

Emeka Japheth Chigozie, Habbaba Dabbagh Ali

# The Impact of Patient Education Interventions to Improve Health Literacy in Patients with Type 2 Diabetes Mellitus - A literature review

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<p>The amount of people who have diabetes has tripled since 1980. About 422 million people worldwide have diabetes. The increase rate of obesity coupled with the ageing of the global population implies that more than half of new diabetes cases will be type 2 diabetes mellitus. In this literature review, we described the effective patient education interventions that improved health literacy in patients with type 2 diabetes mellitus (T2DM). The aim of this literature review is to use this knowledge to achieve health literacy in patients with type 2 diabetes mellitus.</p> <p>The articles were acquired from CINAHL and PubMed which are known to be reliable databases with keywords health literacy AND intervention AND diabetes and health literacy AND patient education AND diabetes type 2 AND adult respectively. 11 articles were selected based on the inclusion and exclusion criteria. The principle of inductive content analysis was used to analyse the articles and the results presented as a literature review.</p> <p>The findings were divided into four primary interventions based on the research questions and then categorised into subthemes. (1) EHealth and web-based interventions, (2) Multimedia, (3) Telecare and, (4) Transformative. All these interventions improved diabetes knowledge in patients with low health literacy.</p> <p>Literacy adapted patient education interventions could be effective in teaching patients with low health literacy about diabetes. The findings from this review may present as a reference to benefit healthcare providers to administer suitable interventions to enhance adaptation and clinical outcomes in patients with type 2 diabetes mellitus.</p>	
Keywords	Patient education, health literacy, interventions, T2DM

Tekijät Otsikko  Sivunmäärä Aika	Emeka Japheth Chigozie, Habbaba Dabbagh Ali  Potilasohjauksen vaikutus tyypin 2 diabetes sairastavien potilaiden terveystiedon lukutaidon. 20 sivua + 1 liite Maaliskuu 2018
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<p>Diabeteksestä sairastavien ihmisten määrä on kolminkertaistunut vuodesta 1980. Noin 422 miljoonalla ihmisellä maailmassa on diabetes. Liikalihavuuden lisääntyminen yhdessä maailman väestön ikääntymiseen merkitsee sitä, että yli puolet uusista diabetestapauksista on tyypin 2 diabetes mellitusta. Tässä kirjallisuuskatsauksessa kuvasimme tehokkaita potilasvalistusmenetelmiä, jotka paransivat tyypin 2 diabetesta sairastavien potilaiden terveystiedon lukutaitoa. Tämän kirjallisuuskatsauksen tavoitteena on tukea tyypin 2 diabetesta sairastavien potilaiden terveystiedon lukutaitoa.</p> <p>Tämän kuvailevan kirjallisuuskatsauksen artikkelit hankittiin luotettavista tieteellisistä tietokannoista, CINAHL ja PubMed hakusanoilla terveystiedon lukutaito AND interventio AND diabetes ja terveystiedon lukutaito AND potilasohjaus AND tyypin 2 diabetes AND aikuinen vastaavasti. 11 artikkelia valittiin sisäänotto ja poissulkemisperusteiden perusteella. Aineisto analysoitiin induktiivisen sisällön analyysin periaatteen mukaisesti</p> <p>Tulokset on jaettu neljään pääluokkaan, jotka perustuvat tutkimuskysymyksiin ja jotka sitten luokitellaan alaluokiksi. (1) EHealth ja verkkopohjaiset toimet, (2) Multimedia, (3) Telecare ja, (4) Transformatiivinen. Kaikki nämä toimenpiteet paransivat diabeteksen tuntemusta potilailla, joilla on alhainen terveyslukutaito.</p> <p>Terveystiedon lukutaidon mukaanotto potilasohjaukseen saattaa olla tehokas menetelmä alhaisen lukutaidon omavilla potilailla. Tulosten mukaan asianmukaisten interventio liittämisen terveydenhuoltopalveluihin saattaa edesauttaa tyypin 2 diabetesta sairastavien potilaiden sopeutumista ja parantaa hoidon kliinisiä tuloksia.</p>	
Avainsanat	potilasohjaus, terveystiedon lukutaito, interventio, tyypin 2 diabetes.

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Appendix 1. Summary of the reviewed articles

## 1 Introduction

The amount of people with diabetes has augmented from 108 million since 1980 to 422 million in 2014. The global ratio of diabetes in adults over 18 years has increased from 4.7% to 8.5% in 1980 and 2014 respectively. About 1.6 million deaths in 2015 were directly related to diabetes. The World Health Organization (WHO) estimates that in 2030, diabetes will be the leading cause of death (WHO 2015.) The increase in the rate of obesity coupled with the rapid ageing of the global population means that the majority of new diabetes cases will be the type 2 diabetes mellitus (T2DM) (Steele & Schöttker 2017).

