

# Drug prescription behavior: A cross-sectional study in public health facilities in two states of North India

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## Abstract

**Background:** Poor prescription practices result in increased side effects, adverse drug reactions, and high cost of treatment. The present study was undertaken to describe the drug-prescribing patterns in two North Indian states through prescription auditing.

**Materials and Methods:** The study was carried out in 80 public health facilities across 12 districts in two states of Haryana and Punjab (6 in each) covering all levels of care. The information from prescription slips was abstracted on a structured pro forma for all patients who visited the pharmacy of the health facility.

**Results:** A total of 1609 prescriptions were analyzed. On an average, 2.2 drugs were prescribed per patient. Nearly 84% of the drugs were prescribed from the essential drug list (EDL). Antibiotics were prescribed in 45.3% of prescriptions, followed by vitamins (34.8%) and nonsteroidal anti-inflammatory drugs (33.9%). Drugs were prescribed in their generic names in 70% of cases. Diseases of the ear, nose, and throat (18%) were most common followed by the diseases of the gastrointestinal and renal (17%) and musculoskeletal system (16%). Only 40% of children suffering from diarrhea received oral rehydration salts while 80% of them received antibiotics. Among cases of upper respiratory tract infection, nearly 75% received antibiotics.

**Conclusion:** The results of this study raise concerns about the overuse of antibiotics although most of the drugs (84%) were from the EDL and in generic names (70%). There is lack of data regarding prescription practices which necessitates real-time prescription monitoring through online data entry and transmission.

**Keywords:** Antibiotic abuse, drug prescriptions, India, prescription drug misuse, rational drug therapy

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## INTRODUCTION

Prescription of medicines is a crucial component of patient care. Rational use of drugs has become an important public health issue because of inappropriate drug prescribing.<sup>[1,2]</sup> Worldwide, >50% of all medicines are prescribed, dispensed, or sold improperly and 50% of patients fail to take them properly.<sup>[3]</sup> It has been frequently observed that doctors are resorting to polypharmacy

promoting unnecessary use of tonics and other medications under the influence of drug companies and overlooking drug interactions. This has resulted in increased side effects, adverse drug reactions, and high cost of treatment.<sup>[3,4]</sup> Overuse of drugs such as antibiotics, painkillers, injections, and cough and cold preparations is quite common.<sup>[5,6]</sup> Injections, still considered as powerful and quick-acting, are widely overused.<sup>[7,8]</sup> There is enough evidence to

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suggest that poor-quality prescription writing increases the risk of serious medication errors.<sup>[9]</sup> A combination of prescription audit and feedback has been shown to be a successful technique which improves the quality of prescribing.<sup>[10]</sup> Prescription audit forms a part of drug utilization studies. It is a potential tool for promotion of rational drug therapy. In view of the plethora of issues related to rational drug prescription and scarcity of data available with regard to drug prescribing, the present study was undertaken to describe the drug-prescribing patterns in two North Indian states through prescription auditing. The World Health Organization (WHO) core drug use indicators for outpatient facilities were used to study the prescribing practices.

The states of Punjab and Haryana have recently institutionalized drug procurement models to provide uninterrupted access to essential medicines free of cost in all public hospitals and health centers and also established standard treatment guidelines for evidence-based practice and rational drug therapy. In this context, the present study reflects the baseline situation and will also serve as a reference to evaluate the impact of various reforms on prescription practices.

## MATERIALS AND METHODS

### Study design

This is a cross-sectional study involving review of prescription slips.

### Study setting

The study was carried out in selected districts of two North Indian states, namely, Haryana and Punjab. The state of Haryana is one of the wealthier states of India with the third highest per capita income in the country in the year 2012–2013. Nearly two-thirds of the 25 million population of the state reside in rural areas.<sup>[11]</sup> Punjab is a prosperous agricultural state with a population of 28 million and about two-third residing in rural areas.<sup>[12]</sup>

### Study population

A multistage stratified random (probabilistic) sampling was followed for district selection. In the first stage, all districts were stratified in three categories based on the human development score, i.e., high, medium, and low status of development.<sup>[13]</sup> Two districts were selected randomly from each stratum in each state. The selected set of districts (12 in numbers) also ensured a geographical representation of the state.

