ORGINAL ARTICLE

Predictors of Diabetes Self-Management Behaviors in Type 2 Diabetes Patients

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Received: 28 July 2020

Accepted: 22 October 2020

Published in December 2020

Abstract

Objective: Type 2 diabetes mellitus (T2DM) is a chronic condition that requires consistent medical care to help control glycemic indices. Diabetes self-management is found to be essential for optimal glycemic control. This study aimed to investigate the predictors of diabetes self-management in adult with T2DM.

Materials and Methods: A cross-sectional study was conducted. A purposive sample of 142 adults with T2DM attended an outpatient endocrine clinic in an academic hospital in Ilam, Iran was invited to participate in this study from September to October 2016. The data were collected using a combination of validated questionnaires and the blood sample. IBM SPSS software version 22 used to conduct the analysis. Hierarchical linear regression analysis with the stepwise method was used to explore the predictors of diabetes self-management.

Results: The mean age of participants was 54.2 ± (11.8) years. The mean duration of diabetes was 8.9 ± (7.4). Hierarchical linear regression analysis determined that self-management behaviors had positive relationship with efficacy expectation (B= 0.445, *P*-value< 0.01), quality of life (B= 0.222, *P*-value= 0.02), and has a negative relationship with HbA1c (B= -0.194, *P*-value= 0.01).

Conclusion: The result of our study indicate that better diabetes self-management behaviors can be predicted by higher efficacy expectation, the better quality of life and lower HbA1c levels. Future interventions should focus on enhancing efficacy expectation, quality of life and optimizing glycemic control to improve self-management of diabetes.

Keywords: Type 2 diabetes, Diabetes self-management behavior, Predictive factors, Iranian adults, Self-efficacy, Depression, Quality of life

Introduction

Diabetes is a chronic progressive disorder that poses an immense economic burden in Iran, and the situation is expected to worsen in the future. 4.6 million are living with diabetes in Iran. It is estimated that there will be 9.2 million

[DOI: 10.18502/ijdo.v12i4.5180]

people with diabetes by the year 2040 (1). T2DM is the most common type of diabetes, accounting for 90-95% of the diagnosed population. Individuals with T2DM implement most of their care diabetes self-management is an essential aspect of diabetes care for improving patient's outcome (2). Self-management refers to daily behaviors that individual undertake to manage their condition such as exercise, eating a healthy diet, self-monitoring of blood glucose (3). Convincing evidence has been generated in recent years indicated that self-management is an effective approach to achieve better health outcomes, reduced the incidence of complications, improved glycemic control and better quality of life (4,5). Previous researched have consistently found that a limited number of educational programs are available in Iran (6). As a result, the practice of diabetes self-management regimen often reported as suboptimal (7). Poor adherence to diabetes self-management and related lifestyle behaviors observed and is a widely recognized problem in this population (6). The common reasons for poor adherence are not clear. Recently, several epidemiological studies have been conducted to identify critical barriers to effective diabetes self-management in adults with T2DM. Multiple lines of evidence suggest that possible barriers to effective diabetes self-management behaviors (DSMB) are poor glycemic control (8), poor quality of life (9), high level of depression (10), low level of self-efficacy (11) and low level of social support (12). Diabetes self-management also seems to be influenced by other personal factors such as age, gender, monthly income, educational status, diabetes duration (13) and treatment plan (14).

The DSMB remain the cornerstone of diabetes management. A recent analysis of diabetes trends in Iran showed that a substantial portion of the diabetic population does not have successful diabetes self-management. To the best of our knowledge, no study investigated factors predict the DSMB in Iranian diabetic population. The purpose of this study was to fill this knowledge gap and statistically examine the predictors of diabetes self-management in adult with T2DM.

Materials and Methods

Study design

This study employed a cross-sectional design using the baseline data from the randomized controlled trial (Registration Number: IRCT2016062528627N1) evaluating the effectiveness of a nurse-led diabetes self-management education on glycemic control.

Study setting

Participants recruited from an urban primary and secondary care clinic located within an academic hospital in Ilam city, Iran. This hospital provides diabetes and cardiovascular health care, ambulance and emergency services, pharmacy, radiology and laboratory facilities. All patients with T2DM who registered at the clinic during the study period invited to participate in this study. Patients who were Iranian adults aged ≥18 years, with a confirmed diagnosis of T2DM at least for six months, who were independent in terms of their activities of daily living, and with baseline HbA1c levels ≥8% were included in this study. Illiterate patients who had an acute medical or surgical condition, with uncontrolled hypertension (≥ mm Hg), cognitive impairment, and diabetes-related complications were excluded from the study.

