A Review on Knowledge of Diabetes and Practice of Medication Adherence Among People Living With Diabetes Mellitus

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ABSTRACT

Introduction: The prevalence of diabetes among adults is increasing globally in the 21st century. However, the knowledge of diabetes and practice of medication adherence among people living with diabetes mellitus are still questionable. **Aims**: This literature review aimed to look for the literature that related to the level of knowledge about diabetes and its correlation with medication adherence among people living with diabetes mellitus. **Methods**: The studies included in this review were identified through a search of Proquest, ClinicalKey for Nursing, CINAHL and Ovid databases. The published articles from year 2010 onwards are included in this study. **Results**: A total of 18 articles were analysed in this review. It was found that having good or poor knowledge of diabetes does not guarantee their health-seeking practice of medication adherence. It was also reported that some of the factors that have been found to predict the level of knowledge and their practices include their sociodemographic characteristic. **Conclusion**: Therefore, the findings of this review giving alarm about future interventions and study in this particular area.

KEYWORDS: Diabetes Mellitus, Knowledge, Practice, Medication Adherence

INTRODUCTION

According to the World Health Organization (WHO) (2020), 8.5% of adults aged 18 years and older had diabetes in the year 2014. Moreover, diabetes was the direct cause of 1.6 million deaths in the year 2016 and high blood glucose was the cause of another 2.2 million deaths in the year 2012 across the globe (1). Hyperglycaemia or raised blood sugar level is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels (1). In the current

days, type 2 Diabetes Mellitus (T2DM) seem to have more prominent than type 1 Diabetes Mellitus (T1DM) across the globe (2). It has shown that more than 90% of all known cases of diabetes fall under T2DM (2). According to Malaysia's National Health and Morbidity Survey (NHMS) conducted in the year 2019, 1 in 5 adults in Malaysia has diabetes.

That is about 3.9 million people of population and based on the age-specification, people aged 18 and above (1). Malaysia as the sixth-largest population in South-East Asia, the prevalence of diabetes continues to increase at an alarming rate over the last 20 years from 6.3% in 1996 to 11.6% in 2006 (4). Based on the ethnic group of Malaysia, diabetes was commonly found in Indians (24.9%) which was the highest prevalence, followed by Malays (16.9%) and Chinese (13.8%) (5).

Malaysia nationwide audit done by the Institute of Health Management showed that the use of insulin in Ministry of Health (MOH) health facilities (primary, secondary and tertiary) was 13% and 19% respectively (6). Insulin therapy for diabetes patients is mainly prescribed in tertiary hospitals with low use in primary and secondary care (6).

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The usage of insulin therapy in tertiary care was much higher at 54%4 and has doubled compared to 28%5 in patients attending specialist clinics in MOH state hospitals and academic institutions (6). Moreover, it showed that insulin use was far greater in the public sector compared to the private sector reflecting the burden of patients seen and managed by the public sector (6).

According to the US Center for Disease Control and Prevention (2020), the number of known case diabetes for adults aged 18 years or older that take insulin, pills or both are in increasing trend (7). However, inadequate knowledge regarding medication is likely to influence its acceptance and adherence (8). Thus, people living with Diabetic Mellitus (DM) must be equipped with sufficient knowledge of diabetes and the practice of medication adherence to maintain their optimal glycemic level. Therefore, in this literature review, the authors aimed to review the available studies that demonstrated the level of knowledge about glycemic control using medications and its correlation with medication adherence in people living with DM.

METHOD

For the literature review search process, electronic databases were used to identify relevant studies. The search keywords were "knowledge", "practice", "medication adherence", "medication compliance", "self-care practice", "medication intake", "Type 2 Diabetes Mellitus" and "patients with diabetes" and yielded an enormous number of studies. The studies included in this review were identified through a search of Proquest, ClinicalKey for Nursing, CINAHL and Ovid.

An initial search using the above terms in searches of abstracts identified 4109 published articles. Four thousand articles were excluded after reading as not relevant for this review. After screening all articles from the rest, finally, 18 articles have extracted for this study. The literature review process was systematically carried out by using PRISMA flow as shown in figure 1. Full texts for all included articles were obtained and independently read by the author and co-authors to identify those papers suitable for inclusion in this review.