Since there is a strong positive connection between health literacy and every component of health promoting behaviours in patients with T2DM, improving the level of health literacy may increase the embracement of health promoting behaviours in patients. The need for health educators to implement focused health literacy is increasing. Improving health literacy ultimately increase the quality of life in these patients, which reduce health care costs levied on the health system (Chahardah-Cherik, Ghebizadeh, Jahani & Cheraghian 2018.)

The lack of competence in patients to self-manage and follow their physician's order have significant consequences in patient's best interest. A lack of health literacy in patients, may produce counterproductive choices regarding their health or even leads to health deterioration. Tackling the dilemma of protecting patient autonomy and providing productive health education is achieved by patients' participation in structuring their education and being included in setting their goals. Patient autonomy improvement makes the patient more invested as a partner in their health and wellbeing, which prevent the patient from opposing to health promoting behaviours (Jotterand, Amodio & Elger 2016.)

## 2 Background

### 2.1 Patient Education

Patient education is a structured and organised learning experience given by health professionals and others to facilitate voluntary adoption of behaviours and to improve their health status. The activities in patient education must be drawn in such a way that planned goals with the patient is achieved. The primary objective of these activities are to gain information, beliefs, skills and attitudes that improve the health status, quality of life and possibly healthcare utilisation (Taal, Rasker & Wiegman 2006.)

Patient education is the foundation for an effective self-management and necessary to achieve a better outcome for patients with T2DM. The primary objectives of patient education in patients with T2DM are the prevention of complications, improving the quality of life and metabolic control and bringing down or avoiding dependency on healthcare systems. (Odgers-Jewell, Isenring, Thomas & Reidlinger 2017.)

### 2.2 Type 2 Diabetes Mellitus

"Type 2 diabetes (formerly named non-insulin-dependent) which results from the body's inability to respond properly to the action of insulin produced by the pancreas" (WHO 2015). On a regular basis, patients encounter different issues with diabetes which fails to do justice in elaborating the diversity of their condition. Recently, through media and online sources, such as social media, patients gain a lot of information about diabetes that is not based on their conditions. Health providers may play a big role to assist patients to disregard unrelated information about diabetes and be confident in managing their conditions and know the effects of diabetes on their lives (Meer 2015.)

### 2.3 Health Literacy

Aoki & Inoue (2017) defines health literacy as the extent to which individuals are capable of attaining, processing and apprehending basic health information and services required to make right health decisions. Consequently, health literacy does not just involve the

ability to understand and write information, but the ability to initiate knowledge concerning health issues. A better knowledge of diabetes and health literacy skills may support and promote diabetes self-management (Heide, Uiters, Rademakers, Struijs, Schuit & Baan 2014.) Sufficient levels of health literacy are known to reduce healthcare cost, prevent illness and chronic diseases, and cut down the rate of mortality. Low health literacy, however, is one of the leading causes of poor health outcomes. There is a growing weight of evidence indicating that low health literacy is related to an increase utilisation of health services and poorer health status (Lizarondo, Wiles & Kay 2014.) Health literacy indirectly influences self-care behaviours through the mediation of self-efficacy. Health literacy may be a possible approach for enhancing self-efficacy. (Lee, Shin, Lin, Lee & Wang, 2016.)

### **3 Purpose, aim and study questions**

The purpose of the literature review is to describe the effective interventions which improved health literacy in T2DM.

The aim of the literature review is to use this knowledge to achieve health literacy in patients with T2DM.

The research questions addressed in this literature review are:

- What are effective patient education interventions that improved health literacy in patients with T2DM?
- What are the characteristics of these interventions?

## 4 Methods

A literature review was chosen as an appropriate method for this bachelor thesis. A literature review is a research method that analyses, summarises and explains previously done studies concerning a topic of interest (Parahoo, 2014:118-119).

This final project is conducted as a descriptive review, which is a normally used to answer research questions connected to incidence, prevalence or regularity of the studied issue and its characteristics. Descriptive review is widely used in quantitative research as an approach to identify and list the phenomena's and their features (Gray, Grove & Sutherland 2017:200.)

### 4.1 Data collection and search strategy

According to Parahoo (2014) the data collection of a literature review has to be widely done through reliable sources such as CINAHL, MEDLINE and PubMed to get comprehensive information. The articles used in this review were obtained by means of a systemic approach from CINAHL and PubMed. The keywords used as shown in table 1 were health literacy AND interventions AND diabetes OR health literacy AND patient education AND diabetes type 2 AND adult respectively. The limits were English language articles published in the past ten years (2008 - 2018), to get the most current, scientific and evidence-based articles and journals.

### 4.2 Inclusion and exclusion criteria

The inclusion and exclusion criteria are stated to describe the boundaries of a review. Identifying who can be included and excluded from the research (Parahoo 2014:126.) The inclusion criteria in this final project include adult patients, patients with T2DM. Patients with gestational diabetes were excluded.

Furthermore, we limited our research period from 2008 - 2018. Other inclusion criteria's included was the use of academic and scientific journals, articles that were written in English language and articles that used quantitative research method (to get study articles that measured and described the interventions that improved health literacy). We also used the PICOT framework as a criterion for considering the articles.