Study recruitment and participants

The program was initially based on Bandura`s self-efficacy theory to promote the patient`s confidence in their ability to manage their condition. Participants recruited through advertisements placed on the notice board of the clinic. The baseline data collected from September to October 2016. People have chosen to participate in this study if they were Iranian adults with T2DM aged ≥ 18 years, HbA1c ≥8% at the initial screening, independent in daily living activates, literate, and had no acute medical illness in the last 6-month. Patients excluded if they had severe

[DOI: 10.18502/ijdo.v12i4.5180]

diabetes-related complications (blindness, kidney disorder, and severe stroke), medical history of cognitive defects such as dementia, and had uncontrolled hypertension (blood pressure ≥ 180/110 mmHg). After the initial screening of eligibility for participation, information sessions arranged at the clinic. All participants provided with a written information sheet and consent form.

Study measures

Socio-demographic and clinical outcome

Information on demographic characteristics was collected using the structured questionnaire that included age, gender, educational status, and difficulty for paying basic needs. The available medical records of patients checked for diabetes-specific information (treatment plan, HbA1c levels, diabetes duration, and the existence of at least one co-morbidity). Glycosylated haemoglobin (HbA1c) was measured using the NycoCard HbA1c analyzer (made in the US). Fasting venous blood samples by standard venous puncture drawn by research assistants. This study is a secondary analysis of a 6-month randomized controlled trial, where we initially investigated training effects on HbA1c levels. Only patients with HbA1c≥ 8% included in our study because the improvement in HbA1c reported being greater in patients with a higher HbA1c at baseline (15).

The DSMB

The DSMB was measured using the Diabetes Self-Management Questionnaire (DSMQ) (16). This questionnaire consisted of 16 items to examine self-care activities associated with glycemic control in T2DM patients. The scoring was based on a 4-point Likert Scale ranging from 0 does not apply to me to 3 applies to me very much. Scores ranged from 0 to 10, with higher scores indicating highest self-rating of assessed behavior. The DSMQ has not been validated in Persian. A pilot study conducted to examine the reliability and validity of the Persian version of the questionnaire. The pilot study conducted in September 2016 among 160 individuals with T2DM who registered at the clinic. Pilot testing demonstrated that the instrument is valid and reliable to assess the DSMB (α= 0.87).

Self-efficacy

There are two constructs from Bandura`s self-efficacy theory: efficacy expectation and outcome expectation. Both constructs were assessed in our study (17).

Efficacy expectation was measured using The Diabetes Management Self-Efficacy Scale (DMSES) (18). We used this scale to assess the participant's confidence in their ability to manage their blood sugar, diet, physical activity, foot care, and medications. The instrument consisted of 20-items (response on an 11-point scale anchored at 0 cannot do at all to 10 certain can do) (18). Responses are summed to create a total score (ranged from 0 to 200) which higher score indicating greater efficacy expectation. This questionnaire has been validated in Persian (19) and showed to have high validity and reliability (α= 0.96).

Outcome expectations were measured using The Perceived Therapeutic Efficacy Scale (PTES) (20). It focused on the activities of patients with T2DM who were on prescribed medications. This instrument contained 10-items (response on an 11-point scale anchored at 0 no confidence to 10 highest confidences). The score ranged from 0 to 100 points, with higher scores indicating greater outcome expectation. To date, this instrument has not been validated in Iran. A pilot study was conducted on 160 patients with T2DM to check the validity and reliability of the instrument. The pilot study indicated that the PTES is a valid and reliable instrument for assessing outcome expectation in Iran (α= 0.95).

Quality of life

Quality of life was measured using the World Health Organization Quality of Life Scale (WHOQOL-BREF) (21). This scale is a self-administered short version of the instrument

[DOI: 10.18502/ijdo.v12i4.5180]

containing 26 items. Respondents asked to rate on a 5-point scale ranging from 1 very poor to 5 very good. Raw scores were transferred on a scale from 0 to 100 with higher scores indicating a higher quality of life. This instrument has previously validated for use in Iranian population (α= 0.94) (22).