For the quality critical appraisal and assessment of the included studies have been carried out with the guideline from the critical appraisal skill program (CASP) (2018) tool although this review is not aiming as a systematic review (9). The inclusion criteria were original studies written in English and published in peer-reviewed journals or articles from 2010 onwards, used human subjects aged 18 and above that had been diagnosed with diabetes and not pregnant or diagnosed patients with diabetes.
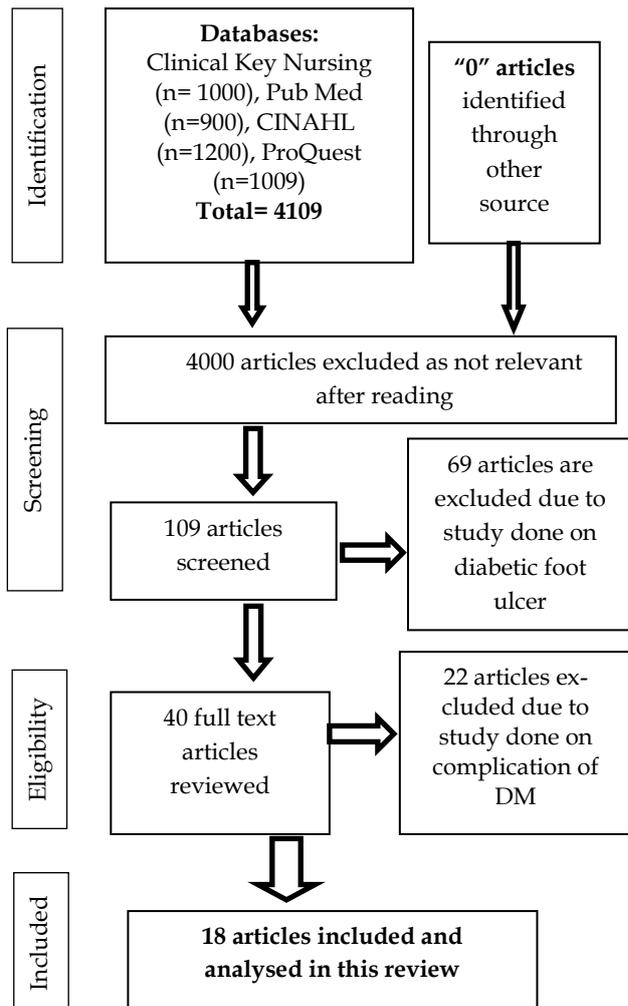

Figure 1. Systematic literature search flow

FINDINGS

Based on the systematic literature search flow as shown in Figure 1, a total of 4109 articles were identified through the initial literature search. Then, the 18 articles were analysed and presented in Table 1. A summary of risk factors for medication adherence among people living with diabetes was presented in Table 2. Each factor was evaluated for any established association with knowledge of diabetes and the practice of medication adherence among people living with diabetic mellitus.

Among the 18 included articles, 17 studies have used quantitative method and the other one is a qualitative method. Regarding sampling method, 13 used convenience sampling, 1 case-control, 1 consecutive sampling, 4 random samplings and 1 used purposive sampling. A sample size of the studies ranged from 72 to 500. Adherence measures used in this study gathered predominantly subjective data via interviews and

self-reported questionnaires. The details of finding from this review are further discussed in the following session.

The knowledge of diabetes

Many studies have been done to assess the level of knowledge of diabetes, glycemic control and self-care practice among people living with diabetes in various regions and clinical settings (10-13). A study done in Ethiopia found that 99 patients (32.7%) out of 303 patients who are living with diabetes had poor knowledge about their disease (10). They further described that patients who had poor knowledge of diabetes were 5.53 times more likely to not attain fasting glycemic goal compared to those who had good knowledge about diabetes.

