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Research article

Diabetic retinopathy: knowledge, attitudes, and practices among diabetic patients

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Abstract: Objective: This study aimed to assess the knowledge, attitudes, and practices of diabetic patients in Arar, Saudi Arabia, regarding diabetic retinopathy (DR) and identify their primary sources of information. **Methods:** This cross-sectional descriptive survey was conducted in Arar, Saudi Arabia, with a sample size of 535 participants recruited via convenient sampling. A pre-designed questionnaire assessed the knowledge, attitudes, and practices toward DR. The survey evaluated the knowledge (12 questions), attitudes, practices (7 questions), and sources of information on DR. Data were analyzed using STATA/SE, and Chi-square tests were used to assess relationships between variables. Statistical significance was set at $p < 0.05$. **Results:** Of the 535 participants, 54% (289 participants) demonstrated a high knowledge, and 57% (305 participants) had positive attitudes and practices towards DR. Significant associations were found between the personal history of DR and both the knowledge and attitudes/practices ($p < 0.001$ each). The internet (71%) was the most common source of information, followed by general physicians (59%) and ophthalmologists (53%). **Conclusions:** While most participants had a high knowledge and positive attitudes towards DR, there is room for improvement. A gap in understanding the impact of diabetes duration as a risk factor for DR was identified, thus highlighting the need for focused educational interventions. Enhancing health care

professionals-patient communication and utilizing digital platforms can further raise awareness and promote preventive practices.

Keywords: attitude; diabetic retinopathy; knowledge; ophthalmology, practice; Saudi Arabia

1. Introduction

Diabetes mellitus (DM) is commonly linked to chronic complications, primarily due to microvascular damage which impacts the retina and kidneys, an increased risk of cardiovascular disease, and neural impairments, including peripheral and autonomic neuropathies. Diabetic retinopathy (DR), a common complication of DM, involves both vascular and neural alterations [1–3]. The key microvascular changes in DR include microaneurysms, capillary loss, and blood-retinal barrier dysfunction [4,5]. The two most well-established risk factors for DR are the duration of DM and suboptimal glycemic control. The recent literature has identified having a younger age, an elevated fasting blood glucose (FBG), and higher HbA1c levels as independent risk factors for the progression of DR [6,7]. Additional risk factors include hyperlipidemia, hypertension, pregnancy, kidney disease, obesity, anemia, and tobacco use [6–9].

DR is a leading cause of preventable visual impairments among the adult working population and represents a significant global public health concern due to the increasing prevalence of diabetes worldwide [8–12]. In Saudi Arabia, DM prevalence is notably high, with the country ranking second in the Middle East and seventh globally. An estimated 30% of the Saudi population is affected by DM, and 5.7% of the general population is at risk of developing DR [11,13]. The early detection of ocular changes through screening can prevent blindness, thus emphasizing the importance of patient motivation to seek timely healthcare and adhere to regular monitoring protocols as recommended by ophthalmologists and endocrinologists. It is essential for individuals with DM to understand their critical role in managing glycemic control and eye care. Enhancing patient awareness regarding DR is crucial for further improvements in its management and prevention [12–15].

While some studies have been conducted in various regions of Saudi Arabia [14–17], research on the knowledge, attitudes, and practices concerning DR among diabetic patients in the Northern region is limited. This study seeks to assess the knowledge, attitudes, and practices related to DR among individuals with diabetes living in Arar, Saudi Arabia.

2. Materials and methods

2.1. Study setting and design

From December 2023 to September 2024, this cross-sectional descriptive survey was conducted in the Arar city of Saudi Arabia.

2.2. Sample size and sampling method

A convenient sample was employed and the minimal sample size for the study (386) was calculated according to the following Equation 1:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^2 P(1-P)}{d^2} \quad (1)$$

Z_1-α/2 is the standard normal variate at 5% type 1 error ($p < 0.05$); it is 1.96.

P = the expected proportion based on previous studies.

d = the absolute error (0.05).

The expected proportion was considered 50% since there is no previous study in the Northern Border region and to maximize the sample size.