Social support

Social support was measured by the Medical Outcome Study (MOS) Social Support Survey (SSS) tool (23). This scale is a self-administered instrument containing 19 items measuring different aspects of perceived social support. Respondents were asked to rate on a 5-point scale ranging from 0 none of them to 5 all of them. Scores ranged from 0 to 100, with higher scores indicating better social support. This instrument has previously validated for use in Iranian population (α= 0.97) (24).

Depression

Depression was measured using The Centre for Epidemiologic Studies Short Depression Scale (CES-D) (25). CES-D is a brief self-report instrument with 10-items measuring depression levels. This instrument used a 4-point Likert scale ranging from 0 rarely or none of the time to 3 all of the time. Responses are summed to create a total score (ranged from 0 to 30) which higher score indicating severe depression. This instrument has previously validated for use in Iranian population (α= 0.93) (26).

IBM SPSS software version 22 used to conduct the analysis. Data were presented with mean±SD for continuous variables and with the number of subjects or percentage for categorical variables. All statistical tests performed at a two-sided *P*-value < 0.05 level of significance. Hierarchical linear regression analysis with stepwise (enter method) procedure was performed to evaluate the predictors of diabetes self-management among adult patients with T2DM. We examined and confirmed that all assumptions for Hierarchical linear regression analysis were met prior to analysis.

Ethical considerations

Ethical approval obtained from the University Putra Malaysia (UPM) ethics committee for research involving human subjects, Malaysia (UPM/TNCPI/RMC/JKEUPM/1.4.18.2), as well as the ethics committee of the Ilam University of Medical Sciences, Iran (22/40/94/5599). Permission to reuse the instruments, as well as the director of the selected hospital, was obtained. After a complete description of the study to the potential participants, all patients gave written informed consent before their inclusion in this study.

Results

Total of 348 patients with T2DM aged 18 years and above invited to participate in this study. Out of 348 patients, 270 patients accepted to take part in this research. Of those accepted to participate in this study, 128 (24%) were excluded due to losing contact following screening (N= 26), ineligibility (N=83), and declining to participate (N=19). Thus, 142 patients with T2DM recruited. The mean age of participants was 54.2 ± (11.8) years (range: 22-69 years). Two third of the participants (N= 87, 61.3%) were aged between 45 and 64 years old. There were more female (N= 93, 65.5%) than males (N= 49, 34%). Majority of participants had the primary education (N= 64, 45.1%) followed by tertiary (N= 55, 38.7%) and secondary (N=23, 16.2%) education. Approximately three-quarters of participants (N=96, 67.6%) reported it was somewhat difficult to pay for basic needs. The mean duration of diabetes was 8.9 ± (7.4) (range: 1 to 40 years). Participants had mean HbA1c 9.32 ± (1.11) % (range: 8 to 11.80%). More than half of the participants (N=83, 58.5%) had HbA1c ≥ 9%. A vast majority of participants had at least one co-morbid condition (N=112, 78.9%) (Table 1).

The DSMB

The DSMB scores ranged from 0.90 to 7.08 out of the total score of 10, with the mean score of 3.56 ± (1.22).

[DOI: 10.18502/ijdo.v12i4.5180]

Table 1. Characteristics of the participants

Varible	Total sample N= 142
Characteristics	**Mean ± (SD)/ Frequency (%)**
Age, years	56 (±11.1)
Gender	
Male	49 (±34%)
Female	93 (±65.5%)
Educational Status	
Primary education	64 (±45.1%)
Secondary education	23 (±16.2%)
Tertiary education	55 (±38.7%)
Difficulty paying for basics	
Very hard	7 (±4.9%)
Somehow hard	96 (±67.6%)
Not hard at all	39 (±27.5%)
Duration of diabetes, Years	8.9 (±7.4)
Presence of at least one co-morbidity	112 (±78.9%)
HbA1c	9.32 (±1.11)
8-8.9%	59 (±41.5%)
≥ 9%	83 (±58.5%)
Use of anti-diabetes agents	
Yes	140 (±98.6%)
No	2 (±1.4%)

SD=standard deviation

Based on the total score, self-management can be classified into three subgroups of high (>6.66), moderate (3.34-6.66), and poor (<3.33). More than half of the participants (N= 76, 53.3%) had a moderate level of the DSMB, followed by insufficient levels (N= 76, 39.4%). The average score was then used in the statistical tests.