In the second stage, a total of 80 public health facilities were chosen for the study so as to cover all levels of

health-care delivery system, i.e., primary, secondary, and tertiary. The study sample included 1 medical college (MC) from each state and 1 district hospital (DH) from each selected district. We selected almost 30% of community health centers (CHCs) in each district and two primary health cares (PHCs) under each CHC randomly (probabilistic sampling). Overall, within each state, 1 MC, 6 DHs, 11 CHCs, and 22 PHCs were selected for the study. The final sample thus comprised of 2 tertiary care MCs, 12 DHs, 22 CHCs, and 44 PHCs for the two states.

### Data collection

A trained team of investigators visited the selected health facilities with data capture tools. The investigators were postgraduates with previous experience of social science research in health system. Moreover, one member of the team who collected the data was a medical officer. This study is part of a larger study also involving assessment of drug procurement, management, distribution, and pricing. One-week training was undertaken for field investigators to train them on data collection methods and tools. Information from prescription slips was abstracted on a structured schedule for all patients who visited the pharmacy of the health facility. A consecutive selection strategy was adopted. Recruitment was done at the level of pharmacist so that patients from all specialties in a secondary or tertiary health facility could be captured. In case of primary health facility, this ensured that males, females, and children on the day of survey are captured. Besides abstracting information from the prescription slip on a structured schedule, a photograph of the prescription slip was also obtained so as to match the information recorded in case of any clarification. A total of 1609 prescriptions were obtained with an average of nearly 20 per health facility. The data were entered in Excel and exported to SPSS version (Armonk, NY: IBM Corp) 19 for analysis. The WHO core drug use indicators for outpatient facilities were used to study the prescribing practices.

Some of the prescribing indicators that were measured included:

1. The average number of drugs prescribed per encounter was calculated to measure the degree of polypharmacy
2. Percentage of encounters in which an antibiotic was prescribed was calculated to measure the overall use of antibiotics
3. Percentage of drugs prescribed from an essential drug list (EDL)
4. The percentage of prescriptions with errors in prescribing (drug dosage and frequency).

**Ethics**

This study was approved by the Ethical Review Board of Public Health Foundation of India. Necessary administrative approvals were obtained before conducting the study.

**RESULTS**

A total of 1609 prescriptions were analyzed with 877 and 732 prescriptions in Haryana and Punjab, respectively [Table 1]. Majority of them were females (57%) and belonged to the age group of 30–50 years (569, 35.5%), followed by the age group of 15–30 years (443, 27.7%). According to the level of health facility, most of the prescriptions were from the PHCs (821, 51.0%), followed by the CHCs (462, 28.7%) [Table 1].

Overall, an average number of 2.2 drugs were prescribed per patient with similar figures in both the states. The males are prescribed higher (2.3) number of drugs than females (2.2) in Haryana whereas it was similar for both sexes in Punjab. According to the level of health facility, overall, the CHCs prescribed the maximum number of drugs (2.4), followed by the DH (2.2). The average number of drugs prescribed for a patient aged >50 years and between 30 and 50 years was maximum (2.3). Children <5 years are prescribed minimum number of drugs (1.9) [Table 2].

A total of 84% of the drugs were prescribed from the EDL with 83% in Punjab and 85% in Haryana. In Haryana, MC prescribed the maximum proportion of non-EDL drugs (50%) and PHC the minimum (10%) [Figure 1]. However, in Punjab, CHC prescribed the maximum number of non-EDL drugs (22%) and PHC the minimum (13%) [Figure 2].

Out of the total prescriptions analyzed, a total of 1111 (69%) prescriptions had drugs from the EDL only, whereas 404 (25%) of them had some drugs from the EDL and another 83 (5%) of them had no drugs out of the EDL. The proportion of EDL prescription was slightly higher in Haryana (71%) than in Punjab (67%) [Table 3]. Overall, the proportion of EDL prescription was highest in a PHC (77%) and lowest in a MC (39%). MC prescribed the maximum proportion of non-EDL prescriptions. The proportion of both EDL and non-EDL prescription was highest in the age group of 0–5 years. Prescription practices were similar across both sexes [Table 3]. Nearly half of the prescriptions (48.8%) had 2 drugs followed by 3 drugs (27.0%). Only 1.6% of the prescriptions had 5 drugs [Table 4]. Among the various classes of drugs, antibiotics were prescribed in

45.3% of prescriptions, followed by vitamins (34.8%), nonsteroidal anti-inflammatory drugs (33.9%), and antipyretics (27.6%) [Table 5]. Out of the total drugs prescribed, 69.6% of them were prescribed in their generic names. Among children <3 years who were suffering from diarrhea, only 40% received oral rehydration salts while 80% of them received antibiotics. Among cases of upper respiratory tract infection, nearly 75% received antibiotics.

