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Article

A Study on the Knowledge and Attitudes regarding Artificial Intelligence among Medical, Dental, and Nursing Students from Sangli (Maharashtra), India

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Abstract: Objective: To assess awareness and attitudes regarding Artificial Intelligence among undergraduate medical, dental, and nursing students.
Methods: A cross-sectional study was conducted in Sangli, Maharashtra, India during October 2024 to March 2025. A total of 1037 participants (379 Medical, 269 Dental, 389 Nursing) were recruited using cluster random sampling. Data was collected using a pre-tested, self-administered questionnaire.
Results: The mean awareness score (range 0-18) and attitude score (range 0-12) were 7.38 (± 4.63) and 3.03 (± 2.12), respectively. The awareness score was highest among medical students and lowest among nursing students, whereas the attitude score showed the opposite trend. Urban residents and exposure to informative AI content were associated with awareness. Participants agreed that AI is an essential tool for education, but were apprehensive about job loss, data privacy, and increased surveillance. Over two-thirds (68%) used AI for academic tasks.
Conclusion: Healthcare students had unsatisfactory awareness of AI, and their overall attitude was negative. These findings highlight an urgent need for an integrated AI curriculum tailored to their actual needs.
Keywords: Artificial Intelligence, Health Occupations Students, Awareness, Attitude, IndiaTop of Form

1. Introduction

Humans have long imagined thinking machines; however, since 2020, this has become a significant phenomenon. It is predicted to change human life fundamentally—the way we live, work, and learn. 1-3 For healthcare students, the immediate impact is felt in the sectors of patient management, research, and education. 4,5 This makes it very important for the medical, dental, and nursing students to learn and utilize AI and keep updating their knowledge to keep up with rapidly evolving technology. 6

Studies among healthcare students conducted in various countries consistently show that, overall, these students are aware of AI and its potential impact on the healthcare industry. However, there was a significant lack of depth in both knowledge and training among them. 7-10 This phenomenon can be understood in the observations made by Alabbad FA et al. among medical students of Saudi Arabia. They observed that while a vast majority of medical

students in Saudi Arabia (98.4%) were aware of AI, less than half (48.9%) could understand its medical implications. 8 The dissimilarity between being aware of the term "AI" and understanding its actual impact or applications can be due to a lack of formal AI education. 9, 11 This problem is further exacerbated by the fact that the source of information for these students is social media and the internet, rather than actual academic sources. 12

When considering their attitude towards AI, students generally accept that AI can improve healthcare delivery by enhancing diagnostics and treatment selection, as well as overall efficiency. 11-13 However, they do exhibit fear regarding its negative impact on their careers or jobs, and ethical issues with AI, such as privacy invasions, inaccurate outputs due to biased data, a lack of empathy, malfunctions, and others. 7, 8

Some studies suggest that a negative attitude towards AI can lead to apprehension in learning and using it. In contrast, other studies have observed that it may result in an increased desire to learn more about AI. 1, 6 Most students had used AI tools for assignments or in research. 1,2

There is an urgent need to develop a curriculum that equips healthcare students to effectively adopt AI for academic purposes, research, and overall career development, with a focus on ethical considerations. 2, 5 However, we need to be aware of the state of awareness and attitude of healthcare students in various geographical and cultural settings. Currently, most of the studies have been conducted in Western countries and the Middle East. Research from India is limited and mainly focused on larger metropolitan areas. At the time of this research's commencement, the authors found very few published studies that addressed the knowledge and attitudes of healthcare students from smaller cities or semi-urban regions in India regarding AI.

The objective of this research is to study the knowledge and attitudes towards AI among students from medical, dental, and nursing colleges from the Sangli district of Maharashtra, India. We hope that these findings will help educators better understand the situation and effectively incorporate AI into the curriculum.

2. Methods

A cross-sectional study was conducted in Sangli (Maharashtra) among undergraduate medical, dental, and nursing students during October 2024 to March 2025. We used cluster random sampling to recruit the participants. The study was approved by the institutional ethical committee. Permissions were also obtained from the heads of the selected institutions. Then we approached the students, explained the study objectives, assured them of anonymity and confidentiality, and informed them that participation was voluntary. Only consenting students were asked to sit on each bench; the remaining students, as well as their teachers, were requested to proceed with their activities. Students absent on the day of data collection were excluded from the study. Investigators were present during data collection to clarify any doubts. To maintain confidentiality, consent forms were deposited in the drop boxes.

