



Expertise
and insight
for the future

Destiny Ijeoma Chukwuani

Effective Methods of Lifestyle Modification Education for Patients with Type 2 Diabetes

A Literature Review

Metropolia University of Applied Sciences

Bachelor of Health care

Degree Programme in Nursing

Bachelor Thesis

12.11.2019

Author(s) Title	Destiny Ijeoma Chukwuani Effective Methods of Lifestyle Modification Education for Patients with Type 2 Diabetes – A Literature Review
Number of Pages Date	28 pages + 4 pages of appendices 12 November 2019
Degree	Bachelor of Health Science
Degree Programme	Degree Programme in Nursing
Specialisation option	Nursing
Instructor(s)	Jukka Kesänen, PhD, RN, Senior Lecturer
<p>Diabetes is one of the most common non-communicable diseases and type 2 diabetes account for majority of the cases. The rise in the rate of obesity together with the aging of worlds' population, implies that type 2 diabetes will be more than half of new diabetes cases. Lifestyle interventions have shown to reduce the incidence of type 2 diabetes, and can also increase the quality of life of patients. Nurses are required to educate and guide patients make this lifestyle modifications.</p> <p>The purpose of this literature review was to describe lifestyle-related patient education methods beneficial in eliciting positive lifestyle modifications in patients with T2DM. The aim is to develop evidence-based lifestyle modification education for patients with type 2 diabetes.</p> <p>In this bachelor thesis, PubMed and CINAHL databases were used to search articles to provide answers to the research questions. The search yielded articles of which eleven articles were selected, analysed and categorised in a systematic manner using the principle of inductive content analysis. The findings were presented in a literature review.</p> <p>Based on the reviewed literature, the findings were sub categorized into four (1) Experiential, (2) Telemedicine, (3) Multimedia and, (4) Web-based system and then divided into ten primary interventions. All these interventions where effective in eliciting lifestyle modifications.</p> <p>Healthcare providers should consider the patient individually when planning the best method of teaching, taking into account patient's health status, age, health literacy, abilities and adapt teaching styles to accommodate multimodal learning as acceptable. Further research on long time effect of these interventions is recommended.</p>	
Keywords	Patient education, lifestyle modification, interventions, T2DM

Tekijä Otsikko	Destiny Ijeoma Chukwuani Tehokkaat menetelmät tyypin 2 diabeteksen potilaiden elämäntavan muuttamiseen
Sivumäärä Aika	28 sivua + 4 sivua liitettä 12.11.2019
Tutkinto	Sairaanhoitaja (AMK)
Tutkinto-ohjelma	Hoitotyö
Suuntautumisvaihtoehto	Sairaanhoitotyö
Ohjaaja	Jukka Kesänen, PhD, RN, seniori lehtori
<p>Diabetes on yksi yleisimmistä tarttuvista taudeista, ja tyypin 2 diabetes on suurin osa tapauksista. Lihavuuden määrän nousu ja maailman väestön ikääntyminen viittaavat siihen, että tyypin 2 diabetes on yli puolet uusista diabetestapauksista. Elämäntapaan liittyvät interventiot ovat osoittaneet vähentävän tyypin 2 diabeteksen esiintyvyyttä ja myös parantaa potilaiden elämänlaatua. Sairaanhoitajia tarvitaan kouluttaa ja ohjata potilaita tee tämä elämäntapamuutokset.</p> <p>Tämän opinnäytetyön tarkoituksena oli kuvata elämäntapaan liittyvät potilaan koulutusmenetelmät, jotka ovat hyödyllisiä tuo positiivista elämäntapojen muutoksia tyypin 2 diabetes potilaalle. Tavoitteena on kehittää sopiva elämäntavan muuttamiskoulutus tyypin 2 diabeetikoille.</p> <p>Tässä opinnäytetyössä, käytettiin PubMed- ja CINAHL-tietokantoja artikkeleiden hakuun antamaan vastauksia tutkimuskysymyksiin. Haku tuotti artikkeleita, joista valittiin yksitoista artikkelia, analysoitu ja luokiteltu systemaattisesti käyttämällä induktiivisen sisältöanalyysin periaatetta. Tulokset esitettiin kirjallisuuskatsauksessa.</p> <p>Tutkimuskysymyksen perusteella, tulokset jaettiin kymmeneen ensisijaiseen interventioon ja luokitellaan sitten alaluokkiin (1) kokemuksellinen, (2) etälääketiede, (3) Multimedia and, (4) verkkopohjainen järjestelmä. Kaikki nämä interventiot tuovat elämäntapojen muutoksia tehokkaasti.</p> <p>Terveystenhuollon työntekijöiden tulee ajatella potilasta yksilöllisesti parhaan opetusmenetelmän suunnittelussa, ottaen huomioon potilaan terveydentila, ikä, terveyslukutaito, kyvyt ja mukauttavat opetustyyliä, mukauttaa opetustyyliä multimodaalisen oppimisen huomioon ottamiseksi hyväksyttävänä. Suositellaan lisätutkimuksia näiden interventioiden pitkäaikaisvaikutuksista.</p>	
Avainsanat	Potilasohjaus, elämäntavan muuttaminen, interventio, tyypin 2 diabetes