2.3. Research tool

A structured questionnaire consisting of five sections was utilized for data collection. The first section provided an overview of the study's objectives, obtained informed consent, and clarified that participation was entirely voluntary, with the option to withdraw at any point. The participants without diabetes were instructed to discontinue the survey. The second section captured the demographic information, followed by the third section, which included 12 questions to evaluate the participants' knowledge. The fourth section consisted of 7 questions focused on the attitudes and practices, while the final section explored the participants' sources of information about DR. The questionnaire was formulated after an extensive review of the literature and subsequently evaluated by two consultants with expertise in the relevant field to ensure content validity. A pilot study was conducted with 20 participants to assess the clarity, relevance, and comprehensibility of the items. Feedback from this pilot study informed several revisions aimed at enhancing the accuracy and effectiveness of the instrument.

Recruitment was conducted online via a Google form shared across various social media platforms. The median split method was used to categorize the knowledge, attitude, and practice scores into low and high groups. For the knowledge assessment, the participants with scores of 9 or higher were classified as having a "high knowledge," while those with scores below 9 were considered to have a "low knowledge." In the attitude and practice sections, the participants with scores of 6 or above were categorized as having a "high attitude," while those with scores below 6 were classified as having a "low attitude."

2.4. Inclusion and exclusion criteria

Participants of both genders, aged 18 years and older, and diagnosed with diabetes were included in the study. Individuals living outside the study area were excluded.

2.5. Statistical analysis

A statistical analysis was performed using STATA/SE, version 11.2, for Windows (STATA Corporation, College Station, Texas) and MS Excel. The data were presented as frequencies and percentages for qualitative variables, and as the mean ± standard deviation (SD) and range for quantitative variables. For the knowledge and practice questions, the correct answers were scored as one, while the incorrect answers were scored as zero. Comparisons of the knowledge levels and attitudes and practices regarding DR across different study groups were conducted using the Chi-square test (χ^2). A multiple logistic regression analysis was carried out to identify significant

predictors for the knowledge and attitude/practice of DR. A P-value of less than 0.05 was considered statistically significant.

3. Results

Following informed consent, a total of 535 participants with DM were enrolled in the study. The group consisted of 301 males (56.3%) and 234 females (43.7%), aged between 18 and 65 years. More than half of the participants (50.8%) fell within the 40–59 year age group. A family history of DM was reported by 88.41% of participants, and 37% had a personal history of DR. The complete demographic details are provided in Table 1.

Table 1. Sociodemographic data of the participants (N = 535).

Variable		N	%
Age (year)	18–29	80	14.95
	30–39	67	12.52
	40–49	137	25.61
	50–59	135	25.23
	≥60	116	21.68
Gender	Male	301	56.26
	Female	234	43.74
Family size	1	78	14.58
	2	43	8.04
	3	72	13.46
	>3	342	63.93
Education level	Up to high school	273	51.03
	Bachelor or diploma	224	41.87
	Master or Ph.D.	38	7.10
Job status	Student	66	12.34
	Employee	274	51.21
	Non-employee	96	17.94
	Retired	99	18.50
Duration of DM	1–3 years	128	23.93
	4–6 years	151	28.22
	7–10 years	125	23.36
	>10 years	131	24.49
Family H/O DM	Yes	473	88.41
	No	62	11.59
Personal H/O DR	Yes	198	37.01
	No	337	62.99

Note: H/O: History of; DM: Diabetes mellitus; DR: Diabetic retinopathy; N: Number.

Regarding the knowledge of DR, 289 participants (54%) demonstrated a high level of knowledge, while the remaining 46% had a low level of knowledge. The mean knowledge score was 8.25 (SD ± 2.61), with scores ranging from 0 to 12. The participants scored highest on the question about the effect of diabetes on the eyes. Detailed responses to all knowledge-related questions are shown in Table 2.

Table 2. DR Knowledge among the study participants (N = 535).