Table 1. Inclusion and exclusion criteria and the PICOT framework

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> <li>English language</li> <li>2008-2018</li> <li>Academic journal</li> <li>Scientific journal</li> <li>Researched article</li> <li>Quantitative method used</li> <li>Adult patients</li> <li>Patient with T2DM</li> </ul>	<ul style="list-style-type: none"> <li>Articles not related to the study questions</li> <li>Patients with gestational diabetes</li> <li>Studies that did not measure literacy among participants</li> <li>Cognitive impairments</li> </ul>
PICOT Framework	
Patients (P)	Patients with T2DM
Interventions (I)	Patient education intervention
Comparison (C)	
Outcome (O)	Improve health literacy
Time (T)	Longitudinal study

#### 4.3 Data selection

The search conducted on CINAHL yielded 91 articles with terms health literacy, AND intervention AND diabetes. Most studies were ruled out after the title and abstract. 8 articles were considered relevant as they answered the research question. Another search was conducted on PubMed with words health literacy, AND intervention AND diabetes and health literacy AND patient education AND diabetes type 2 AND adult which yielded 78 and 55 articles respectively. 3 articles were included based on the inclusion and exclusion criteria and the rest excluded from the title and abstract.

Table 2. Data search and relevant hits

Date	Database	Keywords	Hits	Title	Abstract	Relevant to study
15.2.2018	CINAHL	Health literacy AND interventions AND diabetes	91	8	8	8
26.2.2018	PubMed	Health literacy AND interventions AND diabetes	78	7	5	1
26.2.2018	PubMed	Health literacy AND patient education AND diabetes type 2 AND adult	55	20	3	3
Total			224	35	16	11

#### 4.4 Data analysis

This final project is conducted as a descriptive review. So it was deemed appropriate to use content analysis, which is a technique used to explore the resemblances and the differences in the word data collected and aim to explore and create the full picture when the data is diverse and complex. The content analysis nature in summarizing the main issue and extracting the similarities and differences in the data, create an expressive table of themes or categories which can generate subcategories (Fawcett, Garity, 2009:227.)

According to Elo & Kyngäs, (2007) inductive content analysis is comprised of three phases. These phases are the preparation phase, the organising phase and the reporting phase. The principle of inductive content analysis was used to analyse the 11 interventions. In the preparation phase, the data was define by re-reading the findings to get a sense of the whole. In the organising phase, similar themes which answered the study question were grouped into four categories regarding the intervention's nature. In the last

phase, the findings were summarised and reported. Figure 1 explains the finding according to categories.