A previous study from India found that 26.4% of medical students reported being aware of the basic principles of AI. 14 Using this information ($p=0.264$, $1-p = 0.736$, confidence level at 99%, and absolute precision at 10% i.e., $d=0.1$), the calculated sample size was 129.3, i.e., 130. We decided to include a minimum of 130 participants from each of the streams, i.e., medical, dental, and nursing. However, as our data were collected using cluster random sampling, we included 379 medical, 269 dental, and 389 nursing students, totalling 1037 participants.

Data were collected using a pre-tested, structured, self-administered questionnaire, hosted on Google Forms. We generated a unique QR code for each data collection session, which students scanned on their mobile phones to access the linked form. Students were permitted to submit only one response per mobile device or email address associated with their login. We activated the form link immediately before the data collection session began and deactivated it after data collection to ensure data integrity and prevent the link from being shared with individuals outside the target population. No personal identifiers, such as email addresses, were recorded, thereby maintaining complete anonymity.

The questionnaire consisted of five sections. The first section enquired about the sociodemographic information of the participants (e.g., age, gender, parents' education, and occupation). The second section focused on the participants' current educational stream and their mobile/internet usage patterns. The third section was a predesigned, pre-validated scale to assess awareness of artificial intelligence. It had six multiple-choice questions, allowing participants to select one or more applicable options. The range of probable scores for this section was from 0 to 18. The fourth section was also a predesigned, pre-validated scale that measured attitudes toward AI using a 12-item scale based on a three-point Likert format (Disagree, Neutral/Not sure, Agree). The answer reflected a positive attitude towards receiving one point with a maximum possible score of 12 points. The final section included three questions aimed at understanding the participants' use of AI and their willingness to modify their daily activities or future career

plans in response to the integration of AI. The questionnaire was developed with the help of subject experts from Community Medicine, Computer Science, and Law. It was pilot tested for reliability and demonstrated good internal consistency (Cronbach's alpha for awareness scale 0.866 and attitude scale 0.711). The final section consisted of three questions related to their current use of AI tools and the future of their career with respect to AI.

We used Microsoft Excel 365 and IBM SPSS 29 for data analysis. We used descriptive statistics to summarize the data and applied the Unpaired t-test, ANOVA, MANOVA, and linear regression for inferential analysis.

3. Results:

A total of 1037 students participated in the study: 379 (36.5%), 269 (25.9%), and 389 (37.5%) medical, dental, and nursing students, respectively.

Most participants, 604 (58.2%), were female, and 433 (41.8%) were male. The mean age of the participants was 21.5 (±2.928) years. Six hundred twenty-eight (60.6%) belonged to an urban area, while 409 (39.4%) belonged to a rural area. Nine hundred sixty-five (93.1%) participants belonged to socio-economic class I, while 41 (4%), 9 (0.9%), 5 (0.5%), and 17 (1.6%) belonged to class II, III, IV, and V, respectively.

The participants' daily pattern of usage of electronic devices and the internet shows a clear preference for mobile-centric and online activities. On an average, individuals spent the most time using the internet, 4.64±3.47 hours daily (95% CI: 4.429, 4.851). This was nearly the same as mobile device usage, which was 4.31±2.57 hours per day (95% CI: 4.153, 4.467). When looking at specific online activities, social media platforms like WhatsApp, Instagram, and Facebook consumed a substantial portion of the day, with a mean usage of 2.86±2.40 hours (95% CI: 2.714, 3.006). Watching online videos on streaming services such as YouTube, Netflix, and Hotstar, etc., on an average of 2.04±1.91 hours daily (95% CI: 1.924, 2.156). In contrast, traditional computer use was the least prominent habit among the participants, averaging just 1.3±1.91 hours per day (95% CI: 1.184, 1.416).

Regarding the frequency of watching informative or educational content on mobile devices or computers, most respondents, 527 (50.8 %), replied that they watched it daily, while 332 (32%) watched it frequently (once or twice a week), 159 (15.3%) watched it rarely, and 19 (1.8%) had never watched such content. Similarly, regarding active exposure to AI-related information (i.e., by watching videos or reading articles about AI or machine learning), 436 (42%) reported no exposure, while 601 (58%) reported some exposure.