Variable		N	%
Can DM affect the eyes?	Yes	487	91.03
	No	10	1.87
	I do not know	38	7.10
Can DM cause cataract?	Yes	352	65.79
	No	37	6.92
	I do not know	146	27.29
Can DM affect the retina?	Yes	401	74.95
	No	20	3.74
	I do not know	114	21.31
Can DM lead to blindness?	Yes	335	62.62
	No	51	9.53
	I do not know	149	27.85
How frequently should a diabetic patient undergo an eye checkup?	Every 6 months	240	44.86
	Yearly	175	32.71
	Every 2 years	50	9.35
	Only when vision is affected	70	13.08
In your opinion, what is the most important risk factor that for DR?	Duration of diabetes	106	19.81
	Poor control of diabetes	381	71.21
	I do not know	48	8.97
Please choose what you think is the associated factor that increases affects the eyes of a diabetic patient?	Overweight (obesity)	167	31.21
	High blood pressure	129	24.11
	Nephropathy	95	17.76
	Smoking	84	15.70
	Pregnancy	17	3.18
	I do not know	43	8.04
Is DR treated with eye drops?	Yes	127	23.74
	No	174	32.52
	I do not know	234	43.74
Can DR be treated by injection into the eye?	Yes	219	40.93
	No	115	21.50
	I do not know	201	37.57
Can DR be treated by LASER?	Yes	248	46.36
	No	94	17.57
	I do not know	193	36.07
Is DR treated with surgery?	Yes	303	56.64
	No	70	13.08
	I do not know	162	30.28
What can help in prevention of DR?	Awareness	89	16.64
	Screening	43	8.04
	Good control of diabetes	235	43.93
	Regular follow up	89	16.64
	Modifying lifestyle	47	8.79
	I do not know	32	5.98

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Variable		N	%
Knowledge score	Low (<9)	246	45.98
	High (≥9)	289	54.02
	Mean ± SD	8.25 ± 2.61	
	Range	0–12	

Note: DM: Diabetes mellitus; DR: Diabetic retinopathy; N: Number; LASER: Light Amplification by Stimulated Emission of Radiation.

In terms of the participants' attitudes and practices towards DR, 305 participants (57%) scored high, while 230 participants (43%) scored low. The mean score was 5.22 (SD ± 1.95), with a range of 0 to 7. The participants achieved the highest scores on the question of the importance of regular follow-ups as advised by their doctor. The responses to all the attitudes and practices questions are reflected in Table 3.

Table 3. Attitude and practice towards DR among the study participants (N = 535).

Variable		N	%
Diabetic patient should go for regular eye checkup even if they don't have any problem in their eyes.	Yes	387	72.34
	No	54	10.09
	I do not know	94	17.57
Regular exercises important to prevent DR.	Yes	353	65.98
	No	54	10.09
	I do not know	128	23.93
Good blood sugar control helps to prevent DR.	Yes	436	81.50
	No	33	6.17
	I do not know	66	12.34
Timely treatment can help to reduce the chances of blindness from DR.	Yes	432	80.75
	No	33	6.17
	I do not know	70	13.08
Do you exercise regularly?	Yes	293	54.77
	No	242	45.23
Is your diabetes under control at present?	Yes	422	78.88
	No	39	7.29
	I do not know	74	13.83
Do you go for regular follow up as advised by your doctor?	Yes	469	87.66
	No	66	12.34
Attitude and practice score	Low (<6)	230	42.99
	High (≥6)	305	57.01
	Mean ± SD	5.22 ± 1.95	
	Range	0–7	

Note: DR: Diabetic retinopathy; N: Number.

A significant relationship was found between the participants' personal history and knowledge of DR (p-value < 0.001), as well as their attitudes and practices (p-value < 0.001), as shown in Tables 4 and 5.

Table 4. Association between DR knowledge and demographic factors of the study participants (N = 535).

Variable		Low knowledge (N = 246)		High knowledge (N = 289)		χ^2	p
		No.	%	No.	%		
Age (year)	18–29	32	13.01	48	16.61	3.09	0.54
	30–39	29	11.79	38	13.15		
	40–49	70	28.46	67	23.18		
	50–59	64	26.02	71	24.57		
	≥60	51	20.73	65	22.49		
Gender	Male	129	52.44	172	59.52	2.70	0.100
	Female	117	47.56	117	40.48		
Family size	1	32	13.01	46	15.92	5.60	0.13
	2	15	6.10	28	9.69		
	3	40	16.26	32	11.07		
	>3	159	64.63	183	63.32		
Education level	Up to high school	134	54.47	139	48.10	5.57	0.06
	Bachelor or diploma	101	41.06	123	42.56		
	Master or Ph.D.	11	4.47	27	9.34		
Job status	Student	26	10.57	40	13.84	8.69	0.03
	Employee	115	46.75	159	55.02		
	Non-employee	55	22.36	41	14.19		
	Retired	50	20.33	49	16.96		
Duration of DM	1–3 years	63	25.61	65	22.49	2.87	0.41
	4–6 years	72	29.27	79	27.34		
	7–10 years	59	23.98	66	22.84		
	>10 years	52	21.14	79	27.34		
Family H/O	Yes	213	86.59	260	89.97	1.48	0.22
DM	No	33	13.41	29	10.03		
Personal H/O	Yes	55	22.36	143	49.48	41.93	<0.001*
DR	No	191	77.64	146	50.52		