A study was done in Northern Greece found that younger adult patients' self-care behaviour towards their disease was poor compared to an older adult (11). The author stated that adequate knowledge is considered to be the basis for incorporating self-management behaviour in patients with diabetes. Increased knowledge has been associated with improved control of T2DM whereas inadequate knowledge is associated with poor control. The study involved 177 participants through a university hospital day-clinic with the majority of older patients' age above 65 years old and had a long duration of diabetes.

Since having adequate knowledge is considered to be the basis of incorporating self-management behaviour in patients with diabetes (14). Moreover, the more they know about diabetes the better they can control their glycemic level, whereas inadequate knowledge is associated with poor control in people living with diabetes mellitus (14-15). Meanwhile in another cross-sectional study done in Jordan to evaluate the relationship between diabetes management self-efficacy and diabetes self-management behaviours and glycemic control among 223 people living with diabetes (16). It was found that the majority of their participants did not have their diabetes controlled; their self-efficacy was low, and they had suboptimal self-management behaviours with lead to poor glycemic control. On the other hand, a study done on 392 patients with diabetes found that 245 participants had adequate knowledge (17).

The practice of medication adherence

Having good knowledge is not sufficient to prevent diabetes. To have optimal glycemic control, people living with diabetes mellitus must have sufficient diabetes-related knowledge together with closely adhere to the prescribed medications. Nevertheless,

the reported incidence of poor medication adherence in patients with T2D ranged widely from 38% to 93% owing to widely different methodological approaches (18). A study was done in Pakistan to examine the association between diabetes-related knowledge and medication adherence (17). It was found that a weak positive correlation between diabetes-related knowledge and medication adherence was found for the study (r = 0.036, P < .05). Although their diabetes-related knowledge was adequate shown in the earlier, their adherence to treatment was poor (17).

A cross-sectional study was conducted to assess the knowledge regarding insulin use among 385 patients with diabetes in tertiary care hospitals in India (8). Their finding showed both higher education and economic standards were associated with a better understanding of insulin usage. Furthermore, longer duration of diabetes and its treatment (oral anti-diabetic drugs and insulin) were associated with better knowledge of some parameters (8).

Another study found that higher self-efficacy reported better self-management behaviours in taking medication among people living with diabetes (16). A study was done in Bangladesh, found out that the rate of adherence to an oral hyperglycemic agent (OHA) and insulin was 80% and 93.4% respectively (13). Among the study patients, 50.2% were females and the mean age was 54.2 years. Another study done in Palestine has shown that 57.3% of 405 patients with diabetes were considered adherent to the medications (14). Surprisingly, those with higher patients with diabetes knowledge level were found less likely to be non-adherent. From the findings, finally reported overall high compliance to drug therapy as well as the prescribed insulin injections. Among the pills and injection, most of the participants were compliance with the pills compared to the insulin injection (11 & 14).

In a descriptive study in Oman, the author highlights the self-efficacy and self-care behaviours among T2DM in which to examine the relationship between glycemic control, demographic and clinical factors on these two variables (19). Their results showed that the mean number of days for the medication intake was 1.98 (insulin), 2.38 (pills) and 2.18 (for both). Whereas in Isfahan, a study carried out to assess self-care practices and their relative components among T2DM (20). Through a cross-sectional study, 140 patients with diabetes were recruited to answer the questionnaires including medications. Their findings revealed that medications subscale was considered as the most important one in measuring diabetes self-care

practices with a mean score of 5.24 ± 2.38 days/week (20).

On top of that, in Egypt, there was also one study done regarding the compliance of patients with diabetes to self-management and associating factors related to it (21). Among 206 participants recruited via random sampling in their cross-sectional study, the authors found that out of 206 participants, just above half of them (54.4%) were good compliant to medications (21). A cross-sectional study was done in Turkey to examine self-care practices among people with T2DM and found that participants with a higher level of education have positively correlated with medication adherence (22). A study was done in Nigeria, to identify and evaluate the causes of medication non-adherence among 72 outpatients via random sampling (23). Their result showed that 59.5% of participants were found to have good adherence to their medication (23).