The mean awareness score (range 0-18) and attitude score (range 0-12) were 7.38 (± 4.63) and 3.03 (± 2.12), respectively. There was a very low degree of positive correlation between awareness and attitude score (Correlation Coefficient = 0.052, p = 0.095).

The answers by the participants for the 12-item attitude scale are presented in **Fig 1**.

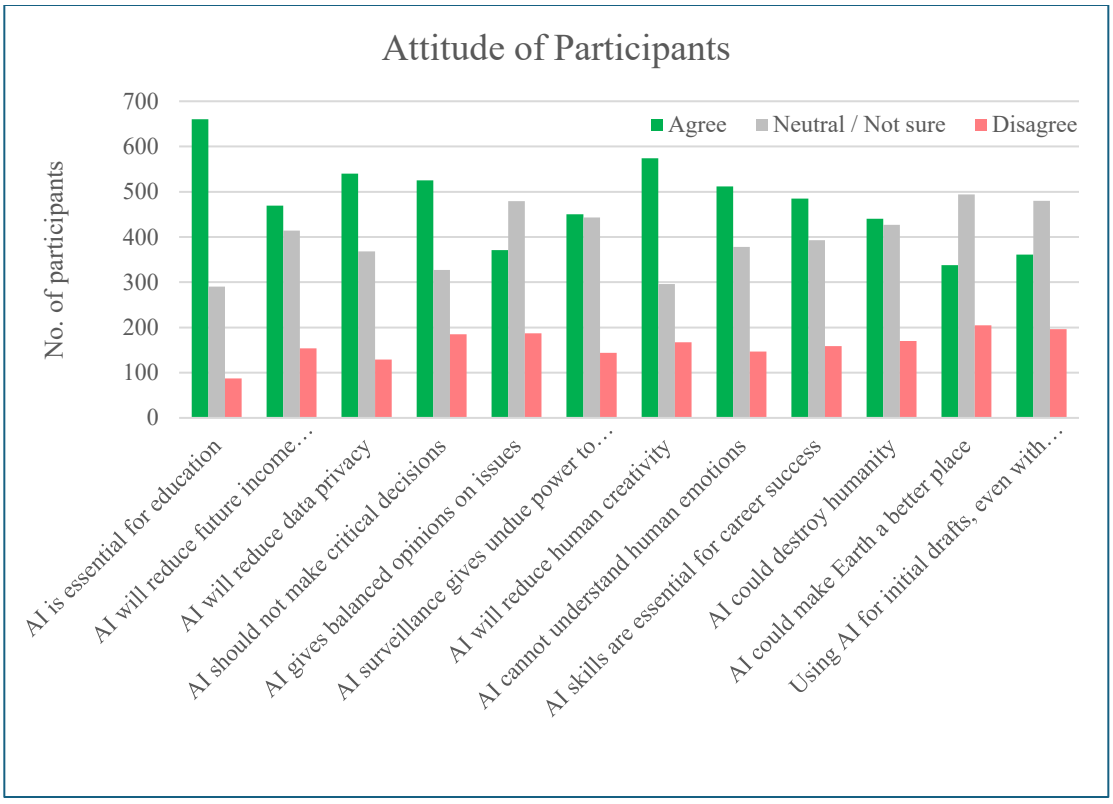

Fig 1. **Participants' responses to the Attitude Scale**

The comparison of various sociodemographic variables with the awareness and attitude score is presented in **Table 1**. Neither score was associated with sociodemographic variables, such as gender, family type, father's or mother's education, or occupation.