Note: χ^2: Chi-square test; Statistical significance was considered at $p < 0.05$. *: Denotes levels of statistical significance. H/O: History of; DM: Diabetes millets; DR: Diabetic retinopathy; N: Number.

Table 5. Relationships between attitude and practice towards DR and sociodemographic characteristics of the study participants (N = 535).

Variable		Low attitude/practice (N = 230)		High attitude/practice (N = 305)		χ^2	p
		No.	%	No.	%		
Age (year)	18–29	30	13.04	50	16.39	3.90	0.42
	30–39	27	11.74	40	13.11		
	40–49	54	23.48	83	27.21		
	50–59	64	27.83	71	23.28		
	≥60	55	23.91	61	20.00		
Gender	Male	126	54.78	175	57.38	0.36	0.55
	Female	104	45.22	130	42.62		
Family size	1	33	14.35	45	14.75	0.27	0.96
	2	17	7.39	26	8.52		
	3	31	13.48	41	13.44		
	>3	149	64.78	193	63.28		
Education level	Up to high school	129	56.09	144	47.21	4.15	0.13
	Bachelor or diploma	86	37.39	138	45.25		
	Master or Ph.D.	15	6.52	23	7.54		
Job status	Student	27	11.74	39	12.79	6.12	0.11
	Employee	107	46.52	167	54.75		
	Non-employee	51	22.17	45	14.75		
	Retired	45	19.57	54	17.70		
Duration of DM	1–3 years	62	26.96	66	21.64	7.63	0.05
	4–6 years	55	23.91	96	31.48		
	7–10 years	48	20.87	77	25.25		
	>10 years	65	28.26	66	21.64		
Family H/O DM	Yes	196	85.22	277	90.82	4.02	0.04
	No	34	14.78	28	9.18		
Personal H/O DR	Yes	64	27.83	134	43.93	14.59	<0.001*
	No	166	72.17	171	56.07		

Note: χ^2: Chi-square test; Statistical significance was considered at $p < 0.05$. *: Denotes levels of statistical significance. H/O: History of; DM: Diabetes millets; DR: Diabetic retinopathy; N: Number.

The primary source of information about DR for the participants was the internet (71%), followed by general physicians (59%) and ophthalmologists (53%). A detailed breakdown of the sources of information is shown in Figure 1. The sources of knowledge of friends/relatives ($p = 0.003$), internet/social media ($p < 0.001$), ophthalmologists ($p < 0.001$), general physicians ($p = 0.0003$), and endocrinologists ($p = 0.008$) were more likely reported by patients with a high knowledge than those with a low knowledge of DR.

