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RESEARCH ARTICLE

The effect of brief educational intervention on level of awareness about chronic kidney disease among type-2 diabetes mellitus patients in Prince Sultan Military Hospital, Taif

Saja Althagafi[1,2] · **Ebtehaj Alotaibi**[1,2] · **Nawaf Almutairi**[3] · **Aeshah Althobaiti**[3]

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Abstract

Purpose Lack of awareness about chronic kidney disease is prevalent and disrupts glycaemic control. In Saudi Arabia many authors highlighted the problem and called for educational interventions to be designed. Our study is the first to address this issue in Saudi Arabia and evaluate a brief educator-led educational intervention in terms of boosting awareness about and knowledge of chronic kidney disease among type two diabetes patients.

Method This was an educational interventional investigation of patients with type two attending diabetes clinic in Taif, Saudi Arabia. The effect of a brief educational intervention focused on awareness about chronic kidney disease was assessed using chronic kidney disease knowledge scale before and after the intervention.

Results We included (n = 100) type two diabetes patients. We estimated good reliability and internal consistency for the knowledge score (Cronbach's alpha was 0.79). Following the educational session, awareness about chronic kidney disease rose from 77 to 100% and knowledge score increased form 7.6 points at baseline to a 15.2 points; paired t value = 15.984, $p < 0.00001$). Improvement in awareness of chronic kidney disease was associated with being in employment, female sex, and shorter diabetes duration.

Conclusion Brief educational intervention among patients with type two diabetes in Saudi Arabia leads to substantial improvement in awareness of and knowledge about chronic kidney disease. All items related to knowledge about chronic kidney disease improved substantially following educational intervention. It is recommended that all patients attending diabetes clinics receive focused education about chronic kidney disease.

Keywords Educational intervention · Improvement in awareness · Chronic kidney disease · Diabetes type two · Taif · Saudi Arabia

Introduction

The definition of Diabetes mellitus rests around persistently high glucose blood levels secondary to a malfunctioning of insulin hormone caused by either deficiency, resistance, or overactivity of opposing hyperglycaemic hormones [1]. A range of metabolic abnormalities would ensue as a direct result of diabetes mellitus [2]. The World Health Organization predicts that over 400 million individuals currently live with diabetes across the globe, with substantial annual mortality (1.5 million deaths), morbidity, and economic adversity [3].

Type-two diabetes is currently the second leading cause worldwide for chronic kidney disease CKD and CKD-related mortality [4]. In 2019, stark statistics were reported as 2.62 million new diabetes-related CKD were recorded globally, some 134.58 million diabetes patients lived with CKD, and further 405,000 people died of diabetes-related CKD [4]. Notably, overall knowledge levels of CKD among patients with diabetes were found to be very poor

✉ Saja Althagafi
SajaDhafer@hotmail.com

1 Department of Family Medicine, Prince Mansour Military Hospital, Taif, Saudi Arabia

2 Department of Family Medicine, Alhada Military Hospital, Alhada, Saudi Arabia

3 Department of Diabetes Health Education, Prince Sultan Military Hospital, Taif, Saudi Arabia

[5, 6]. It was also notable that, even after deterioration of renal function was recorded in the course of diabetes care, a considerable proportion of patients (some 37%) remain unaware of CKD [7]. When patients are unaware of their CKD diagnosis, the likelihood of disrupted glycaemic control is high, paradoxically among those in earlier stages of renal dysfunction [8]. Hence, awareness about diabetes-induced CKD is of vital importance for easing the burden of the disease and for earlier detection, presentation, treatment, and minimization of complications. There were studies that showed positive impact for educational intervention in terms of lesser disease burden, shorter hospital stay, and improved economic savings [9].

Authors have long observed extremely poor awareness levels of CKD among diabetes patients in Saudi Arabia [10, 11] Many have called incessantly for implementation of effective educational interventions and campaigns particularly at primary healthcare diabetes care facilities [11]. Studies, although highlighting a bleak picture for poor knowledge of CKD among Saudi diabetes patients, have shown better levels of knowledge when health professionals were the primary source of information to patients [12–15]. However, no studies provided evidence for effective educational interventions in terms of improvement of CKD-related knowledge among patients when healthcare professionals proactively provide information about the condition within the primary care settings.