Another qualitative study was done in Addis among thirteen in-depth interviews with T2DM (24). Their study was done to see the self-care practices among T2DM and found that most of the participants were reported they are complying most with instructions regarding medicines more than any of the other components. However, contradict findings were found in research regarding adherence of medication in Pakistan by (17). This time, the target population was 392 patients with diabetes. Out of all participants, 282 (71.93%) were categorized as having poor adherence, and 97 (24.75%) were classified as having medium adherence. Only 3.3% of the patients showed high adherence to the treatment regimen.

Apart from that, another research in the United Arab Emirate stated that among 446 patients that were enrolled, 288 (64.6%) patients were considered as non-adherent. While 118(26.5%) and 40 (9.0%) had low adherence and medium adherence respectively (25). Another study was done in Bandung, Indonesia showed that 49.4% exhibited low adherence, 29.7% and 20.9% exhibited to medium and high adherence to diabetes medication respectively. Patients' income is said to be one of the factors that affected adherence (26). Parallel to the findings in another cross-sectional study in Singapore among 382 participants, the findings revealed that 57.1% had low medication adherence (27). This can be associated with younger age. However, the educational level of patients and the level of income did not seem to be associated with MA. Lastly, one cross-sectional study aimed to assess patients with diabetes' knowledge and the

therapeutic goal in Ethiopia (10). In their study, convenience sampling was used to recruit 303 participants in the clinic. They were pretested using a structured questionnaire, and the authors finally found out that 156 patients (51.5%) had poor practice on medication adherence which can be associated with males.

DISCUSSION

This review finding for knowledge of diabetes and the practice of medication adherence among people living with diabetic mellitus was varied. On the knowledge of diabetes aspect, the studies provided ranges of findings which deprived of different background of populations. The level of knowledge seems to be significantly associated with demographic characteristics of people living with diabetes, their disease duration as well as adherence to their medication (8 &16). Apart from that, they are known to predict the consequences if they are not compliant to the medication such as leading to severe complications including neuropathy. Unfortunately, there was one study that seems to be not supported this view (17).

Therefore, the level of knowledge among different demographic factors of patients with diabetes is still inconclusive. Incongruent to that, the practice of medication adherence also seems to be far from satisfactory where the number of patients with diabetes who knows but not practice with the medications is very low in most of the study (18, 20 & 26). Moreover, it seems that many fail to translate this knowledge into real practices. Evidence suggested that medication adherence is associated with various factors not only their demographics characteristic but also the knowledge of diabetes among people living with diabetes mellitus (24-27).

Seven studies revealed older age have an association with medication adherence as shown in table 2. While eight studies confirmed that gender can influence adherence towards medication. Seven studies agreed in their findings that a higher level of education was associated with medication adherence. Lastly, six studies stated that longer duration had an association with medication adherence. However, only one study revealed that income status has an association with medication adherence as stated in table 2.

Thus, successful self-management requires considerable knowledge on a medication by patients and families as it is crucial to understand the effects of diabetes on the body, the goals treatment and the effects of various behaviour in

glucose regulation. Unfortunately, people with different socio-demographic may have a different level of education thus affecting their level of knowledge. Consequently, due to lack of knowledge, usually, patients will take this matter slightly thus unable to achieve successful treatments. Therefore, strategies to enhance and promote self-efficacy and self-management behaviors for patients are essential components of diabetes education program to increase their medication adherence (16).

For the limitation of this review, there are some methodological limitations across the studies. Firstly, among quantitative designs, most studies adopted convenience sampling. The sample collected from this method might under- or over-represent the population. Yet, the degree of generalizability is also being questioned. Besides, most of the studies adopted cross-sectional designs in which this design can be said to have the lowest evidence level compared to control trials and cohort studies. Cross-sectional studies are also unable to form causal inferences. Hence, it is difficult to establish any causal relationships of overtime (28).

CONCLUSION

Although several studies on these aspects have been done in several countries which looking at different demographic factors of patients with diabetes, further study is needed to confirm the findings of these studies. However, the demographic characteristic of people living with diabetes have an association with their medication adherence, but it is still unclear if one of those factors can lead to medication adherence. Hence, due to the inconsistencies of the findings, more studies can be conducted in the future.