Efficacy expectation

The efficacy expectation scores ranged from 57 to 138 out of the total score of 200, with the mean score of 98.35± (13.95). Based on the total score, the level of efficacy expectations can be classified into poor (<66.6), fair (66.7-133.3), and good (>133.4). The vast majority of the participant`s efficacy expectations (N= 132, 93%) was classified as acceptable levels. The average score was then used in the statistical tests.

Outcome expectations

Out of a total score of 100, the outcomes expectation scores ranged from 44 to 77 with the mean score of 57.80 ± (7.11). Based on the total score, the outcome expectations can be classified into poor (<33.3), fair (33.4-66.6), and good (>66.7). A large proportion of participants had a fair level of outcome expectations, followed by good levels (N=20, 14.1%). The average score was then used in the statistical tests.

Quality of life

The mean score of participants` quality of life was 50.42 ± (9.17). Based on the total score, the quality of life can be classified into low (33.3), fair (33.4- 66.6), and high (>66.7). A vast majority of participants (N= 131, 92.3%) had an acceptable quality of life. The average score was then used in the statistical tests.

Social support

The social support scores ranged from 30 to 77.63 out of the total score of 100, with the mean score of 52.63 ± (9.31). Based on the total score, the social support score can be classified into low (<33.3), fair (33.4-66.6) and good (>66.7). Over four-fifths of participants had a moderate level of social support, followed by high levels (N=19, 13.4%) and low levels (N= 4, 3.5%). The average score was then used in the statistical tests.

Depression

Out of a possible score of 30, the depression scores ranged from 2 to 24, with the mean

[DOI: 10.18502/ijdo.v12i4.5180]

score of 12.15 ± (4.99). Based on the total score, the depression score can be classified into mild (<9), moderate (10-14), and severe (>15). More than a third of participants (N= 52, 37.3%) had a moderate level of depression. The figures for severe and fair levels of depression were quite similar, at 33.1% (N=47) and 29.6% (N=42) respectively. The average score was then used in the statistical tests.

Relationship between the DSMB and independent variables

A correlation coefficient was computed to assess the relationship between the DSMB and independent variables. As we expected, there was a negative correlation between the DSMB and HbA1c levels (r= -0.56, *P*-value <0.01), depression (r=-0.24, *P*-value <0.01). We also found a positive correlation between the DSMB and efficacy expectation (r= 0.69, *P*-value <0.01), outcome expectation (r= 0.51, *P*-value <0.01), quality of life (r= 0.59, *P*-value<0.01), social support (r=0.19, *P*-value= 0.01), and difficulty for paying for basic needs (r= 0.16, *P*-value= 0.01). We found no significant correlation between age, gender, educational status, treatment plan, diabetes duration, the existence of co-morbidity and the DSMB (Table 2).

Factors predicting the DSMB

Hierarchical linear regression analysis performed to assess the factors associated with the DSMB. The assumptions of Hierarchical linear regression analysis met. We performed the stepwise procedure in which variables added to the model in three steps. In the first step (Model A) socio-demographic variable (difficulty paying for basic needs) was included in the regression model followed by clinical outcome (HbA1c) and control variables (efficacy expectation, outcome expectation, quality of life, social support, depression). The hierarchical linear regression model showed that the independent variables explain 54% of self-management behaviors. The strongest predictor of the DSMB was self-efficacy (B= 0.445, *P*-value< 0.01), followed by quality of life (B= 0.222, *P*-value= 0.02) and HbA1c (B= -0.194, *P*-value= 0.01). Table 3 provides the relationship between self-management behavior and associated factors. Efficacy expectation and quality of life positively affected the DSMB with a significant value of B= 0.445, *P*-value <0.01 and B= 0.222, *P*-value = 0.02 respectively. With every increase in one unit of HbA1c, the self-management behavior decreased by 0.194 units (*P*-value =0.01).

Discussion

The concept of diabetes self-management means the patients need to take an active role in regulating their treatment, self-care and accept responsibility for their illness (27).