Contents

1	Introduction	1
2	Background	2
2.1	Type 2 Diabetes	2
2.2	Type 2 Diabetes and Lifestyle Intervention	2
2.3	Patient education	3
3	Purpose, Aim and Study Question	4
4	Methods	5
4.1	Descriptive literature review	5
4.2	Search Strategy	6
4.3	Inclusion and Exclusion Criteria	7
4.4	Study Selection Process	8
4.5	Data Analysis	10
5	Findings	12
5.1	General Findings	12
5.2	Experiential Interventions	13
5.2.1	Structured Individual-based Lifestyle Education (SILE)	13
5.2.2	Motivational Interview	13
5.2.3	Demonstration	14
5.2.4	Peer-Led Diabetes Education	14
5.3	Telemedicine	14
5.3.1	Tele video	15
5.3.2	Telemedical Lifestyle Intervention Program (TeLiPro)	15
5.3.3	Telephone-Based health coaching	15
5.4	Multimedia Intervention	16
5.4.1	DialBetics	16
5.4.2	Pictorial and Videotape	16
5.5	Web-Based system	17
6	Discussion	20
6.1	Discussion of the Findings	20
6.2	Discussion on Validity	22

6.3	Discussion on Ethical Consideration	22
7	Conclusion	23
8	References	25

Appendices

Appendix 1. Summary of Reviewed Articles

1 Introduction

Diabetes is one of the most common non-communicable disease that is affecting people around the world (Porntip et al, 2019). Diabetes is one of the leading cause of death, in 2012 1,5 million deaths globally were associated directly to diabetes. An estimated number of about 422 million adults have diabetes worldwide and 1.6 million deaths are directly attributed to diabetes each year. The prevalence of diabetes is increasing worldwide, the number of people having diabetes has almost quadrupled since 1980 from 108 million to 422 million in 2014. Type 2 diabetes amounts to 90-95% of the two types of diabetes. Furthermore, report of type 2 diabetes in children previously rare have increased worldwide. Thirty minutes of moderate-intensity physical activity on most days and healthy diet can drastically reduce the risk of developing type 2 diabetes (WHO, 2016.)

There is an increase in the prevalence of diabetes in the European Region, already reaching rates of 10-12% of the population in some Member States. This increase is believed to be strongly related to the increasing trends towards overweight and obesity, physical inactive, unhealthy diets and socioeconomic disadvantage. Diabetes causes hardship and suffering for the approximately 60 million people in the European Region currently living with the disease, as well as straining the Region's economies and health systems. Diabetes can lead to complications in different parts of the body and increase the risk of dying prematurely. Possible complications due to diabetes include heart attack, kidney failure, stroke, leg amputation due to foot ulcers (infected or non-healing) vision loss and nerve damage. (WHO,2016.)

A significant proportion of diabetes and its complications can be prevented by regular physical activity, a healthy diet, maintaining a normal body weight and avoiding tobacco use (WHO, 2016). Since there is a strong positive connection between diet and management of type 2 diabetes, but as a result of increase in the prevalence of type 2 diabetes and limited resources hindering dieticians from providing nutrition education to those with T2DM, it has become the role of primary health care professionals such as nurses and general practitioners to provide nutrition education to clients. Hence, the need to support primary health care professionals such as nurses by improving their health literacy in methods of providing dietary advice to ensure people with diabetes receive a high level of care is increasing (Parry Strong, Lyon, Stern, Vavasour and Milne, 2014.)

2 Background

2.1 Type 2 Diabetes

Diabetes mellitus is a chronic disease which can be as a result of inherited and/or acquired deficiency in insulin production by the pancreas, or by the ineffectiveness of the produced insulin. This deficiency can result in increased blood glucose concentration. There are two main types of diabetes namely type 1 diabetes (insulin dependent) and type 2 diabetes (non-insulin dependent). T2DM which is the most common type of diabetes accounts for about 90-95% of diabetes cases. T2DM is as a result of the body's inability to respond adequately the activity of the insulin produced by the pancreas (WHO, 2016.)