Overall, inappropriate prescribing was found to be 9.2% and 3.0% based on drug dosages and frequency [Table 6].

**Table 1: Basic demographic characteristics of patients and type of public health facility in the state of Haryana and Punjab, India 2015**

Basic characteristics and level of facility	Haryana, n (%)	Punjab, n (%)	Total, n (%)
<b>Sex</b>			
Female	480 (54.7)	434 (59.3)	914 (56.8)
Male	397 (45.3)	298 (40.7)	695 (43.2)
Total	877 (100)	732 (100)	1609 (100)
<b>Age (years)</b>			
<1	13 (1.5)	11 (1.5)	24 (1.5)
1-5	41 (4.7)	21 (2.9)	62 (3.9)
5-15	116 (13.3)	84 (11.6)	200 (12.5)
15-30	245 (28.0)	198 (27.3)	443 (27.7)
30-50	309 (35.3)	260 (35.8)	569 (35.5)
>50	151 (17.3)	152 (20.9)	303 (18.9)
Total	875 (100)	726 (100)	1601 (100)
<b>Level of facility</b>			
CHC	234 (26.7)	228 (31.1)	462 (28.7)
DH	163 (18.6)	107 (14.6)	270 (16.8)
MC	30 (3.4)	26 (3.6)	56 (3.5)
PHC	450 (51.3)	371 (50.7)	821 (51)
Total	877 (100)	732 (100)	1609 (100)

PHC=Primary health care, CHC=Community health center, DH=District hospital, MC=Medical college

**Table 2: Average number of drugs prescribed by age, sex, and level of facility in Haryana and Punjab, India 2015**

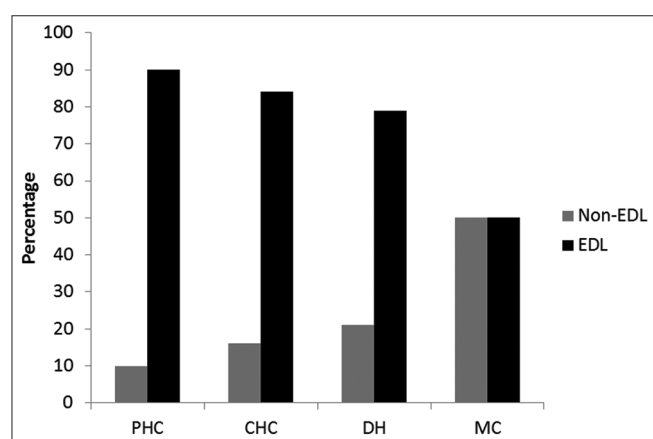
	State						Total
	Haryana			Punjab			
	n	Mean	SEM	n	Mean	SEM	
<b>Sex</b>							
Female	480	2.2	0.04	434	2.2	0.04	2.2
Male	396	2.3	0.05	298	2.2	0.05	2.3
Total	876	2.2	0.03	732	2.2	0.03	2.2
<b>Level of facility</b>							
CHC	234	2.4	0.06	228	2.3	0.06	2.4
DH	163	2.5	0.08	107	1.8	0.06	2.2
MC	30	1.7	0.14	26	2.6	0.14	2.1
PHC	449	2.1	0.04	371	2.2	0.04	2.1
Total	876	2.2	0.03	732	2.2	0.03	2.2
<b>Age group (years)</b>							
0-5	54	2.0	0.14	32	1.8	0.17	1.9
5-15	116	2.2	0.08	84	2.1	0.09	2.2
15-30	245	2.2	0.06	198	2.2	0.06	2.2
30-50	308	2.3	0.05	260	2.2	0.05	2.3
>50	151	2.3	0.07	152	2.3	0.07	2.3
Total	874	2.2	0.03	726	2.2	0.03	2.2