Table 1: Comparison of awareness and attitude scores with various sociodemographic variables

Sociodemographic variables		Awareness Score		Attitude Score	
		Mean (± SD)	**t-test/ ANOVA**	**Mean (± SD)**	**t-test/ ANOVA**
Gender	Male (n = 433)	7.54 (±4.991)	t = 0.921 p = 0.357	3.1 (±2.213)	t = 0.891 p = 0.373
	Female (n = 604)	7.27 (±4.352)		2.98 (±2.052)	
Residence	Urban (n = 628)	7.91 (±4.635)	t = 4.609 **p < 0.001**	3.03 (±2.076)	t = -0.035 p = 0.972
	Rural (n = 409)	6.57 (±4.507)		3.04 (±2.19)	
Type of Family	Nuclear (n = 655)	7.57 (±4.6)	t = 2.669 **p = 0.008**	3.13 (±2.174)	t = 1.234 p = 0.218
	Joint (n = 382)	6.56 (±4.307)		2.9 (±2.036)	
Have you ever read articles or watched videos about AI?	No (n = 436)	6.24 (±4.256)	t = -7.017 **p < 0.001**	2.89 (±2.135)	t = -1.799 p = 0.072
	Yes (n = 601)	8.21 (±4.716)		3.13 (±2.106)	

How often do you watch informative/documentary/educational content on your device?	Never (n = 19)	2.05 (±2.415)	F = 9.881 **p < 0.001**	3.79 (±2.485)	F = 8.763 **p < 0.001**
	Rarely (n = 159)	6.9 (±4.324)		2.64 (±2.004)	
	Frequently (n = 332)	7.69 (±4.6)		2.71 (±2.055)	
	Daily (n = 527)	7.53 (±4.679)		3.33 (±2.136)	
Education stream	Medical (n = 379)	8.92 (±4.8)	F = 41.549 **p < 0.001**	2.46 (±2.056)	F = 24.088 **p < 0.001**
	Dental (n = 269)	7.21 (±4.327)		3.23 (±2.187)	
	Nursing (n = 389)	6 (±4.193)		3.46 (±2.013)	

On post hoc analysis, the mean awareness score was significantly different for all the educational streams. The attitude score was significantly different among medical and dental, as well as among medical and nursing, while the difference between nursing and dental was not significant. The post hoc analysis of "Frequency of watching informative videos", the difference in awareness among those who never watch with those who watch rarely, frequently, and daily was statistically significant. However, a significant difference in awareness was not observed among those watching rarely, frequently, or daily. However, the attitude score was significantly different between those who watch daily and those who watch frequently or rarely.

The pattern of digital device usage and online content exposure among the students, according to the education stream, is summarised in **Table 2**.

Table 2: Digital Device Usage and Online Content Exposure among the students according to the education stream

Digital Device Usage and Online Content Exposure	Mean (± Std. Deviation)			ANOVA	P value
	Medical (379)	Dental (269)	Nursing (389)		
How much time do you use your computer per day (in hours)	1.41 (±2.176)	1.45 (±1.786)	1.09 (±1.681)	3.87	**0.021**
How much time do you use your mobile per day (in hours)	4.66 (±2.392)	4.09 (±2.563)	4.14 (±2.718)	5.4	0.005
How much time do you use your internet per day (in hours)	5.05 (±3.213)	4.79 (±3.518)	4.14 (±3.621)	6.982	**< 0.001**
How much time do you use social media (e.g., WhatsApp / Instagram/ Facebook, etc.) per day (in hours)	2.78 (±2.152)	2.9 (±2.447)	2.91 (±2.587)	0.364	0.695
How much time do you watch videos online (e.g., YouTube, Netflix, Hotstar, etc.) per day (in hours)	2.09 (±1.887)	2.02 (±1.712)	2 (±2.046)	0.223	0.801
How often do you watch informative/documentary/educational content on your device?	2.22 (±0.756)	2.26 (±0.846)	2.45 (±0.784)	8.797	**< 0.001**
Have you ever read articles or watched videos about A.I. / Machine Learning / Data Mining?	0.56 (±0.497)	0.59 (±0.493)	0.59 (±0.492)	0.499	0.608

We applied linear logistic regression, with awareness and attitude as dependent variables, and the associated sociodemographic factors as independent variables. (**Table 3**)

