics without rationale indication increase its side effects compared to those who did not attend such courses (9.4% vs. 1.3%), $P = 0.029$. Physicians who reported five or more antibiotics prescriptions/day were more likely to agree that use of antibiotics leads to relief of infectious symptoms compared to those prescribed less antibiotics (76.7% vs. 53.4%), $P = 0.004$ and also they were more likely to agree that use of antibiotics leads to decline in morbidity and mortality of infectious diseases (86.7% vs. 64.7%), $P = 0.020$ and taking antibiotics without rationale indication increase its side effects (96.7% vs. 77.4%), $P = 0.014$.

Practice of antibiotic prescription

Majority (90.8%) of the physicians reported that in the absence of laboratory confirmation of bacterial infection, one or more of the symptoms of high fever, bad general condition, enlarged, palpable, or tender lymph node, inflamed tonsils, localized inflammation, long duration of symptoms) made them prescribed antibiotics and thought that educating the patient regarding antibiotic use will have an effect on their expectation in a later

Table 2: Responses of the primary healthcare physicians, Ministry of Health, Jeddah, to knowledge statement concerning antibiotic use

	Agree n (%)	Neutral n (%)	Disagree n (%)	Don't know n (%)
Antibiotics should not be prescribed for non-febrile diarrhea	123 (75.4)	19 (11.7)	20 (12.3)	1 (0.6)
Antibiotics should not be prescribed for upper respiratory tract infections	82 (50.3)	37 (22.7)	43 (26.4)	1 (0.6)
Dosage reduction of antibiotics is needed for renal failure	113 (69.3)	19 (11.7)	10 (6.1)	21 (12.9)
Amoxicillin is a safe antibiotic product for pregnant patients	151 (92.7)	9 (5.5)	1 (0.6)	2 (1.2)
Metronidazole has the best activity against anaerobes	125 (76.7)	23 (14.1)	4 (2.5)	11 (6.7)
Methicillin resistant staphylococcus aureus is resistant to beta-lactam antibiotics	99 (60.7)	15 (9.2)	12 (7.4)	37 (22.7)
Ceftriaxone most effectively crosses the blood-brain barrier	90 (55.3)	25 (15.3)	9 (5.5)	39 (23.9)
Aminoglycosides are very active if they are administered as parenteral once daily	49 (30.1)	35 (21.5)	13 (8.0)	66 (40.4)
Bacterial pneumonia (including one of the following symptoms: fast breathing, chest in-drawing, or stridor) requires antibiotic treatment	120 (73.6)	22 (13.5)	17 (10.4)	4 (2.5)
Antibiotics do not reduce the duration and the occurrence of complications of upper respiratory tract infections	64 (39.3)	29 (17.8)	67 (41.1)	3 (1.8)
The average number of patients taking antibiotics should be below 30 per 100 in a primary care facility	103 (63.3)	25 (15.3)	11 (6.7)	24 (14.7)

Table 3: Factors affecting level of knowledge about antibiotic use among primary healthcare physicians, Ministry of Health, Jeddah

Variables	Percentage of the knowledge score			P
	Median	IQR	Mean rank	
Age in years				
25-30 (n=43)	54.55	45.45-72.73	72.59	0.255**
31-40 (n=96)	63.64	45.45-81.82	86.67	
>40 (n=24)	54.55	38.64-81.82	80.17	
Gender				
Male (n=58)	54.55	43.18-72.73	75.16	0.166*
Female (n=105)	63.64	45.45-81.82	85.78	
Nationality				
Saudi (n=161)	63.64	45.45-81.82	81.80	0.640*
Non-Saudi (n=2)	72.73	45.45-72.73	98.50	
Marital status				
Single (n=41)	63.64	50-81.82	82.91	0.562**
Married (n=114)	63.64	45.45-81.82	80.50	
Divorced/widowed (n=8)	72.73	56.82-81.82	98.69	
Educational level				
MBBS (n=80)	54.55	45.45-72.73	73.56	0.059**
Diploma (n=11)	72.73	36.36-81.82	84.95	
Master (n=3)	54.55	27.27-54.55	51.83	
Family Medicine Board (n=69)	72.73	54.55-81.82	92.63	
Experience in years				
<5 (n=65)	54.55	45.45-72.73	71.72	0.067**
5-10 (n=57)	72.73	45.45-81.82	87.13	
>10 (n=41)	63.64	54.55-81.82	91.16	
Previous attending courses in antibiotic use and resistance				
No (n=85)	54.55	45.45-72.73	73.70	0.018*
Yes (n=78)	63.64	54.55-81.82	91.04	
Average number of patients seen per day				
<5 (n=3)	54.55	36.36-54.55	70.0	0.856**
5-20 (n=37)	54.55	45.45-81.82	80.0	
>20 (n=123)	63.64	45.45-81.82	82.89	
Average frequency of prescribing antibiotics per day				
<5 (n=133)	63.64	45.45-81.82	80.49	0.267**
5-10 (n=26)	59.10	52.27-81.82	84.10	
>10 (n=4)	81.82	68.18-81.82	118.63	