Having a good or poor knowledge level on diabetes medication does not guarantee their health-seeking practice of medication adherence. Overall, this review analyzed empirical findings that identified factors which are associated with the level of knowledge and their practice towards medication adherence. These factors are important to design interventions to improve adherence. Therefore, further focus on providing patient education and support in health care clinics to ensure that they have sufficient awareness of diabetes and the practice of medication adherence. So that it can be prevented from the early development of diabetes complication.

CONFLICT OF INTEREST

Authors declare none.

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Table 1: Literature Findings

AUTHOR/ PUBLICATION YEAR	TYPE/METHOD	SAMPLE SIZE,MERTHOD	INSTRUMENT	FINDINGS/RESULT
Choudhury, et al., 2014	Quantitative; cross sectional study	N=385, convenience sampling,	51 items questionnaires Urdu versions of the Morisky Medication Adherence Scale (MMAS-U) and the Michigan	The results showed *both higher education and economic standards* were associated with better understanding of insulin use. *Longer duration of diabetes* and its treatment were associated with better knowledge of some parameters
Nazir, et al., 2016)	Quantitative, cross-sectional study	N= 392	Questionnaires	Only 34 (8.67%) showed adequate knowledge which are majority were associated with *age* of the participants which was 51 years with 56.6% of respondents being *male*. Whereas, *duration of T2DM* was 5.6 years. Eighty-three participants (21.2%) had a matriculation *level of education.* Nearly 58% (n = 226) had a *monthly income* of more than 15 000 Pakistani rupees (PKR) per month.
Al-Khawaldeh, et al., 2012	Quantitative, cross-sectional study	N=223	Questionnaires	56.1% were men and 54.6% had a *monthly income of more than 500* Jordanian dinars. Their average age was *56.9 years.* The authors found out the highest self-efficacy score was for efficacy to carry out prescribed medical treatment with mean of 6.1.
Saleh, et al., 2014	Quantitative, cross-sectional study	N=500 Inclusion criteria - >25 years old - at least 1year having T2DM	Questionnaire 1) socio-demographic and family history 2) self-care practices r/t diabetes 3) five domains mobility,self care,usual activities,pain/ discomfort and anxiety	The rate of adherence of OHA and insulin was 80% and 93.4%. Among the study patients, 50.2% *were females and mean age was 54.2 years*
Sweileh et al., 2014	Quantitative. Cross-sectional study	N= 405, convenience sampling	Questionnaires	Approximately 57.3% of patients with diabetes with high knowledge score were less likely to be non-adherent. The duration of having *diabetes was 7 year and more than half of the patients had high education.*
Chourdakis, et. al, 2014	Quantitative, cross-sectional study	N=177	Questionnaires	High compliance to drug therapy as well as the prescribed insulin injections. This factors of *older age and longer duration of illness* are positively correlated with the medication adherence as prescribed.

AUTHOR/ PUBLICATION YEAR	TYPE/METHOD	SAMPLE SIZE,MERTHOD	INSTRUMENT	FINDINGS?RESULT
Sheila , et al., 2017	Quantitative cross-sectional study	N=140, Simple random sampling Inclusion criteria 18-80year, Diagnosed T2DM 2yrs	Interview-based questionnaire	Higher mean scores in medication self-efficacy among adults *with Bachelor/Master degree level of education, longer duration of diabetes*
Al-Haj Mohd, et al., 2016	Quantitative, case-control study	N= 446 223 (intervention) 223(control)	Questionnaires	288 (64.6%) patients were considered as non-adherent. While 118(26.5%) and 40 (9.0%) had low adherence and medium adherence respectively. The mean age *was 61 years old and 48.4% were males.*
Alfian, et al., 2016	Quantitative, cross-sectional study	N= 91, consecutive sampling	Questionnaire	49.4% exhibited low adherence, 29.7% and 20.9% exhibited to medium and high adherence to diabetes medication respectively. *Patients' income* are said to be one of the factors that affected the adherence
Tol, et al., 2012	Quantitative, Cross-sectional study	N= 141, random sampling	Questionnaire	Medications subscales as the most important subscale of self-care practices was relevant with age, disease duration, diabetes complications and type of treatment.
Mahfouz, et al., 2011	Quantitative, cross-sectional	N= 206, random sampling	Questionnaire	112 were good compliant to medications and the majority came from the adults less than 60 years. In terms of *gender,* female seems to be more adherent compared to male with 55.6% were good adherent to their medications
Kav, et al., 2015	Quantitative, cross-sectional study	N=200	Questionnaire	*Higher level of education and they were females positively correlated with medication adherence.* higher mean score was obtained by majority of the patients in practicing medication in their self-care daily practices
Lee, et al., 2017	Quantitative study Cross-sectional	N= 382 patients	The five-question Medication Adherence Report Scale (MARS-5)	57.1% had low medication adherence by using MARS-5. This can be associated with *younger age.*