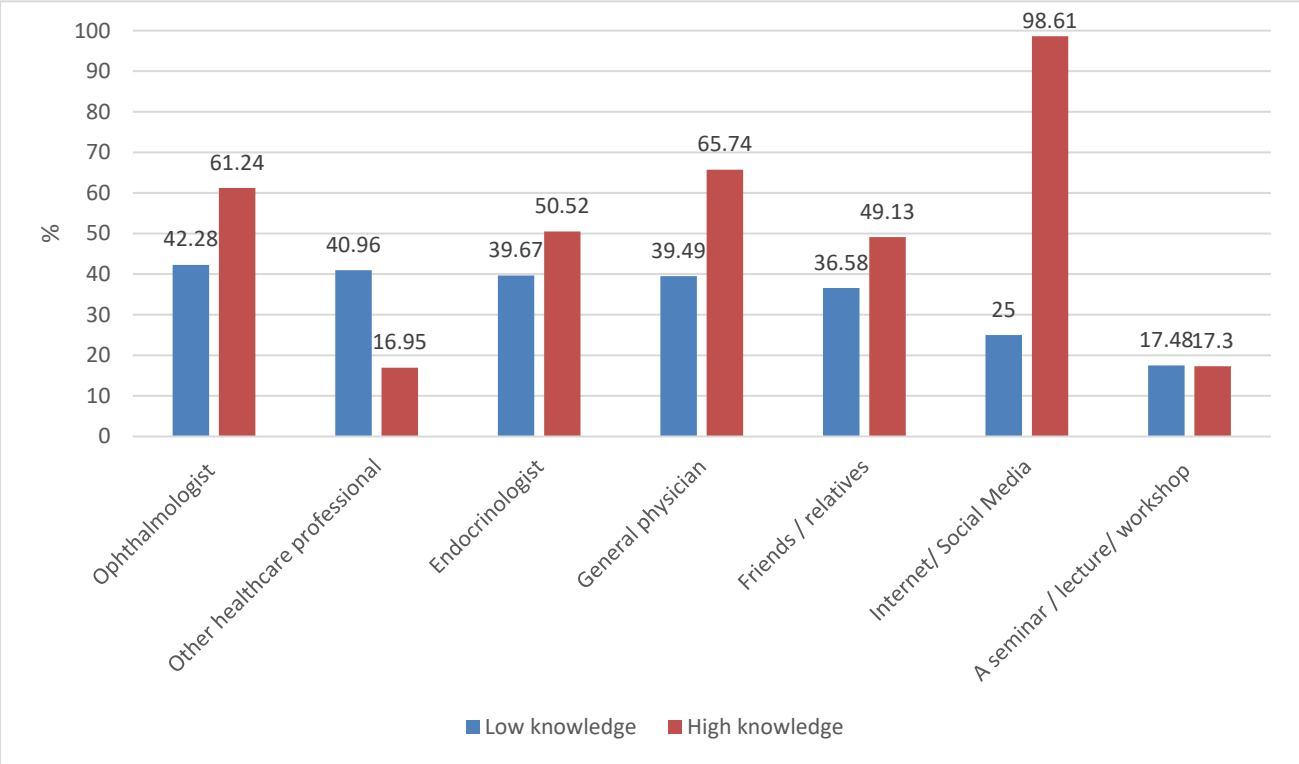

Figure 1. Frequency distribution of the sources of information about DR among the study participants by the level of knowledge (N = 535, more than one answer was allowed).

Table 6. Multiple logistic regression for the knowledge and attitude/practice of diabetic retinopathy conditioned on significant predictors.

Predictors	Knowledge			Attitude/practice		
	OR	95% CI	p	OR	95% CI	p
Have you been diagnosed with DR Yes vs. No	0.23	0.15–0.35	<0.001	0.39	0.26–0.59	<0.001
Age*	0.81	0.70–0.93	0.004	0.78	0.68–0.90	0.001
Educational level*	1.48	1.10–1.97	0.008	1.35	1.01–1.79	0.04
Family history of diabetes Yes vs. No				0.59	0.34–1.03	0.06

Note: *A linear variable was used to indicate a trend. DR: Diabetic retinopathy; OR: Odd ratio; 95% CI: 95% Confidence Interval. p: Probability, statistical significance was considered at $p < 0.05$.

Table 6 shows the significant predictors for the participants' knowledge and attitude/practice of DR. Being diagnosed with DR and aging were associated with low knowledge (OR (95% CI): 0.23 (0.15–0.35) and 0.81 (0.70–0.93), respectively), while a high educational level was associated with high knowledge (1.48 (1.10–1.97); $p = 0.008$). Being diagnosed with DR and aging were associated with a low attitude/practice of DR (0.39 (0.26–0.59) and 0.78 (0.68–0.90), respectively), and a high educational level was associated with a favorable attitude/practice of DR (1.35 (1.01–1.79); $p = 0.04$). A positive family history of diabetes was associated with a low attitude/practice of DR at a borderline ($p = 0.06$).

4. Discussion

A total of 535 individuals with diabetes participated in the study, with a slightly higher proportion of males (56.3%) compared to females (43.7%). Over half of the participants (50.8%) were aged between 40 and 59 years. A significant majority (88.41%) reported having a family history of diabetes, and 37% were diagnosed with DR.