SEM=Standard error of mean, PHC=Primary health care, CHC=Community health center, DH=District hospital, MC=Medical college

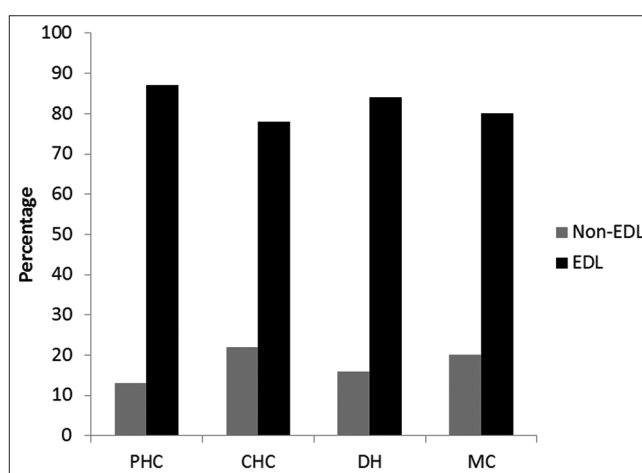
**Table 3: Prescription practices according to age, sex, and level of facility in Haryana and Punjab, India 2015**

Category	Haryana			Punjab			Total		
	EDL (%)	Partial EDL (%)	Non-EDL (%)	EDL (%)	Partial EDL (%)	Non-EDL (%)	EDL (%)	Partial EDL (%)	Non-EDL (%)
Level of facility									
CHC	67	28	5	59	35	6	63	32	5
DH	61	33	6	72	18	10	66	27	7
MC	30	37	33	50	50	0	39	43	18
PHC	80	17	3	72	24	4	77	20	3
Age group (years)									
0-5	76	19	5	72	19	9	74	19	7
5-15	71	26	3	67	26	7	69	26	5
15-30	70	25	5	65	28	7	68	26	6
30-50	71	23	6	69	27	4	70	25	5
>50	73	22	5	66	30	4	69	26	5
Sex									
Male	72	23	5	66	28	6	70	25	5
Female	70	24	6	69	26	5	70	25	5
Total	71	24	5	68	27	5	70	25	5

PHC=Primary health care, CHC=Community health center, DH=District hospital, MC=Medical college, EDL=Essential drug list



**Figure 1:** Proportion of drugs prescribed from state's essential drug list in public health facilities in Haryana, India 2015. PHC = Primary health care, CHC: Community health center, DH = District hospital, MC = Medical college



**Figure 2:** Proportion of drugs prescribed from state's essential drug list in public health facilities in Punjab, India 2015. PHC = Primary health care, CHC: Community health center, DH = District hospital, MC = Medical college

Out of the total 1609 prescriptions, 18% (291) of them had no diagnosis over them. In the remaining 1318 prescriptions, 1342 diagnoses were made. A total of 2.5% (33) of the prescriptions had diagnosis written in illegible language or in abbreviated form beyond comprehension. Out of the diagnoses made, nearly 52.4% (703) were nonspecific complaints or symptoms rather than specific diagnosis. The most common categories were upper respiratory infection (URI) (13.6%), nonspecific pain (8.2%), pregnancy (4.9%), allergy (4.6%), abdominal pain (4.6%), dental problems (4.6%), hypertension (4.2%), and injury (3.3%). According to the organ system affected, diseases of the ear, nose, and throat (18%) were most common followed by the diseases of the gastrointestinal and renal (17%), musculoskeletal system (16%), and skin and subcutaneous tissue (11%) [Figure 3].

## DISCUSSION

This is one of the very few studies in India which has looked at prescription practices across different levels of

public health facilities. Most other studies have reviewed prescribing pattern in a single center, usually a tertiary care facility.<sup>[14-20]</sup> This study also looks at the utilization of drugs in the EDL and prescription by generic names in public health facilities. The results of this study raise concerns about the overuse of antibiotics, especially in childhood diarrhea and upper respiratory tract infection and warrant urgent intervention. However, the reassuring fact was that most of the drugs (84%) were from the EDL, and in 70% of cases, drugs were prescribed in their generic names, contrary to the common belief.