Patients living with diabetes are at substantial risk for development of CKD. Such risk could be ameliorated by better awareness and earlier detection of this disease. Little is known about effective educational interventions that can routinely be delivered in primary care settings in terms of improving patient awareness and, hence, minimize CKD-related complications.

The main objective for the current study was to estimate the effect of a well-designed brief educational intervention deliverable at primary healthcare setting level among patients with diabetes in Taif, Saudi Arabia.

Methods

Study design The study was a pre- post- questionnaire-based interventional investigation for evaluation of knowledge and awareness among diabetes patients. The study was reported in accordance with STROBE Checklist of cross-sectional studies.

Study area The survey was conducted primarily in a diabetes clinic, located on the grounds of Prince Sultan Military Hospital in Taif, Saudi Arabia.

Study setting The diabetes clinic, located on the grounds of Prince Sultan Military Hospital in Taif, Saudi Arabia. The study took place between January 2023 and March 2023 for completion of recruitment and educational intervention for the selected participants. Data collection was immediate before and after educational intervention. Data analysis and final report were complete by April 2023.

Study participants The target population included all adult patients with Type 2 Diabetes T2D attending the diabetes clinic, located on the grounds of Prince Sultan Military Hospital in Taif, Saudi Arabia.

Inclusion criteria Diagnosis of T2D for at least six months prior to participation in the study, literate with sound cognitive abilities, age above eighteen years, and registered to attend the diabetes clinic, located on the grounds of Prince Sultan Military Hospital in Taif, Saudi Arabia.

Exclusion criteria Paediatric patients, type one diabetes diagnosis, severe behavioural and cognitive disturbances that prevent participation in the survey.

Study variables Mean knowledge score before and after educational intervention, demographic variables as independent adjustment variables (age, gender, education level, and employment status) and clinical variables (diabetes duration). Adjustment to educational background is deemed importance as it minimizes the effect of bias related to better knowledge among participants with higher educational attainment.

Sample size based on a pre-test knowledge level of 47.6% that increased to 76% pots-educational intervention as reported by *Stolpe et al.*, [2021] [16], for a 99% confidence interval, 80% power, we will require (n = 63) adult patients with diabetes [17].

$$\text{Sample size} = \left(Z_{\alpha/2} + Z_{\beta}\right)^2 * \left(p_1(1-p_1) + p_2(1-p_2)\right)/(p_1 - p_2)^2,$$
$$p_1 = 47.6\%,\ p_2 = 76\%,\ Z_{\alpha/2} = 2.58,\ Z_{\beta} = 0.84$$

Sampling scheme We used a random sampling scheme of patients scheduled to attend on a specific clinic day. The sampling frame was constructed using data of all patients scheduled to attend on a specific weekday clinic. Of every 100 patients scheduled to attend, a sample of 20 was drawn using pseudorandom number generator. During the five weekdays a total of (n = 100) were set as the target. All potential patients were approached by the main researcher and invited to participate. A written consent to participate was a obligatory before engagement in the educational intervention provided.

Data collection tool A pre-designed CKD awareness measurement tool: This was adapted from the work of [Balwani et al., 2019] [10] and [Stolpe et al., 2021] [16] with internal reliability of 79% on Cronbach's alpha estimate and face validity confirmed by a group of senior family medicine consultants and academics. It was provided to participants before and after a 15-minutes group educational intervention. We also collected data pertinent to demographic and clinical attributes.

Data collection method patients selected for recruitment were interviewed by the principal investigator. The study purpose was explained in simple plain Arabic, and they were given ample opportunity to ask questions about the study. After they sign the consent form, they were immediately provided with pen and papers containing the questionnaires that would measure the knowledge level. If the patient was illiterate, then a member of the research team would offer assistance in filling the questionnaire. Then a 15-minute educational intervention was delivered to the participants in groups of three patients by professional health educators. After completion of the educational group, the same knowledge questionnaire would be completed by all the participants.