Table 3: Linear regression models for various independent variables with awareness score and attitude score					
Model	**B (95% C.I. for B)**	**Std. Error**	**Standardized Coefficients**	**t**	**p-value**
Dependent Variable: Awareness Score					
(Constant)	9.583 (8.24, 10.926)	0.684		14.003	<.001
Type of Family	-0.354 (- 0.902, 0.194)	0.279	-0.037	-1.267	0.206
Residence	-0.836 (-1.389, -0.283)	0.282	-0.088	-2.966	**0.003**
Education stream	-1.453 (-1.767, -1.139)	0.16	-0.27	-9.085	**<.001**
How often do you watch informative/documentary/educational content on your device?	0.546 (0.209, 0.883)	0.172	0.094	3.181	**0.002**
Have you ever read articles or watched videos about A.I. / Machine Learning / Data Mining?	1.906 (1.367, 2.446)	0.275	0.203	6.935	**<.001**
Dependent Variable: Attitude Score					
(Constant)	2.006 (1.361, 2.651)	0.329		6.103	<.001
Type of Family	-0.234 (- 0.497, 0.029)	0.134	-0.053	-1.745	0.081
Residence	-0.158 (- 0.424, 0.107)	0.135	-0.036	-1.169	0.243
Education stream	0.494 (0.344, 0.645)	0.077	0.201	6.436	**<.001**
How often do you watch informative/documentary/educational content on your device?	0.208 (0.046, 0.37)	0.082	0.078	2.523	**0.012**
Have you ever read articles or watched videos about A.I. / Machine Learning / Data Mining?	0.161 (-0.098, 0.42)	0.132	0.038	1.22	0.223
B = Unstandardized Coefficients , C.I. = Confidence Interval					

To study the effect of various sociodemographic factors on awareness and attitude as a combined output, we applied MANOVA. **(Table 4)**

Table 4: Combined Univariate and Multivariate Analysis of Variance (MANOVA) for Effects of various sociodemographic factors on the Awareness and Attitude Scores						
Factor	Pillai's Trace	F (Multivariate)	df (Hypothesis, Error)	p-value	Dependent variables Univariate ANOVA (F, P)	
					Awareness	Attitude
Intercept	0.395	298.84	2, 917	< 0.001	F = 303.743, P < 0.001	F = 354.984, P < 0.001
Education stream	**0.016**	**3.669**	**4, 1836**	**0.006**	**F = 3.172, P = 0.042**	**F = 3.633, P = 0.027**

Residence	0.008	3.887	2, 917	0.021	F = 1.767, P = 0.184	**F = 6.629, P = 0.01**
Type of family	0.001	0.292	4, 1836	< 0.001	F = 0.573, P = 0.564	F = 0.02, P = 0.98
How often do you watch informative/documentary/educational content on your device?	**0.031**	**4.817**	**6, 1836**	**< 0.001**	**F = 5.612, P < 0.001**	**F = 4.075, P =0.007**
Have you ever read articles or watched videos about A.I. / Machine Learning / Data Mining?	0.003	1.558	2, 917	0.211	F = 2.781, P = 0.096	F = 0.169, P = 0.681
(all higher-order interactions)	--	--	--	> 0.05	--	--

The results showed that the Education stream, Residence, and Frequency of informative educational content significantly affect students' awareness and attitude. The education stream and the Frequency of informative educational content significantly affected both awareness and attitude. Residence only made a difference in attitude, not in awareness. Other factors, like the type of family and whether they had taken information about AI, did not make much difference.

Regarding the participants' use of AI and their willingness to modify their daily activities or future career plans in response to the AI, 483 (46.6%) have made an effort to integrate AI technologies in their routine, 705 (68%) had used AI for study related activities, and 428 (41.3%) had adjusted or willing to adjust their career plans based on perceived impact of AI.

4. Discussion

We aim to study the knowledge and attitudes regarding Artificial Intelligence (AI) among undergraduate medical, dental, and nursing students from the Sangli district of Maharashtra, India. As AI rapidly integrates into healthcare worldwide, this study provides much-needed insight into its perception among healthcare students in semi-urban India—a population that has been significantly underrepresented in the literature.

The mean awareness score in our study was 7.38 out of a possible 18, while the mean awareness score among the medical students was 8.92. This suggests a poor to moderate level of awareness related to AI. This shows an overall lack of awareness regarding AI among the students. Similar observations were made by Allam et al. (2024) across nine Arab countries, where they concluded that although most of the medical students have heard about AI, most of them lack detailed knowledge regarding it.15 Even Alabbad et al. (2025) observed that among the Saudi medical students, almost everyone was aware of the term AI, and the majority of them lacked any awareness of its applications.16 However, in Egypt, Ghanem et al. (2025) observed that around 45% medical students had good knowledge, and 2/3rd knew some application of generative AI in their field; however, only around 30% knew about deep/machine learning.17 These findings are generally positive than our observations. However, our questionnaire and method of data collection were different than Ghanem et. al., which may have contributed to the differences in the observations.