The average number of drugs per prescription is an important index for review of prescription practices. In the present study, the average number of drugs per prescription was similar to the study by Srishyla *et al.* (2.17); however, it was above the ideal standards (1.6–1.8).<sup>[16,21]</sup> Most of the studies in the literature have reported higher prescription

rates ranging from 2.4 to 3.52.<sup>[2,4,15]</sup> Another study reported high average number of drugs per prescription (4.22) probably because the study setting was a tertiary care teaching hospital.<sup>[14]</sup> A study of the pattern of drug use in 12 developing countries reported the mean number of drugs per prescription ranging from 1.3 in Zimbabwe and Ecuador to 3.8 in Nigeria.<sup>[22]</sup> Higher figures always ought to be justified because of the increased risk of drug interactions and errors of prescribing with polypharmacy. A high average number of drugs might be due to financial incentives to prescribers to prescribe more, lack of training of prescribers, or shortage of appropriate drugs.<sup>[15]</sup>

**Table 4: Incidence of polypharmacy in selected public health facilities of Haryana and Punjab, India 2015**

Number of drugs per prescription	Number of prescriptions (%)
1	270 (17.0)
2	772 (48.8)
3	427 (27.0)
4	89 (5.6)
5	25 (1.6)
Total	1583 (100)

**Table 5: Prescribing frequency of chosen drug groups in public health facilities of Haryana and Punjab, India 2015**

Drug groups	n (%)
Antibiotic	717 (45.3)
Antacid	304 (19.2)
Antiasthmatic	70 (4.4)
Antiallergic	406 (25.6)
Antidiabetic	42 (2.7)
Antihypertensive	92 (5.8)
Antipyretic	437 (27.6)
Sedative	25 (1.6)
NSAIDs	536 (33.9)
Vitamin	551 (34.8)

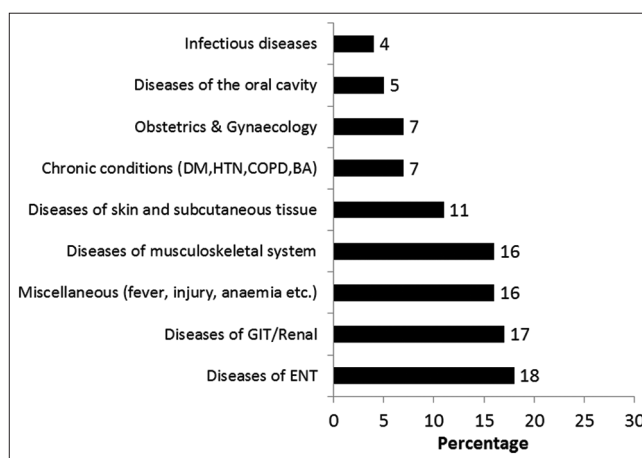
NSAID=Nonsteroidal anti-inflammatory drugs

**Table 6: Inappropriate prescribing (based on drug dosage and frequency) by age, sex, and level of facility in public health facilities of Haryana and Punjab, India 2015**

Basic characteristics and level of facility	Haryana		Punjab		Overall	
	Drug dosage (%)	Drug frequency (%)	Drug dosage (%)	Drug frequency (%)	Drug dosage (%)	Drug frequency (%)
Sex						
Female	8.3	3.1	9.4	2.5	8.9	2.8
Male	11.6	3.3	7.1	3.4	9.7	3.3
Total	9.8	3.2	8.5	2.9	9.2	3.0
Age (years)						
<1	15.4	0.0	9.1	0.0	12.5	0.0
1-5	14.6	4.9	5.0	4.8	9.7	4.8
5-15	9.5	5.2	6.0	3.6	8.0	4.5
15-30	9.8	4.1	9.6	1.5	9.7	2.9
30-50	10.7	1.9	9.6	4.2	10.2	3.0
>50	6.6	2.6	7.9	2.0	7.3	2.3
Total	9.8	3.2	8.5	2.9	9.2	3.0
Level of facility						
CHC	9.4	3.0	8.3	3.9	8.9	3.5
DH	11.0	3.1	8.4	1.9	10.0	2.6
MC	9.0	3.3	7.7	3.8	8.9	3.6
PHC	11.0	3.3	8.6	2.4	9.1	2.9
Total	9.8	3.2	8.5	2.9	9.2	3.0