Educational intervention the session was carried out by the professional health educator on duty on the day of recruitment. Professional health educators in the centre were experienced in their role with a university degree in nursing and sub-specialism in diabetes health education and average experience of 3 to 8 years in diabetes-related health education. It was conducted in the purpose-built health education room with patients comfortably seated around their health educator. No barrier was placed between the educator and patients. The session was completed within 15 min. No more than three participants were allowed per session. The session was mostly didactic with a focus on learning outcomes of how to define chronic kidney disease and enumerate its symptoms and complications, describe the connection between chronic kidney disease and diabetes, know the methods of preventing chronic kidney disease in the context of diabetes. Participants also received education about the importance of regular monitoring of vital signs and kidney functions in addition to lifestyle modifications. There was opportunity for questions and answers at the end of each session. All sessions were conducted in Arabic language.

Data analysis Data were entered in a Microsoft excel file as they were collected. The document was saved in the personal computer device of the principal investigator. It was password protected. We utilized generalized linear regression modelling analysis and pre and post paired t test analysis to evaluate the impact of our educational intervention on CKD knowledge. Data were entered into a password-protected Microsoft excel document as they were Descriptive analysis of demographic and clinical factors was carried out using counts and proportions for categorical variates and mean and standard deviation for numerical variates. Statistical significance was set a $p < 0.05$. Missing data would be imputed using the robust Multiple Imputation by Chained Equations method.

In explorative and inferential statistical analyses, we used R Statistical Software 3.6.0, popular in clinical academic research [18].

The study was approved by the local research and ethics committee based in Al-Hada Armed Forces Hospital in Taif, Saudi Arabia.

Results

The current study recruited a total of (n = 100) patients with type two diabetes who attended the diabetes clinic in Prince Sultan Military Hospital, in Taif. All the (n = 100) patients underwent brief educational intervention with measurement of knowledge evaluated before and after the education session.

In terms of the clinical and demographic factors for the participating individuals, as shown in Table 1, the mean age among those agreed to be included was 59.7 years (SD = 11.1 years). Age ranged between 35 and 87 years. The median age was 59 years.

Most participants (n = 86, 86%) were married, with only (n = 6, 6%) who were widowed, and (n = 1, 1%) who was single.

In terms of family size, the mean children count was 8.1 children (SD = 5.6 children), ranging between 0 and 25 children, with the median count of children was 7 children.

With regards to employment status, there were (n = 35, 35%) who were retired, (n = 33, 33%) who were employed currently, (n = 4, 4%) who were military personnel, (n = 4, 4%) who were housewives, and (n = 3, 3%) who were civil servants.

Most participants (n = 38, 38%) were uneducated, followed by primary school graduates (n = 27, 27%), secondary school graduates (n = 18, 18%), Intermediate school graduates (n = 11, 11%), and university graduates (n = 3, 3%).

Men constituted (n = 54, 54%) of the participants, and women were (n = 46, 46%) of the respondents.

The mean duration of diabetes was 11.3 years (SD = 8.4 years), ranging from 1 year to 40 years and the median duration of diabetes was 10 years.

Table 1 Clinical and demographic characteristics of the study participants

Factor	Mean/Count	SD/Percentage
Age	μ = 59.7 years	SD = 11.1 years
Marital Status	86	86%
Married	6	6%
Widowed	1	1%
Single		
Number of children	μ = 8.1 children	SD = 5.6 children
Employment	33	33%
Unemployed	35	35%
Retired	4	4%
Military	4	4%
Housewife	3	3%
Civil servant		
Education	38	38%
Uneducated	27	27%
Primary	11	11%
Intermediate	18	18%
Secondary	3	3%
University		
Sex	54	54%
Man	46	46%
Woman		
Duration of DM	μ = 11.3 years	SD = 8.4 years

As shown in Table 2, all items related to knowledge about chronic kidney disease improved significantly following the educational intervention. Following the educational session, the proportion of patients who ever heard of chronic kidney disease rose from 77 to 100%. constituted (n = 54, 54%) of the participants, and women were (n = 46, 46%) of the respondents.

It was notable that only 76% of patients ever performed a kidney function test at baseline. Of those attended the educational session only 86% did such renal testing. This improvement, however, was not statistically significant (Chi squared = 1.1045, p = 0.2933).

The Cronbach's alpha estimate for the knowledge score was found to be 0.79 (95% from 0.72 to 0.84), which indicated good reliability and good internal consistency.

The mean baseline knowledge score was 7.6 points (out of maximum 17 points), SD was 4.79 points. This mean knowledge score rose substantially to 15.2 points following educational intervention (SD = 2.49 points). This improvement was statistically significant paired t value = 15.984, $p < 0.00001$. See Fig. 1.