*Mann-Whitney test. **Kruskal-Wallis test

consultation (87.8%). On the other hand, only 13.5% of them reported that if their workload was high, they more likely to prescribe antibiotics to relieve patient worry quickly.

Male physicians were more likely compared to female physicians to prescribe antibiotics to relieve patient worry quickly, if their workload is high (27.6% vs. 5.7%), $P < 0.001$. Physicians aged between 25 and 30 years were more likely compared to those aged over 40 years (18.6% vs. 0%) to prescribe antibiotics to relieve patient worry quickly, if their workload is high, $P = 0.032$. MBBS holder physicians were more likely than family Medicine Board-certified physicians to believe that if they do not prescribe antibiotics, patients will feel their illnesses are not taken seriously (60% vs. 37.7%), $P = 0.013$. More than one-third (38.5%) of low experienced physicians (<5 years) compared to 26.3% of those who had 5–10 years of experience thought that if an antibiotic prescription is issued, the consultation will be short, $P = 0.045$. Physicians who did not attend training courses in antibiotics use and resistance were more likely than who attended such courses to feel under pressure if

their patient expects antibiotic prescription (45.9% vs. 20.5%), $P = 0.003$ and were more likely to prescribe antibiotics to relieve patient worry quickly, If their workload is high (17.6% vs. 9%), $P = 0.045$.

Factors influencing antibiotic prescription

Majority of the participants would increase antibiotic prescription in cases of purulent discharge (83.5%) and to prevent complications (71.1%) while minority would increase antibiotic prescription in cases of patient satisfaction (11.7%), drug promotion (10.4%), patient request/expectation (9.8%), antibiotic resistance concerns (9.2%), and lastly, medication cost (6.7%) Figure 1.

Discussion

Physicians and in particular primary care ones play an important role in antibiotic prescription and usage,^[14,15] which in turn if misused and/or overused will contribute in development of antibiotic resistance,^[16-18] which is nowadays considered a global

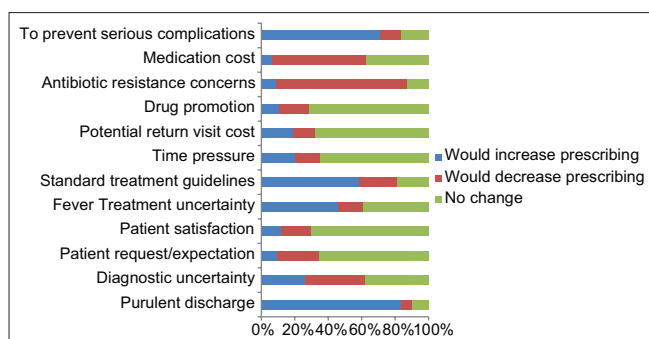


Figure 1: Factors influencing antibiotic prescription among the participants

health burden.^[19] Furthermore, it has been hypothesized that physicians' knowledge and attitude toward antibiotic use and resistance are correlated with practice of antibiotic prescription. Recently in China,^[20] physicians with higher knowledge score regarding antibiotic and its resistance prescribed less antibiotics. However, results of most research studies indicated that despite knowledge has an important role in physicians response to different factors originating from patients and colleagues, these responses are not always associated with practice of antibiotic prescription.^[11] In this context, the present study explored the knowledge, attitude, and practice of primary healthcare physicians in Jeddah, Saudi Arabia, regarding antibiotic use with the aim of facilitating development of interventional program to improve their attitude and consequently practice of antibiotic prescription.