Table 2. Factors correlated with diabetes self-management behaviors

Independent variables	r	*P*-value
Age [a]	-0.10	0.21
Gender [b]	0.00	0.99
Educational Status [c]	0.05	0.43
Difficulty for Paying Basic Needs [c]	0.16*	0.01
Use of Anti-Diabetes Agents [b]	0.16	0.054
Baseline Hba1c[a]	-0.56*	<0.01
Diabetes Duration [a]	-0.08	0.30
Existence of At Least One Co-Morbidit y[b]	0.09	0.25
Efficacy Expectation [a]	0.69**	<0.01
Outcome Expectation [a]	0.51**	<0.01
Quality of life [a]	0.59**	<0.01
Social support [a]	0.19*	0.01
Depression [a]	-0.24**	<0.01

a: Pearson Product-Moment correlation coefficient; b: Point Biserial correlation coefficient; c: Kendall rank correlation coefficient; ** correlation is significant ta the 0.01 level (2-tailed), * correlation is significant at the 0.05 level (2-tailed); dependent variable: diabetes self-management behaviors

[DOI: 10.18502/ijdo.v12i4.5180]

Table 3. Predictors of diabetes self-management behaviors among patients with T2DM

Variable	Model 1			Model 2			Model 3		
	B	SE	β	B	SE	β	B	SE	β
Constant	2.386	0.472		8.882	0.918		-0.580	1.603	
Difficulty paying for basic needs	0.562**	0.206	0.224	0.35*	0.175	0.141	0.089	0.154	0.036
HbA1c				-0.647*	0.082	-0.546	-0.230*	0.088	-0.194
Efficacy expectation							0.037***	0.007	0.445
Outcome expectation							0.020	0.014	0.110
Quality of life							0.031*	0.014	0.222
Social support							-0.009	0.009	-0.078
Depression							0.026	0.024	0.095

* *P*-value <0.05; ** *P*-value <0.01; *** *P*-value <0.001

For successful and effective diabetes care patients must be able to take control of their illness through self-management (27). The main aim of diabetes self-management is to maintain quality of life to preserve the optimal glycemic level and remain free from the symptoms of the disease (28). As a result, the risk of developing a life-threatening complication of diabetes reduced, and disease progress substantially slowed. During the self-management, process patients feel more empowered and become more aware of their abilities in day-to-day management of their illness independently. The feeling of being empowered lead to significant changes in one`s life and better physical and psychological wellbeing, with a low level of depression all along. All these have a positive effect on the quality of life in a long time (28). This study aimed to identify the factors that predict DSMB among adults with T2DM. The data analysis of this study showed that efficacy expectation, quality of life, and HbA1c explained a significant proportion of the variance in the DSMB. On the other hand, age, gender, educational status, treatment plan, diabetes duration, the existence of co-morbidity did not significantly predict the patient`s score in the DSMB.

The efficacy expectation found to be the strongest predictor of the DSMB. Participants who had higher efficacy expectations were more likely to engage in healthier behaviors. This finding is in line with previous studies that also found that efficacy expectations were the most critical predictor of DSMB (17, 29,30). The efficacy expectation is an important concept driven from Bandura`s self-efficacy theory that refers to "an individual`s belief in his or her capacity to execute behaviors necessary to produce specific performance attainments" (31). Efficacy expectation reflects confident in the ability to act in a way that achieves desired future outcomes (31). Efficacy expectation can be useful in increasing confidence and motivation to engage in health-promoting behaviors. Individuals with high efficacy expectations tend to face the situation without resistance and perceive their disabilities less severe than those with low efficacy expectations (32). Thus, efficacy expectation is an essential prerequisite for successful self-management.

Quality of life observed to be the second strongest predictor of the DSMB. Quality of life is considered an essential aspect of well-being in patients with chronic disease such as diabetes. Diabetes can affect health and quality of life of people living with this condition in many ways. Physical symptoms like the pain of neuropathy or fatigue are one way. Mental symptoms such as depression over lost health or fear of future complications are another. Eating and physical activity behaviors, relationships, finances, and work issues all affect the quality of life and are affected by diabetes (33). Diabetes can make the patient feel overwhelmed. Feeling overwhelmed leads to diminished self-management, which in turn leads to worsened glycemic control and increased risk for complications (28). Our results are consistent with previous studies reported that quality of life is an important predictor of self-management behaviors. Little is known about the precise relationship between self-management and quality of life

[DOI: 10.18502/ijdo.v12i4.5180]

among patients with T2DM (34). Further researches are needed to evaluate the relationship between these two concepts.