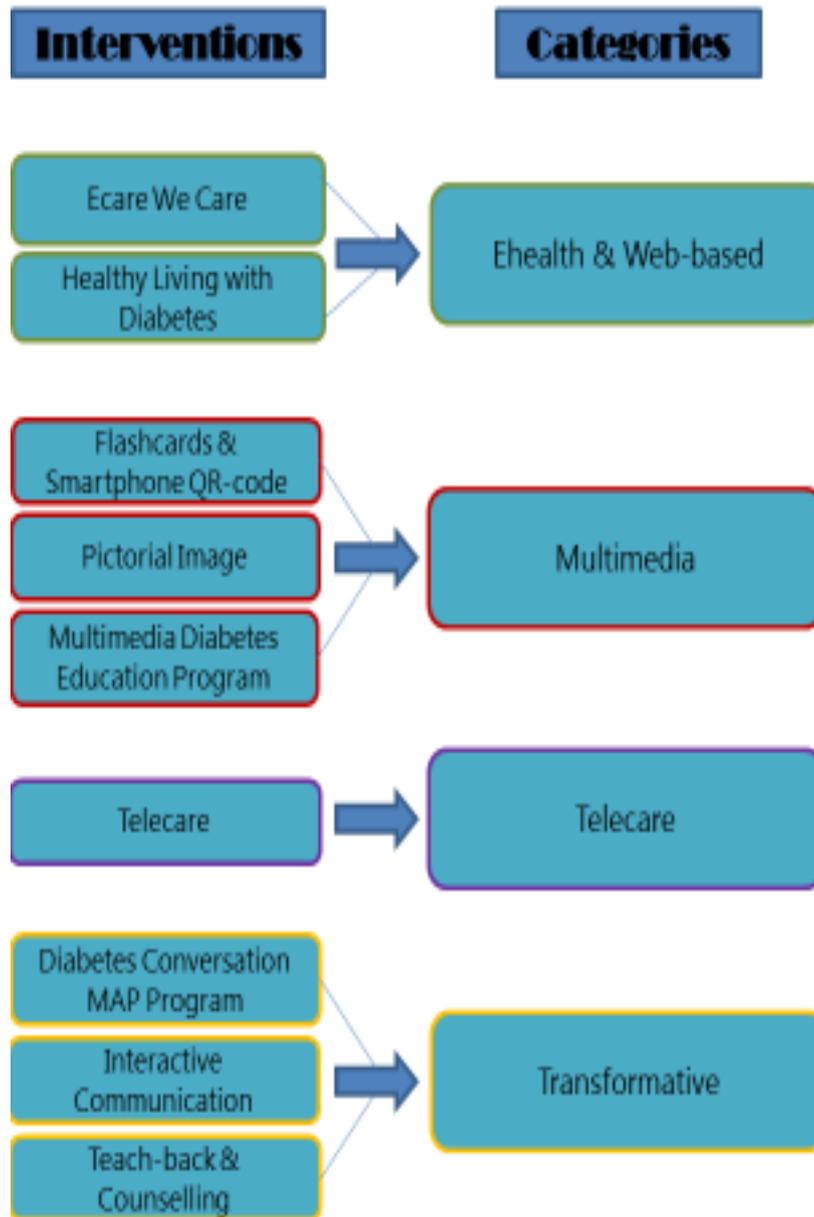


Figure 1. Analysis according to categories.

## 5 Findings

### 5.1 EHealth and Web-based Interventions

According to WHO (2016), eHealth is defined as the utilisation of Information and Communication Technologies (ICT) for health. (WHO 2016)

The studies grouped under eHealth and web-based interventions focused on the use of eHealth and web-based approaches to increase diabetes knowledge, support self-managing and motivate patients with T2DM to increase their physical activity. (Moussa, Sherrod & Choi (2013); Muller, Rowsell, Stuart, Hayter, Little, Ganahl, Muller, Ing, Doyle, Chang, Lyles, Nutbeam & Yardley (2017).

#### 5.1.1 ECare We Care

Moussa et al. (2013) examined an evidenced-based e-health programme (eCare We Care) which was developed to broadcast diabetes management information via an instructive website. This website was designed to augment the understanding and knowledge of diabetes among patients and support them to self-manage. The eCare We Care online tutorial promote health and self-management through the use of instructive online technologies. This web-based interactive tutorial gives access to educative information portal links such as a non-paid and trustworthy governmental health information website, universities and organisation websites, online magazines and law corporations that specialise in work-related accidents. The eCare We Care online tutorial used a four-week diabetes information meeting schedule to explain the general diabetes information. This four-week web-based tutorial consisted of, an introduction to diabetes (week 1), discussion on eye complications (week 2), discussion on foot care (week 3) and meal planning (week). The information was disseminated using simple language, directional arrows to texts and animated.

Health literacy was measured using the Literacy Assessment for Diabetes (LAD). The post-intervention results showed a significant improvement in the values of the diabetes health literacy.

### 5.1.2 Healthy Living with Diabetes

Muller et al. (2017) reviewed the use of a tailored web-based intervention (Healthy Living with Diabetes) to encourage and motivate patients with T2DM to exercise. The Living with Diabetes was comprised of a 2 web-based intervention that was developed using LifeGuide software (a web-based software designed to encourage healthy behaviours). Both interventions (plain-text version and interactive version) contained the same information which was the importance and benefits of exercise for people with T2DM. The interactive version consisted of features such as tailored advice, quiz, exercise planner, feedback and audio-visual (that demonstrated a good lifestyle and exercise).

Health literacy was measured using a 9-item knowledge quiz which was based on the content of the intervention. The post-intervention results showed a significant increase in the health literacy outcome and intentions to engage in exercise.

## 5.2 Multimedia Intervention

The English Oxford living dictionary defines multimedia as an integrating audio and video, especially interactive. That serves as an expressive and communicative medium. (English Oxford living dictionary).

The studies grouped under the multimedia intervention described the use of multimedia such as audio, video sequences, pictorial image, flash cards and QR-coded prescription bottles to transfer information to patients with limited health literacy. Yeung, Quinones, Clark, Oliver, Alvarez & Jaiyeola (2017) examined the use of flashcards and a QR-coded prescription bottle for medication and diabetes teaching as an inventive manner of improving knowledge, follow recommendations for prescribed medications and support to low-health literacy patient population. Negarandeh, Mahmoodi, Noktehdan, Heshmat, & Shakibazadah (2012) explored the effect of pictorial image on knowledge, medication adherence and nutrition among patients with type 2 diabetes, while Kandula, Nsiah-Kumi, Makoul, Sager, Zie, Glass, Stephen & Baker (2009) and Huang, Hung, Yu, Berry, Shin & Hsu (2016) used the Multimedia Diabetes Education Programs (MDEP) to improve knowledge on diabetes.

### 5.2.1 Flashcards and Smartphone Activated QR-code

In the Yeung et al. (2017) study, the intervention to improve medication adherence (which is defined as the degree to which a patient is capable of adhering to the recommendations of a prescribed drug) was the use of flashcards and a smartphone-activated QR-code (a quick response barcode). The QR-code is attached to patient's medication bottle and is read using a smartphone. When read by the smartphone, it provides instructive and educational videos about the patient's medication. This informative approach was designed to help and educate patients to understand their disease state of health, indications of their medication and common side effects.