In the current study, the knowledge of the physicians regarding antibiotics was average as the median (Interquartile range) was 63.64 (45.45-81.82). In China,^[21] very close figure to what has been reported in the present study was reported with the mean \pm standard deviation of knowledge of the physicians was 6.3 ± 1.8 , based on a total score of 10. In other recent Chinese studies,^[11,20] also, comparable levels of knowledge regarding antibiotics were reported as nearly 55% and 62.8% of correct answers were observed, respectively. Other international studies reported rates ranged between 60–86%.^[22-24] Recently in Jeddah (2020),^[25] almost two-thirds (63%) of the first year medical and other health allied fields colleges students expressed a moderate level of knowledge about antibiotic use. Comparison between various studies carried out locally or internationally should be seen in the light of using different tools in assessing knowledge as well as different demographic characteristics of the participants as in the present study we included PHC physicians while in some other studies, they included hospital physicians or even medical students in addition to PHC physicians.

Previous attendance of courses in antibiotic use and resistance was a significant predictor for better knowledge in this study. Similarly, in China,^[21] physicians attending courses on antibiotics had better knowledge of antibiotics. In South India,^[13] knowledge of the physicians about antibiotic resistance was significantly associated with receiving periodic updates regarding bacterial

resistance patterns and attending courses on antibiotics. Additionally, those working at internal medicine department, or working as chief physicians or working at tertiary care hospitals expressed better knowledge about antibiotics compared to those working in secondary hospitals or primary healthcare settings. In the present study, Family Medicine Board holders' physicians were more knowledgeable than others, although not reaching a critical significant value.

In agreement with the finding of a study carried out in the United States (2016),^[26] physicians' experience was not associated with their knowledge level about antibiotic resistance in the current study.

In the present study, most of the physicians agreed that taking antibiotics as prescribed minimize its side effects (81.6%) whereas only 16.6% agreed that use of antibiotics in case of viral infection prevents secondary bacterial infection. Conflicting results were reported in other Saudi studies. In Riyadh (2015),^[27] more than half physicians (56.1%) perceived antimicrobial resistance as an important problem in their daily practice and 69.8% perceived it as a significant national problem. Inappropriate empirical therapy (47.6%) and excessive utilization of antimicrobials in healthcare settings (31.1%) were the main contributors to increasing bacterial resistance according to the physicians' belief. A study done in AlQassim city,^[12] a significant belief among physicians that symptoms of viral upper respiratory tract infection are relieved by using antibiotics. Also, they believed that taking antibiotics without rational indication increases the side effects. Additionally, physicians believed that the main factors for development of antibiotic resistance were inadequate (treatment duration) prescription, use without prescription, and non-adherence of as well as they considered bad practice of pharmacists as one of the important contributing factors to the development of antibiotic resistance. In Jeddah,^[25] 25.7% the first year medical and other health allied fields colleges students thought that taking antibiotics could help faster recover when having cold symptoms. Similarly, other studies reported positive attitude concerning dealing with pressures from consumers to prescribe antibiotics.^[11,28] In Ghana (2018),^[29] about a third of physicians (30.1%) perceived antibiotic resistance as very important worldwide problem. However, other studies documented costumers' pressure may be main factor for antibiotics prescription.^[30,31] Again, variations in the physicians' characteristics might explain difference in their attitude toward antibiotic prescription.

In the current study, less experienced physicians were more likely to believe that if an antibiotic prescription is issued, the consultation will be short. On the other hand, more experienced physicians were more likely to agree that use of antibiotics leads to decline in morbidity and mortality of infectious diseases. In line with this finding, in South India,^[13] more experienced physicians were less likely to follow a rational antibiotic use for uncomplicated bronchitis and acute gastroenteritis.