Figure 1 shows that, at baseline, the mean knowledge score was 7.6 points (shown in the left-hand side red box-and-whiskers plot). This mean knowledge score rose substantially to 15.2 points following educational intervention

Table 2 Chronic kidney disease knowledge responses among the participants before and after the educational intervention

Item	correct answers before the intervention	correct answers after the intervention	Chi squared test	p
Ever heard of CKD	77%	100%	23.778	< 0.00001
Can diabetes cause chronic kidney disease?	72%	98%	24.51	< 0.00001
Do you need to do a periodic kidney function analysis even if asymptomatic?	66%	95%	24.972	< 0.00001
Can you avoid chronic kidney disease?	57%	92%	30.425	< 0.00001
Weight loss is a symptom of chronic kidney disease	36%	94%	71.407	< 0.00001
Swollen ankles is a symptom of chronic kidney disease	41%	92%	56.11	< 0.00001
Itchy skin is a symptom of chronic kidney disease	23%	91%	91.575	< 0.00001
Difficulty sleeping is a symptom of chronic kidney disease	28%	96%	95.267	< 0.00001
Anemia is a complication of chronic kidney disease	27%	94%	91.139	< 0.00001
High blood pressure is a complication of chronic kidney disease	37%	95%	72.393	< 0.00001
Inflammation of heart membrane is a complication of chronic kidney disease	28%	88%	71.449	< 0.00001
Seizures activity is a complication of chronic kidney disease	29%	78%	46.307	< 0.00001
Weak immunity is a complication of chronic kidney disease	40%	93%	60.689	< 0.00001
Screening of chronic kidney disease can reduce the risk of kidney failure	56%	86%	20.423	< 0.00001
Have you ever done a kidney function test?	76%	83%	1.1045	0.2933
Has your doctor or nurse ever told you about your risk for developing CKD?	35%	51%	4.59	0.03216
Chronic kidney disease can have no symptoms	32%	89%	65.614	< 0.00001

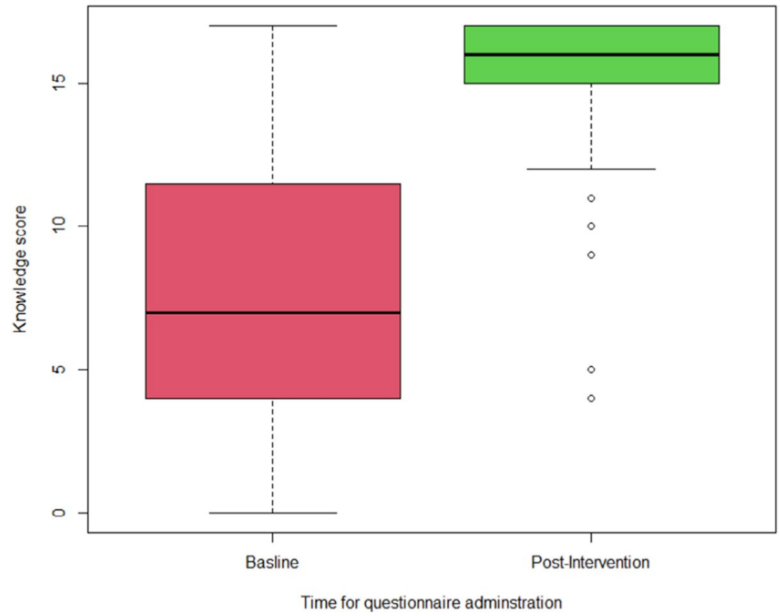

Fig. 1 Improvement in chronic kidney disease knowledge following brief educational intervention delivered to the study participants