We observed a significant difference in awareness scores for all three education streams, with medical students having the highest mean awareness score, followed by dental, and then nursing students. In a similar study conducted by Syeda LH et al. (2025) in Rawalpindi, Pakistan, significant differences in AI knowledge among the undergraduate students across the health sciences disciplines were observed.18 Similar to our results, they observed nursing students showing the least awareness about AI, but, unlike our results, dental students had better AI knowledge than medical students. These differences could be attributed to differences in study settings, method of data collection, and analysis. However, these do highlight the need for the introduction of AI awareness, especially into the nursing curriculum.

Participants from urban areas and those belonging to nuclear families scored significantly higher in the awareness score. This may be due to better access to the internet and electronic devices, and a more encouraging home and school environment. Similarly, as expected, participants who watched documentaries or informative videos and those who had some exposure to AI had higher awareness. In research conducted by Daepp & Counts (2024), they reviewed Bing searches to identify patterns of AI utilization in the USA. They concluded the presence of an urban-rural divide in AI utilization.19, 26-31

The participants were cautious towards AI, with a mean attitude score of 3.03 (range 0-12). The majority of participants agreed that AI can be an essential tool for education and that AI skills are necessary to have a successful career. However, most of them believed that it would reduce income opportunities, data privacy, increase authorities' surveillance, and have the potential to destroy humanity. Syeda LH et al. observed similar attitudes among healthcare undergraduate students. 18,21-25 While students appreciated the utility of AI as educational tools, they were wary of the potential loss of employment opportunities.

There was a weak correlation between awareness and attitudes in our study. Similarly, nursing students, despite lower awareness scores, presented with the most positive attitude towards AI. This was followed by dental students and then by medical students. These observations contrasted with the overall trend in many studies, where the authors had observed increased AI acceptance or reduced AI anxiety among students with higher AI knowledge. 15,17,18 However, Wu M, et al (2024) had concluded that despite very high awareness, medical students are apprehensive of AI, with its potential to reduce jobs. 20 Hence, this topic must be explored in detail to understand the dynamics between AI awareness and AI apprehension.

We also observed better awareness among the participants who had some exposure to AI content, which is obvious. Similarly, better awareness and attitudes were observed among those who watched informative videos or documentaries. This might suggest that students who are accustomed to exploring knowledge or information online are more likely to come across AI-related information and be receptive towards it. Similar findings were made by Sallam et al. (2023) among Jordanian students. 12 However, we have an interesting finding in our study that there was no increasing trend in AI awareness with increasing frequency of online content consumption. This suggests that increased or excessive screen time does not necessarily mean a better AI awareness.

Over 2/3rd of our participants had used AI for study, while over 45% students had modified their routine to accommodate AI, and nearly 40% have altered their career plan in response to AI. Most of the studies have reported a similar use of AI technologies by the students for completing academic tasks. 9, 12, 17

5. Conclusion

The study reveals that overall awareness regarding AI among the health sciences students is lacking. It depends on exposure to educational content as well as the educational stream. The students feel AI is useful for education but are apprehensive about its impact on their careers and future.

This highlights the need for integrating AI in education along with proper counselling by experts to alleviate the apprehensions. Similarly, such a curriculum should be a blanket token for every educational stream. We need to understand the needs of the students and design the curriculum accordingly. The focus of such a curriculum should not only be on imparting knowledge along with specific recent advances and skills, but also on fostering ethical and critical thinking about AI. As this is a dynamic field, the educators must update their approach accordingly.

Strengths and Limitations of the Study

One of the strengths of our study was that we included over one thousand participants, allowing us to compare the data across the educational streams meaningfully. We used pretested, pre-validated, reliable scales for data collection and employed detailed statistical analysis to ensure scientific rigor. It is one of the few studies dealing with the concept conducted in a non-metropolitan area in India.

Limitations of this study include a cross-sectional study design and a self-reported method of data collection; similarly, the study was conducted in a small geographical area. Hence, the generalizability of these observations is limited. Similarly, as this field is very dynamic, it is difficult to predict its applicability in the future.

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Declaration of conflict of interest

None to declare.

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