AUTHOR/ PUBLICATION YEAR	TYPE/METHOD	SAMPLE SIZE,MERTHOD	INSTRUMENT	FINDINGS?RESULT
Yujuan, et al., 2013	Descriptive study Jan-May 2010	N= 163	Interview using questionnaire on diet, medication, exercise and glucose monitoring	The majority of participants took oral hypoglycemic agents (OHAs; 60.1%) and some were also treated with OHA-insulin combination therapy (17.8%). Participants with medication adherence (52%) tended to have lower FBG levels. Only 13% of participants practiced self-monitoring of blood glucose (SMBG). The predictors of a knowledge deficit or poor self-care were a low level of education (P<0.01) or old age (older than 53 years old; P=0.002). Deficits in diabetes-related knowledge and self-care practices existed among the majority of patients with suboptimal blood glucose control.
Kh H , et al., 2011	Quantitative, Cross-sectional study	N= 505 Convenience sampling	Questionnaire on: 1 general diabetes knowledge 2 medication adherence 3 glycemic control	A significantly higher score for knowledge and adherence (P\0.05) was found in those patients with lower HbA1C. Higher diabetes knowledge, higher medication adherence and using mono-therapy were significant predictors of good glycemic control in the multivariate analysis
Okoro, et al., 2012	Quantitative, cross-sectional study	N= 72, random sampling	Questionnaire	59.7% were considered as good adherence. *Being females is positively correlated* with the medication adherence.
Tewahido & Berhane, 2017	Qualitative study	Purposive sampling, Inclusion criteria T2DM 5yrs, 35-65y/o	Semi-structured interview 45-60minutes -Conducted by the first author in a private space within the hospital compound. The interviews were conducted in Amharic language.	Most patients better adhered to medication prescriptions. Associated with different socio-demographic factors which are *age, duration of diabetes, gender and level of education.* Overall, it can be said that most of the respondents entirely depended on their medications to manage their illness.
Aklilu, et. al., 2014	Quantitative study Cross-sectional	N= 303 T2DM patients	Structured questionnaires	156 patients (51.5%) had poor practice on medication adherence which can be associated with *males.*

Table 2: Summary of Risk factors for medication adherence

Risk factors for adherence	Total number of studies	Association established	No association established
Older age	8	7/8 (Tol et al., 2012), (Saleh et. al., 2014) (Chourdakis et al., 2014), (Yujuan et al., 2013), (Tewahido et al., 2017) (Nazir et al., 2016), (Moh et al., 2016)	1/8 (Lee et al., 2017)
Female gender	8	6/8 (Tol et al., 2012), (Saleh, et al., 2014) (Mahfouz et al., 2011), (Kav et al., 2015), (Okoro et al., 2012), (Tewahido et al., 2017)	3/8 (Mohd et al., 2016) (Aklilu et al., 2014)
Higher education status	7	5/7 (Sweileh, et al., 2010), (Kav et al., 2015), (D'Souza et al., 2017), (Kh H , et al., 2011), (Tewahido et al., 2017)	2/7 (Tol et al., 2012) (Yujuan et al., 2013)
Higher income status	1	(Alfian et al., 2016)	
Longer duration of illness	6	(Sweileh, et al., 2010), (Tol et al., 2012) (Chourdakis et al., 2014), (Tewahido et al., 2017), (D'Souza et al., 2017),(Nazir et al. 2016)	