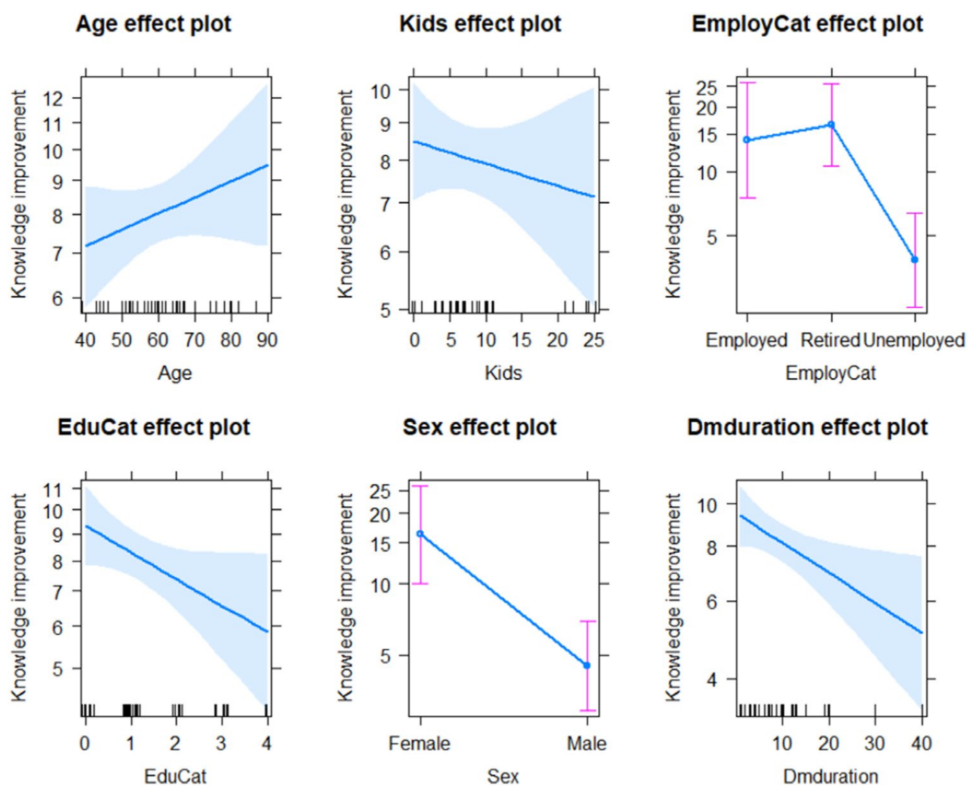

Fig. 2 Clinical and demographic factors' impact on patients' rise in knowledge score following educational intervention

(as shown on the right-hand side green box-and-whiskers plot). This improvement was statistically significant paired t value = 15.984, $p < 0.00001$.

Figure 2 shows that when adjusted for the effect of clinical and demographic factors, the effect of being unemployed was associated with reduction in the mean knowledge score by 72.48% (Odds = 0.2752, p = 0.01354). Also, male participants were far less improved in terms of expected knowledge score than female participants by 72.26% (Odds = 0.2774, p = 0.00501). Moreover, the longer the DM duration the lower the score increase by an average of 1.57% (Odds = 0.9843, p = 0.01845). Other factors were not significantly associated with change in knowledge score increase.

In terms of the adjusted effect for clinical and demographic variables on improvement in knowledge score following the educational intervention, we modelled the increase in score using Poisson regression analysis. Being unemployed was associated with reduction in the mean knowledge score by 72.48% (Odds = 0.2752, p = 0.01354). Also, male participants were far less improved in terms of expected knowledge score than female participants by 72.26% (Odds = 0.2774, p = 0.00501). Moreover, the longer the DM duration the lower the score increase by an average of 1.57% (Odds = 0.9843, p = 0.01845). Other factors were not significantly associated with change in knowledge score increase. See Fig. 2 and Table 3.

Discussion

The current interventional study included one hundred patients living with type two diabetes. To the best of the authors' knowledge, this investigation is the first of its kind in Saudi Arabia to focus on improving awareness of chronic kidney disease in the context of type two diabetes. Provision of patient-centred education in terms of chronic kidney disease remain a significant challenge even in developed countries [19].

We confirmed, based on our results, that a brief educator-led intervention substantially improves awareness of chronic kidney disease in the context of type two diabetes. Our findings confirmed positive effect for the educational intervention on all items related to knowledge about chronic kidney disease. For instance, at baseline only 77% of our participants ever heard of chronic kidney disease. This proportion jumped to 100% following our focused educational intervention. Indeed, awareness about chronic kidney disease among patients with diabetes is poor, even in regions with advanced healthcare facilities [7]. Our intervention proved quite efficacious in raising awareness about chronic kidney disease in the context of type two diabetes. Awareness is crucially important in timely identification of renal function deterioration and instigation of appropriate treatment at an early stage of the disease [20].