When assessing the participants' knowledge of DR, 54% exhibited a high level of understanding, which is a figure similar to the findings from a recent study carried out in Saudi Arabia, where 53% of the respondents also demonstrated a good knowledge about DR [16,18]. However, the continued occurrence of DR among them suggests that knowledge alone may not ensure preventive action. Barriers such as a limited access to care or poor follow-ups may undermine the impact of awareness, thus highlighting the need for integrated education and healthcare support. In contrast, a study in Yemen revealed a lower level of knowledge about DR among the diabetic population, which was attributed to factors such as lower education levels, the female gender, and older age within the sample [17,19]. In our study, 91% of participants recognized that diabetes could adversely affect vision. This finding aligns with studies from Syria and Saudi Arabia, where more than 90% of the participants were aware of diabetes' potential impact on eye health [18–21].

While over 70% of the participants correctly identified poor glycemic control as a significant risk factor for the development of DR, only 20% were aware that the duration of diabetes also plays a crucial role in increasing the risk. This knowledge gap highlights specific areas that could be targeted for educational interventions in the future to improve the overall awareness.

Regarding the attitudes and practices toward DR, 57% of the participants scored highly. This reflects a generally positive outlook and proper management practices among the diabetic population, such as findings reported in a study from China, where the participants also demonstrated favorable attitudes and practices regarding DR management [20,22].

A statistically significant association was identified between a personal history of DR and the participants' knowledge, attitudes, and practices (p-value < 0.001 for each). This suggests that personal experience with DR may have motivated the participants to become more informed and proactive in managing the condition.

Additionally, the study found that the internet was the most prevalent source of information about DR, followed by consultations with general physicians and ophthalmologists. This preference may stem from the internet's accessibility, anonymity, and convenience. It offers immediate, cost-free access without appointments or travel, which allows the users to privately explore health topics and at their own pace. Online content is often easier to understand and culturally relatable, and many platforms provide peer support and shared experiences not typically available in clinical settings.

The interaction with healthcare professionals, particularly general practitioners and eye specialists, likely contributed to the high levels of awareness and the positive attitudes and practices observed in this study.

The main limitation of the study was the use of a convenient sample, which might affect the generalizability of the results due to limited representativeness, as patients with a good knowledge and positive attitudes may be more willing to participate in the study. Additionally, the use of an online survey via Google Forms limited responses to those who had internet access and could read the survey.

5. Conclusions

This study revealed that most participants exhibited moderate to high levels of knowledge, attitudes, and practices regarding DR. The majority demonstrated an understanding of diabetes as a risk to eye health and expressed positive attitudes toward DR management, with an emphasis on the importance of regular medical follow-ups. Personal experience with DR was strongly linked to a greater knowledge, which suggests that such an experience drives improved awareness and proactive management. The internet emerged as the primary source of information on DR, followed by healthcare professionals, thus highlighting the role of accessible digital resources and medical guidance.

Despite the study's strengths, a notable knowledge gap was identified regarding the role of diabetes duration as a risk factor for DR, thus highlighting the need for focused educational efforts. Strengthening communication between healthcare providers and patients, alongside the strategic use of digital platforms, can improve awareness and promote preventive practices. Addressing these gaps may involve integrating DR education into primary care, using community and media campaigns, and delivering clear information through visual aids and mobile apps. Additionally, training healthcare workers, involving community leaders, and enhancing access to eye care are key to improve early detection and management.

Author contributions

Mujeeb Ur Rehman Parrey: conception, design and data interpretation. Hanaa El-Sayed Bayomy: statistical analysis. Fawaz Salah M Alanazi, Asseel Farhan K Alanazi, Abdullah Hamoud M Alanazi, Abdulelah Raka A Alanazi: data collection. All authors have reviewed and approved the final manuscript.

Use of AI tools declaration

The authors declare they have not used artificial intelligence (AI) tools in the creation of this article.

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Ethical approval of the research and informed consent

Ethical approval (85/44/H) was obtained from the Local Bioethics Committee of Northern Border University. And confirm we have received the informed consent from patients.

Conflict of interest

The authors declare no conflict of interest.

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