HbA1c identified to be the third most potent predictor of the DSMB. Patients who frequently monitored their blood glucose levels were more likely to engage in diabetes self-management successfully compare with those who did not. The goal of diabetes self-management is to optimize metabolic control, minimize complications and improve quality of life while keeping costs under control (27). Regular monitoring of A1c is known to be the primary way to track glycemic control in diabetes. Maintaining reasonable control of HbA1c is known to be an essential precondition for successful self-management. In recent years, there has been an increased focus on encouraging patients to become aware of their HbA1c values to improve glycemic control and gain diabetes self-management skills. This finding is consistent with the prior finding in which continuous glucose monitoring identified as a critical technique to evaluate the effectiveness of the management plan (35).

The finding of this study revealed that outcome expectation did not influence diabetes self-management. Within the framework of social cognitive theory, efficacy expectation can act alone in the absence of high outcome expectation. This implies that individuals are more motivated to engage in DSMB if they expect beneficial consequences from those behaviors (positive rather than negative outcomes). Previous studies suggested that patients with high outcome expectation were more likely to engage in diabetes self-management (36,37). Many studies highlight the importance of efficacy expectation and outcome expectation for the successful self-management. However, few studies examined their potential interactive effects. Further research is needed to identify the nature of the possible relationship between outcome expectation and diabetes self-management.

Our study indicated that social support was not a significant predictor for DSMB. Our result is in line with previous studies showing that social support did not have a considerable influence on the DSMB in patients with type 2 diabetes (13,38). On the other hand, this finding is in contrast to previous work indicating those with stronger social support were more likely to report better diabetes self-management (39). Data discrepancies need to be addressed to confirm the relationship between social support and diabetes self-management. The progressive nature of diabetes often requires patients to maintain recommended self-management behaviours. Social support has been founded to be a crucial factor for patients to practice and sustain self-management behaviors (40). Patients need support to modify their daily guidelines and change their lifestyle habits. Social support is perceived to help direct these changes and thus offering a chance to the patients to manage their condition better (41). There have been very few studies which have reported the importance of social support in diabetes self-management. Therefore, further research needs to be undertaken to clarify this issue.

Our study revealed that depression did not show a significant effect on the DSMB. Few studies have examined the relationship between depression and diabetes self-management (42-44). In general, most of these studies have consistently indicated that depression is associated with poorer DSMB. Little is known about how depression can influence the DSMB. It would seem evident that individuals with depression need more support in developing self-management activities such as medication adherence and lifestyle modifications. A better understanding of how self-management activities were compromised in depression can shed light on the fundamental relationship between depression and unfavorable health outcomes (43). With this knowledge, further researches should be focused on establishing the potential relationship between depression and diabetes self-management.

[DOI: 10.18502/ijdo.v12i4.5180]

There are some potential limitations to our study. The primary limitation of our study is the cross-sectional design which does not allow for causal inference. The second limitation of this study is the non-probability sampling method and small sample size, which might reduce the external validity. The third limitation of this study is that all of the variables were derived from self-reported data, increasing the possibility of recall bias. The fourth limitation of this study is that only patients with T2DM addressed in this study. This can influence the observed results as a survey of people with type 1 diabetes may provide another side of the story. This should be a particularly interesting area for further research.

Conclusions

The purpose of this study was to determine the factors predicting diabetes self-management in adults with T2DM, Ilam, Iran. Our research indicated that self-management behaviours have a significant correlation with HbA1c, difficulties paying for basic needs, efficacy expectation, outcome expectation, quality of life, social support and depression. Further analysis indicated that efficacy expectation, quality of life and HbA1c were the only significant predictors of diabetes self-management. Together these three variables explained 54% of the variance in diabetes self-management. Efficacy expectation was found as the strongest predictor of diabetes self-management, followed by quality of life and HbA1c.

Acknowledgments

Acknowledgments are extended to our patients, who kindly shared their experience to aid in furthering medical education. Thanks are also extended to the Clinical Research Development Unit of Shahid Mostafa Khomeini Hospital, Ilam University of Medical Sciences, Ilam, Iran, to prepare this report.

Funding

Ilam University of Medical Sciences financially supported this study.

Conflict of Interest

The authors declared no conflict of interest.

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[DOI: 10.18502/ijdo.v12i4.5180]

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[DOI: 10.18502/ijdo.v12i4.5180]

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[DOI: 10.18502/ijdo.v12i4.5180]