PHC=Primary health care, CHC=Community health center, DH=District hospital, MC=Medical college

High incidence of antibiotic prescription in cases of illnesses such as upper respiratory tract infection or diarrhea is an urgent public health and patient safety priority. Such overuse of antibiotics causes avoidable adverse events, contributes to antibiotic resistance, and unnecessary treatment costs. The present study reveals higher antibiotic prescription rates than the ideal rates (20.0%–26.8%).<sup>[21]</sup> Drug use evaluation should be done to evaluate whether the antibiotics were prescribed appropriately or not. Other studies have also reported higher rates of antibiotic prescriptions.<sup>[2,5]</sup> In the drug use pattern study in 12 developing countries, the percentage of encounters in which an antibiotic was prescribed ranged from 23% in Bangladesh to 63% in Sudan.<sup>[22]</sup> There is recent evidence



**Figure 3: Classification of diseases according to organ system involvement in public health facilities in Punjab and Haryana, India 2015.** DM = Diabetes mellitus, HTN = Hypertension, COPD = Chronic obstructive pulmonary disease, BA = Bronchial asthma, GIT = Gastrointestinal, ENT = Ear, nose, and throat



which shows broad-spectrum antibiotic prescribing when either no therapy is required or when narrower-spectrum alternatives are appropriate.<sup>[23,24]</sup> Antibiotic prescription policy should be instituted in every facility and monitored closely through prescription audits.

It has been demonstrated that serial prescription audits and active feedback along with training programs improve prescription behavior and reduces prescribing errors.<sup>[10]</sup> Efforts to promote rational use of drugs have been mainly targeted at the health-care provider level to improve drug prescribing through educational interventions, standard treatment guidelines, EDLs, etc. However, correct prescribing alone does not guarantee appropriate use of drugs. Nonadherence to prescribed drugs and self-medication is very common on the part of the consumer and also needs attention.<sup>[25]</sup>

Some of the prescriptions had diagnosis or medications written in illegible handwriting beyond comprehension. From the patient's perspective, it can delay treatment, lead to unnecessary tests, and inappropriate doses or even wrong medication which, in turn, can result in further worsening of the illness and death.<sup>[26]</sup>

Providing diagnosis on a prescription helps in evaluating a patient's illness history when he visits the same physician or any other. It also aids in patient safety by improving dispensing accuracy.<sup>[27]</sup> In the present study, however, nearly 18% of prescriptions had no diagnosis written over them. Educational interventions such as in-service training have been significantly shown to improve the number of prescriptions containing diagnosis nearly three times.<sup>[27,28]</sup> Studies in Nigeria have shown that the prescriber's level of training or lack of training is one factor that would influence drug prescribing in health facilities.<sup>[29]</sup>

The prescribing errors in terms of drug dosage and drug frequency were 9.2% and 3.0%, respectively, which is slightly higher than the figures reported by Joshua *et al.*<sup>[30]</sup> These errors were more among the children than the adults similar to the previous study. This highlights the importance of training the physicians on drug dosages for children.

The major limitation in this study was that we were unable to account for the drop-outs, namely, patients who did not require drugs after consultation and patients who did not purchase drugs from the hospital pharmacy. Data were collected over a 2-week period, and although no reason was identified that this was different from any other periods, there is a possibility that drug shortages during the period of data collection could perhaps influence prescribing.

There was a lack of data regarding appropriateness of prescription such as drug dosage, frequency, duration, and selection because of incomplete and illegible prescription writing.

## CONCLUSION

The results of this study raise concerns about the overuse of antibiotics which calls for antibiotic prescription policy in each facility. However, most of the drugs (84%) were from the EDL and in their generic names. There is a lack of pharmacoepidemiological data of this kind for continuous monitoring of prescription behavior. Real-time monitoring of prescription practices should be done through online data entry and transmission at the facility. Based on the observations of this preliminary study, it is proposed to carry out a prescription costing study as patient compliance in a developing country like India is primarily dependent on cost of treatment. Most of the interventions have focused on prescribers while a large part of irrational drug practice takes place at the consumer level, which needs further research. Evaluation of the impact of standard treatment guidelines and EDLs are future areas of research.

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## Conflicts of interest

There are no conflicts of interest.

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