Health literacy was measured using The Rapid Estimate of Adult Literacy Medicine-Short Form (REALM-SF). Due to the fact that some of the patients had some level of education, the intervention only showed significant increase in knowledge in patients with limited literacy.

### 5.2.2 Pictorial Image

In the Negarandeh et al. (2012) study, the participants received the education through demonstrative subjects in three weekly sessions. Each session lasted for 20 minutes, which was done individually in a private room. Visual images and other instructive materials such as familiar objects and symbols were combined together and used based on the educational goals of the patients. Pictures were added to written and verbal materials which proved to be helpful. This pictorial strategy was designed to help patients recall, improve comprehension and develop adherence.

Health literacy was measured using the level of functional health literacy in adults (TOF-HLA). The educational strategy results increased diabetes knowledge in addition to adherence to medication and diet among low health literacy participants with type 2 diabetes.

### 5.2.3 Multimedia Diabetes Education Program (MDEP)

Kandula et al. (2009) assessed the relationship between literacy and knowledge improvement and the effect of Multimedia Diabetes Education Programs (MDEP). The

MDEP is a 5-minute web-based module which combines animation, audio, graphics and on-screen text to teach learning goals. The graphics consisted of slides and pictures of anatomy, individuals and key concepts. The MDEP presented ideas such as “what diabetes is”, “what glucose is” and “what insulin is”. The MDEP was categorised into two learning modules. The end goal for the module “Understanding diabetes” was to know what diabetes is and learning how to manage the blood sugar. The learning goals for the module “ the ups and downs of blood sugar” were the safe blood sugar level, understanding how eating many sweet foods or overeating may increase the blood sugar and the use of medication and physical exercise to regulate blood sugar.

Health literacy was measured using the Short Test of Functional Health Literacy in Adults (S-TOFHLA). The instructional approach results showed a significant increase in diabetes knowledge after the intervention.

Huang et al. (2016) evaluated the implementation of MDEP that improved diabetes and insulin injection knowledge. The MDEP consisted of a unit-based step by step format. An introduction to diabetes (10min), information on medication and treatment (10min), hyper- and hypoglycaemia management (5min) and complications of diabetes and experiences from 2 patients regarding injecting of insulin. The study assessed four sources of information and self-efficacy improvement techniques which were used to scheme the MDEP. The improvement techniques were, enactive attainment; a technique that provided injection dummies to enable patients to practice how to inject while watching instructive materials. Vicarious experience; a technique where injection demonstrations are done by real persons allowing participants to understand insulin injection techniques. (3) Verbal persuasion; a method that described the connection between insulin and plasma glucose and emphasised the significance of insulin therapy in regulating blood sugar and maintaining health. Emotional arousal; a technique that applies clinical observations and simulations to persuade participants about the significance of glycaemic control. Participants were encouraged to practice and imitate the learned skills which helped them to reduce stress and learning barriers.

Health literacy was measured using the Generalized Estimating Equations (GEE). The results showed a significant increase in knowledge on diabetes and insulin injection after the intervention.

### 5.3 Telecare Intervention

The study used the Proactive, Call Centre Treatment Support (PACCTS) intervention for patients with T2DM. The PACCTS intervention combined numerous behavioural change theories, a motivational interview and a patient centred care. The primary goal of this intervention was to increase patients' knowledge of diabetes and encourage them to self-management. The team of the intervention consisted of two non-medically trained tele-carers, assisted with a specialist diabetic nurse, which run under the supervision of the consultant physician. The designated intervention tele carer made proactive calls to the patient according to their blood glucose and the calls lasted for 20 minutes. This intervention used structured questioning and computerised script to ask patients about their lifestyle decisions and the management of medications (Long & Gambling 2011.)

The PACCTS illustrated the correlations between the result of the content analysis and the data and the score of the Diabetes Empowerment Scale-Short Form (DES-SF) which showed an increase in the knowledge about diabetes, self-management and empowerment.

### 5.4 Transformative Interventions

Transformative learning theory utilises critical thinking, which provides a space for knowledge development, new ideas and acting on those new ideas. This learning theory mostly focuses on adults especially those with post-secondary education. Transformative learning exhibits two kinds of learning (communicative and instrumental). This learning process involves the teaching of new schemes and reflection about content (Illeris 2014.)