This study revealed that the majority (90.8%) of the physicians reported that in the absence of laboratory confirmation of

bacterial infection, one or more of the indicating symptoms made them prescribed antibiotics and in addition they thought that educating the patient regarding antibiotic use will have an effect on their expectation in a later consultation (87.8%). In AlQassim (Saudi Arabia),^[12] most of the PHC physicians have chosen high fever as the symptom that enforced them to prescribe antibiotics in case of absence of laboratory confirmation. In another Saudi study, physicians were against a regulation to prohibit antibiotic prescription in case of absence of laboratory confirmation.^[32] On the other hand, only 13.5% of the PHC physicians in the present study reported that if their workload was high, they more likely to prescribe antibiotics to relieve patient worry quickly. In Jeddah (2015),^[32] about one-third (33%) of the general physicians depended upon parent's demand for the choice of antimicrobials as compared to only 13.2% of the residents, and minority (4.3%) of the specialists. Furthermore, general physicians were more likely to prescribe expensive antimicrobial agents (70.4%) compared to 26.4% and 30.4% of residents and specialists, respectively.

In the present study, majority of the PHC physicians would increase antibiotic prescription in cases of purulent discharge and to prevent complications while minority would increase antibiotic prescription in cases of patient satisfaction, drug promotion, patient request/expectation, antibiotic resistance concerns, and lastly, medication cost. In India,^[9] factors that influenced PHC physicians to prescribe antibiotics were unsure diagnosis, perceived patients' expectation and demand, practice sustainability and financial issues, pressure from medical representatives and insufficient knowledge. Additional factors were mentioned by public sector physicians such as overstocked and near-expiry drugs as well as lack of time. In Spain (2012),^[33] a qualitative research through focus group discussion with five groups of general practitioners identified factors influencing their antibiotic prescribing as insufficient knowledge, fear, self-satisfaction, and external responsibility of the pharmaceutical industry, patients, as well as over-the-counter antibiotics. However, they believed that antibiotic resistance is not a problem at a community level. Reluctance to respond to customer's pressures was observed among Chinese primary healthcare physicians.^[11] In AlQassim,^[12] most of the PHC physicians reported that they feel being under pressure.

Limitations of the present study included the following

- Conduction of the study in primary healthcare settings in one city of the Kingdom of Saudi Arabia (Jeddah) could influence the ability to generalize our findings over other settings in Jeddah and outside it.
- Information about practice was obtained through self-reporting rather than observation, which may lead to an overestimation of the real situation.

Despite those limitations, the study could have a public health importance in raising and understanding this important issue in

our community, where the over prescribing of antibiotic use is a common practice.

Conclusion

Knowledge of PHC physicians in Jeddah city regarding antibiotics use and resistance needs improvement. Physicians who reported previous attendance of courses in antibiotic use and resistance were more knowledgeable compared to their peers. Their attitude toward antibiotic use and resistance is mostly acceptable as majority of them agreed that taking antibiotics as prescribed minimize its side effects and taking antibiotics without rationale indication increase its side effects the use of antibiotics in case of viral infection does not prevent secondary bacterial infection. Regarding their practice, majority of them reported that in the absence of laboratory confirmation of bacterial infection, some symptoms will make them to prescribe antibiotics and they thought that educating the patient regarding antibiotic use will have an effect on their expectation in a later consultation. Majority of them would increase antibiotic prescription in cases of purulent discharge and to prevent complications while minority would increase antibiotic prescription in cases of patient satisfaction, drug promotion, patient request/expectation, antibiotic resistance concerns, and lastly, medication cost.

According to the present study's findings, the following are recommended

1. Improvement of knowledge of PHC physicians regarding antibiotic use and resistance through organizing continuous medical education activities with accredited hours.
2. Continuous monitoring of the practice of PHC physicians concerning antibiotic prescription.
3. Further in-depth study is needed to explore the underlying reasons for irrational use of antibiotics among PHC physicians.

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Conflicts of interest

There are no conflicts of interest.

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