Table 3 Effect of background demographic and clinical factors on improvement of chronic kidney disease knowledge among the participants before and after the educational intervention

Factor	Odds	95% (Odds)	P value
Age	1.0057	0.9966 to 1.0149	0.21975
Kids	0.9930	0.9737 to 1.0126	0.48079
Employment: Retired	1.1830	0.7261 to 1.9276	0.49980
Employment: Unemployed	0.2752	0.0988 to 0.7663	0.01354 *
Education	0.8897	0.7901 to 1.0019	0.05372 .
Sex: Male	0.2774	0.1132 to 0.6794	0.00502 **
DM Duration	0.9843	0.9713 to 0.9973	0.01845 *

Furthermore, our findings confirmed that educational intervention improves knowledge of chronic kidney disease in the context of type two diabetes. Knowledge score doubled following our educational intervention (from7.6 points to 15.2 points). Previous research has shown that educational packages could improve the health and well-being of patients with diabetes in terms of their renal parameters [21]. Patient education was seen as an important tool in early identification of chronic kidney disease and subsequent reduction in risk of renal failure [22]. Furthermore, educational interventions were shown to be cost-effective in terms of substantial reduction in healthcare costs [9]. Patients with chronic kidney disease were shown to respond favourably to educational interventions in terms of disease management, compliance with lifestyle advice, and nutritional choices [23]. Many authors have called for efficient patient-centred educational campaigns to reduce the risk for development of renal complications among patients with diabetes [24].

Improvement in knowledge score was seen among employed patients, women, and patients with shorter diabetes duration among our participants. It could be difficult to explain such association, given the paucity of research into effectiveness of educational intervention in terms of knowledge of chronic kidney disease among patients with diabetes. Women were shown to have lower levels of awareness regarding chronic kidney disease than men [25]. However, in Saudi Arabia, although women were less aware than men in terms of diabetes-related renal impairment, the difference was shown to be marginal and non-significant clinically or statistically [12]. Similarly, diabetes duration was associated with slight increase in awareness about chronic kidney disease, likely because of more frequent contact with healthcare professionals and blood testing [12]. We may speculate that lower levels of baseline knowledge could have led to greater improvement in knowledge acquisition score because of the essential increased room for improvement. However, we should wait for further research to determine the presence of and exact causes for such association between female gender, shorter duration of diabetes and employment and better score in terms of chronic kidney disease knowledge among patients with diabetes.

One point of strength to our current study was the use of valid and reliable research tool to correctly gauge the level of knowledge at baseline and following completion of the educational session. We confirmed good internal consistency based on our dataset. However, several limitations existed in our current investigation that merit mentioning in the course of our paper. The results were obtained based on an evaluation on the same day of educational intervention. Therefore, the long-term benefit of our educational session can not be assessed based on our findings. Furthermore, our survey focused on awareness and knowledge components of patient learning. Other aspects of learning, such as health-related behaviour or attitudes remain beyond the scope of our study. In addition, our study results were based solely on questionnaire assessment. We did not test the individual patient understanding of learning outcomes using a 'show me' or 'teach-back' approach which was shown to be efficacious in self-management of a variety of chronic diseases [26]. This should be evaluated in further research.

Future research should evaluate other forms of health educational interventions, such as visual aids, patient-led interventions, and multifaceted educational interventions. Also, long-term benefits of educational interventions should be evaluated in longitudinal research in addition to the effects in terms of self-management skills, positive attitudes towards health interventions, and adoption of healthy practices and behaviours. Future research should also actively check diabetes patients' understanding of chronic kidney disease using teach-back methods. Further research is required to consolidate the effect of clinical and demographic factors on knowledge acquisition and examine if the baseline knowledge has any effect on further knowledge gain.

We may conclude that brief educational intervention among patients with type two diabetes in Saudi Arabia leads to substantial improvement in awareness of and knowledge about chronic kidney disease. All items related to knowledge about chronic kidney disease improved substantially following educational intervention. It is recommended that all patients attending diabetes clinics receive focused education about chronic kidney disease.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40200-023-01366-3.

Competing interests Authors disclose no financial nor non-financial interests that could be related to the current paper either directly or indirectly.

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