#### 5.4.1 Diabetes Conversation MAP Program (DCMP)

Diabetes conversation MAP program is an interactive discussion with a patient to explore their information, feeling and the choices they take in managing their health condition. This MAP conversation program allows them to discuss the implications of their decisions with patients that share the same situation and to freely verbalise their feelings in a close and secure environment (International Diabetes Federation)

The research participants are 95 patients with T2DM divided into a control and an experiment groups. The control group received standard health education for 20 minutes after every medical visit, which was conducted by a specialised diabetic nurse to discuss symptoms and treatment. The experiment group had seven DCMP group sessions consisting of a trained DCMP registered nurse and 10-12 patients for of seven weeks. Each session lasted for 1, 5 hours. The DCMP sessions used seven coloured maps each illustrate the topics “walk with diabetes”, “what is diabetes healthy diet and exercise”, “walk with insulin”, “diabetes complications and related risk factors”, “foot care for diabetes patients” and “type 1 diabetes patient in the home”. These maps had coloured drawings as symbols which created shared imagery for the participants. Also, the patients were offered self-designed conversation cards which allowed them to share individual glycaemic control experiences and discuss the effect, treatments and life changes due to the illness, in an environment of interactive learning. (Hung, Chen, Livneh, Chen, Guo & Tsai, 2017)

The effect of the intervention regarding the health literacy was measured with Diabetes Mellitus Health Literacy Questionnaire (DMHLQ), which was developed by the primary investigators of the research. The result showed that the DCMP was beneficial to improve health literacy in patients with T2DM.

#### 5.4.2 Interactive Communication

Ntiri & Stewart (2009) aimed attention at interactive communication and its relation to diabetes terminology. Each session lasted for an hour, two times a week for three consecutive weeks (six sessions). Sessions were held at the same time and on the same day of the week by a diabetic educator. This intervention was designed to support patients and encourage them to reflect on diabetes mellitus information and how to self-manage. The main topics each session focused on were “what is diabetes”, “eating habits”, “physical activity”, “medications”, “commons effects of diabetes” and “diabetes self-management”. The learning process involved wide posters of basic diabetes terms, phrases and meaning based on the primary topic of each session. Other materials were information from The Diabetic Channel Series and pamphlets that had information such as signs and symptoms of diabetes, blood sugar level targets in fasting and after a meal and the desired level of glycosylated haemoglobin. Active discussion, repeatedly pronunciation of diabetes terms, personal directed questions and individual experiences through stories were the communication method diabetes educator used in the session.

Health literacy was measured using the short-form Test of Functional Health Literacy Assessment in adult (s-TOFHLA), Literacy Assessment for Diabetes (LAD), and Diabetes Knowledge Test (DKT). Post-intervention values for (s-TOFHLA) and (DKT) showed a significant increase in health literacy.

#### 5.4.3 Teach-back and Counselling

Negarandeh et al. (2013) assessed teach-back instructional strategy, in which the participants received a three weekly session. Each session lasted for 20 minutes and was done individually in a private room. This intervention was primarily designed to assess patient's knowledge of diabetes before providing more information. The patients were asked precise questions such as " what do you already know about diabetes?". Then the researcher explained the information using simple terms and patients were asked to repeat and teach back until they understood.

Health literacy was measured using the level of functional health literacy in adults (TOFHLA). The educational strategy results showed increased knowledge of diabetes, medication adherence and nutrition among low health literacy participants with type 2 diabetes.

Wolf, Seligman, Davis, Fleming, Curtis, Pandit, Parker, Schillinger & Dewalt (2013) examined a carve-in and carve-out Diabetes Guide counselling strategy which aimed to motivate patients in behaviour change process by helping them set personal goals that can be easily achieved and mentor them on how to achieve these goals. The carve-in strategy is a teach-back counselling technique which positively encouraged patients, examined their skills and identified goals then mentor patients to set action plans. The patients were followed up by telephone calls. The carve-out strategy is a 10 to 15 minutes counselling session done by health professionals. Diabetes Guide was distributed and reviewed to all eligible patients and patients were assigned to a diabetes educator who later contacted them by telephone calls.

Health literacy was measured using the Rapid Estimate of Adult Literacy in Medicine (REALM). The post-intervention counselling results showed an improvement in patient's diabetes knowledge.

Table 3. Analysis of the study findings.

Interventions	Characteristics	Health literacy measurement scales	Health literacy outcomes
<b>EHealth and web-based ECare We Care</b>	Web-based instructive tutorials such as online magazine and informative websites, 5-week discussion sessions.	LAD	Improved health literacy
<b>Healthy Living with Diabetes</b>	LifeGuide software designed to encourage healthy behaviours, audiovisual demonstration, exercise planner and feedbacks.	9-item knowledge quiz	Improved health literacy
<b>Multimedia Flashcards &amp; smartphone Activated QR-code</b>	QR-code that provided educational videos about patients medication	REALM-SF	Improved health literacy
<b>Pictorial Image</b>	Three weekly demonstrative sessions, symbols, visual images such as pictures	TOFHLA	Improved health literacy
<b>Multimedia Diabetes Education Programs (MDEP)</b>	Web-based modules which combined slides, images and animations to teach diabetes.	S-TOFHLA	Improved health literacy
<b>Multimedia Diabetes Education Programs (MDEP)</b>	Injection dummies and instructive videos.	GEE	Improved health literacy

<b>Telecare Proactive Call Centre Treatment Support (PAC- CTS)</b>	Proactive phone calls	DES-SF	Improved health literacy
<b>Transformative Diabetes conversation MAP program</b>	7-week sessions of diabetes teachings and related risk factors. Conversation cards.	DMHLQ	Improved health literacy
<b>Interactive communication</b>	3-week discussion sessions that focused on T2DM and how to self-manage	S-TOFHLA, LAD and DKT	Improved health literacy
<b>Teach-back and counseling</b>	Telephone calls and teach-back counselling sessions	TOFHLA and REALM	Improved health literacy

## 6 Discussion

### 6.1 Discussion of the findings

The purpose of this descriptive literature review was to describe the effective interventions which improved health literacy in T2DM. All the interventions mentioned in this study improved patients knowledge on diabetes and their ability to cope with their conditions thus, enhancing their self-care capability.

Moussa et al. (2013) examined the effects of the intervention (eCare We Care) on diabetic knowledge of patients with type 2 diabetes mellitus. The post-intervention results presented a compelling increase in diabetes knowledge. The participants enjoyed the combination of pictures, audios, illustrations and simple text. Thus, perceived the program exciting and easy to understand. These findings suggest that eHealth and internet-

based learning could become a convenient and effective means for delivering accessible health information to patients with low health literacy.

Huang et al. (2016) insinuated on the importance of multimedia health education strategy in diabetes treatment and the control of sugar level in patients. Healthcare providers should engage in multimedia health education approaches for patients with T2DM to improve their quality of care. The multimedia education strategy allowed patients connect to the instructive materials at their convenience, reduce the use of workforce and increased learning effectiveness. Kandula et al. (2009) determined multimedia educational strategy as a communication enhancement tool for patients with low health literacy. These findings propose that multimedia could become a more suitable and effective method to deliver available health information to patients with low health literacy, in comparison to traditional health education interventions.

The findings from the telecare intervention did not only show an enhancement on diabetes knowledge, but also improve confidence and competence to translate knowledge into everyday self-care. The T2DM is a complex disease which obliges several lifestyle changes such as changes in physical activity, dietary, taking medication and the monitoring of glucose. Based on the Long & Gambling (2011) findings, the telecare intervention can enhance physiological outcome. The treatment of diabetes is centred on how to control the blood sugar, slow advancement of the disease and manage complications. A strict regulation of blood sugar can decrease the progression of diabetes and prevent the incidence of complications. Telecare intervention may facilitate the control of the level of glucose through telephone counselling. However, some factors affected the implementation of telecare in patients with diabetes type 2. Factors linked to the knowledge and skills of the users which are the foundation of an effective execution of telecare.

Bertera (2014) summarised the use of storytelling slides to improve diabetes knowledge and self-efficacy. The intervention consisted of a 2, 5 to 3 hours session that used audio and storytelling slides to educate people about diabetes. The storytelling slides focused on dialogues such as "how can diabetes be controlled with diet" and "how to encourage an active lifestyle (exercise and foot care) in elderly people. The post-intervention results showed a significant increase in diabetes knowledge. This article was excluded from the findings because the research only included elderly people with high risks of developing diabetes.

## 6.2 Ethical Consideration

The Finnish Advisory Board on Research Integrity (TENK) in compliances with the Metropolia University of Applied Sciences mandates the practice of appropriate citations and referencing, giving actual credibility to the sources and avoiding data manipulation or intentional misinterpretation. Results must be presented in transparency, fairness, honesty and variability. We have to obey the standard traditional for scientific knowledge in the planning, implementation, reporting the findings and in recording the data attained during the research (Finnish Advisory Board on Research Integrity 2014.) Principles of ethics in nursing such as beneficence and justice in research are fully taken into consideration. Which demands the research to be beneficial to either participants or the public in general and fair (Malty, Williams, Mcdarry & Day 2010:348-349).

## 6.3 Validity and reliability

Validity simply means the precision wherein the results accurately reflect the data. Which can be ensured by these strategies careful record keeping, transparent and consistent interpretation of data, Indicating clarity in relations to thought processes during data analysis and subsequent interpretations (Noble & Smith, 2015.) Designing a literature review checklist that will help evaluate written materials, ensure consistency and reduce biases (Vergnes, Marchal-sixou, Nabet, Maret & Hamal, 2010).

The articles used in this review were obtained from reliable databases (CINAHL and PubMed) as shown in table 2. A checklist was used in all phases of this review to avoid misinterpretation and omission of data. The authors of this thesis decided to use only quantitative studies that used measuring scales to prove the improvement of health literacy in each intervention. The findings from the articles used were analysed by both authors with the intention to attain objectivity, own beliefs and views were omitted to avoid distorted results and wrong conclusions.

## 7 Conclusion

This literature review resulted in a list of synthesised patient education interventions that recognise and improve the level of health literacy in patients with T2DM.

Diabetes is a chronic disease and inadequate health literacy has been shown in various settings to have a negative effect on the patients' health. These effects include the inability to self-manage and comprehend the disease. Hence, patients with low health literacy suffer the worse outcomes of the disease, and the most affected group with low literacy were mostly the elderly and minorities.

The importance of this review relies on the facts that patient education is a cornerstone in the nursing practice and equality is one of the main pillars in nursing ethics codes. Hence, the patient must receive tailored patient education, which is sensitive to the patient's health literacy level, to support the patient with the disease and develop better adherence and self-care abilities. Despite the fact that most of the interventions mentioned in this review consumed workforce, time and education, they may serve as an effective strategy to reduce emergency care and early retirement. Literacy adapted patient education interventions could be effective in educating patients with low health literacy on diabetes. The findings from this review may present as a reference to benefit healthcare providers to administer appropriate interventions to enhance self-management, adaptation and clinical outcomes in patients with type 2 diabetes mellitus.

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## Summary of the reviewed articles

Title	Authors, year of publication & location	Samples size	Purpose of study	Findings
An e-health intervention for increasing diabetes knowledge in African Americans.	Moussa et al. 2013.  <b>USA</b>	The study included 46 African Americans between 40-65 years old who were diagnosed with or had type 2 diabetes and also had low diabetes literacy.	To examine the effect of the program (eCare We Care) on diabetes knowledge development in Africa American adults with low health literacy.	The ecare We care was an effective educational approach for enhancing patient's knowledge on diabetes.
Effects on engagement and health literacy outcomes of web-based materials promoting physical activity in people with diabetes: An international randomized trial.	Muller et al. 2017  <b>UK</b>	The study included 1041 participants over 18 years old with diagnoses of type 2 diabetes and had access to the internet. Participants were recruited from UK, Austria, Germany, Ireland and Taiwan.	To develop an online intervention promoting physical exercise among people with type 2 diabetes mellitus.	There was a significant improvement in the health literacy outcomes.
Low-health literacy flashcards & mobile videos reinforcement to improve medication adherence in patients on oral diabetes, heart failure, and hypertension medications.	Yeung et al. 2014  <b>USA</b>	The study included 68 primary care patients prescribed medication for heart failure, hypertension and diabetes.	To improve medication adherence through a flashcard and a smartphone activated QR-code.	Due to the fact that some of the patients had some level of education, the intervention only shows significant increase knowledge in patients with limited literacy.
Teach-back and pictorial image educational strategies	Negarandeh et al. 2013	The study included 127 patients with low health literacy	To examine the impact of pictorial image and a teach-	Both educational approaches increased

on knowledge about diabetes and medication/dietary adherence among low health patients with diabetes type 2	<b>Iran</b>	and are 18 years old or older.	back educational approach.	health literacy significantly.
The relationship between health literacy and knowledge improvement after a multimedia type 2 education program	Kandula et. al 2009 <b>USA</b>	The study included 190 elderly patients that were diagnosed with type 2 diabetes mellitus.	To assess the relationship between literacy and knowledge improvement and the effect of multimedia diabetes education programs (MDEP).	The study results showed a significant improvement in the health literacy outcomes.
The effectiveness of multimedia education for patients with type 2 diabetes mellitus.	Huang et al. 2016 <b>Taiwan</b>	The study included 72 participants that had the diagnosis of type 2 diabetes mellitus and a prescription for insulin injection.	To examine the implementation of MDEP that improve diabetes and insulin injection knowledge	The study results showed a significant improvement in the health literacy outcomes.
Enhancing health literacy and behavioural change within a tele-care education and support intervention for people with type 2 diabetes.	Long & Gambling 2011 <b>UK</b>	The study included 319 patients that had the diagnosis of type 2 diabetes mellitus.	To improve physiological outcomes for patients with type 2 diabetes mellitus.	The study results showed a significant enhancement in the competence to translate knowledge into practice.
Long-term effectiveness of the Diabetes	Hung et al. 2017 <b>Taiwan</b>	The study included 95 patients with type 2 diabetes mellitus.	To examine the use of DCMP to encourage patients to discuss diabetes and its management.	The study results showed a significant improvement in the health

Conversa- tion Map Program.				literacy out- comes.
Transform- ative learn- ing inter- vention: ef- fect on functional health liter- acy and di- abetes knowledge in older Af- rican Amer- ican.	Ntiri & Stewart 2009  <b>USA</b>	The study included 20 elderly African American with the diagnosis of Diabe- tes.	To examine the ef- fect of an instructive strategy using trans- formative learning on functional health knowledge and dia- betes knowledge in patients.	The study re- sults showed a significant improvement in the health literacy out- comes.
Clinic- Based Ver- sus Out- sourced Implemen- tation of a Diabetes Health Lit- eracy Inter- vention	Wolf et al. 2013  <b>USA</b>	The study included 486 adults' patients with type 2 diabetes mellitus.	To examine the Dia- betes Guide coun- selling strategy which aimed to moti- vate patients in be- haviour change pro- cess by helping them set personal goals that can be easily achieved.	The study re- sults showed a significant improvement in the health literacy out- comes.