The causes of T2DM are complex, but the rise in the number of people with diabetes is believed to be due to the increase in the number of people who are overweight or obesity, and in the wide spread of physical inactivity (Coppola et al, 2015). Complication of diabetes include foot complication, neuropathy which is diabetic nerve damage which lessens an individual's ability to feel pain, skin changes, Calluses, Foot ulcers, poor circulation, amputation, diabetic ketoacidosis which can lead to coma or even death, nephropathy, hypertension, heart diseases, stroke, gastroparesis, hyperosmolar hyperglycemic non-ketotic syndrome (HHNS) and eye complication (American Diabetes Association, 2018).

2.2 Type 2 Diabetes and Lifestyle Intervention

Evidence suggests that good glucose control can reduce significantly or delay the onset of microvascular complications associated with diabetes. Though there are various diabetes medications available, the cornerstone in achieving good glycaemic control remains lifestyle modification consisting of diet and exercise (Porntip et al, 2019.) Furthermore, restricting diets and prescribing drugs are not the correct approach to the emerging problems of diabetes, rather understanding the diabetes, living with it and preventing future complications are now more urgently required than ever (Jain, 2012).

According to Cooper et al (2008), the empowerment of patients with diabetes helps them adopt adequate healthy behaviours and improves self-management practices. Empowerment can be of help to patients with type 2 diabetes in making choice for personally meaningful and realistic goals related to staying active, eating right and other important aspects of self-management (Anderson and Funnell, 2010).

Lifestyle intervention is an established, non-invasive and effective way to manage weight, blood pressure, glycaemic control and to reduce the risk of fatal complications in T2DM (Kumari, Singh, Jhingan, Chajer & Dahiya, 2018). Furthermore, efficacy trials have shown that specific lifestyle interventions which targets physical activity, weight loss and dietary changes are effective as well as cost-effective majors in preventing T2DM among people with impaired glucose tolerance. As encouraging as this is, the real challenge is to diverse means to deliver these interventions under real world conditions (Thankappan et al, 2018.)

Furthermore, Individual with T2DM should be provided with uncomplicated, individualized activity and nutrition recommendations based on current eating patterns, metabolic goals and preferences. Nutritional needs should be addressed based on personal and cultural preferences, accessibility of healthy food, health literacy and numeracy, willingness and capacity to make behavioural changes as well as barriers to changes, putting into consideration the patient's age and season as nutrition requirement and management goals differs for different age group (Warwick, 2018.)

2.3 Patient education

An individual's knowledge and ability to self-manage their disease is an important part of diabetes care. Diabetes education provides individuals with diabetes, their family as well as caregivers with skills and knowledge to indulge in self-care activities and lifestyle changes to enable them manage diabetes more effectively. Hence, it is advisable that people with diabetes are given diabetes self-management education to enhance necessary skills and knowledge in managing diabetes (Porntip et al, 2019.)

On an everyday basis, patients encounter completely different issues regarding diabetes which fails to do justice in elaborating the diversity of their condition. Recently, through media and online sources, like social media, patients acquire significant amount of

information regarding diabetes. Health providers could play an enormous role to help patients to disregard unrelated information concerning diabetes and be confident in managing their conditions and know the effects of diabetes on their lives (Meer 2015.)

Furthermore, Type 2 diabetes often requires that patients make challenging self-management changes which is usually different from long-established routines. These lifestyle changes can be overwhelming and most time entail improved coping skills. The help from caregivers to the patients to understand how to care for themselves may improve their overall type 2 diabetes care (American Association of Diabetes Educators, 2011; American Diabetes Association, 2014).

Inzucchi et al, (2012), note that engaging patients on an individual level may help establish a shared decision-making approach and places patients at the centre of care, which may promote adherence to therapy. During the management of diabetes, depending on knowledge alone is insufficient to encourage behaviour change. Living successfully with diabetes most times depends on the ability of the patient in self-managing their condition through informed decision-making, have the motivation to make changes, take responsibility for self-care, participate in establishing their care plan and feel supported in the process. The diabetes education session should be tailored to an individual's educational needs preferences and values, and need to be patient-centred (Elaine, 2018.)

3 Purpose, Aim and Study Question

The purpose of this literature review was to describe lifestyle-related patient education methods beneficial in eliciting positive lifestyle modifications in patients with T2DM.

The aim of this literature review is to use the evidence-based knowledge resulting from this literature review to clearly provide nurses with effective patient education methods that result in positive lifestyle change or improved HbA1c for patients with T2DM.

Study Question:

- ✓ What are the features (methods, characteristics, contents and outcome) of effective lifestyle modification education for people with T2DM?

4 Methods**4.1 Descriptive literature review**

The descriptive literature review was selected as the proper method for this bachelor thesis. A literature review is a method of research that explains, analyses and summarises formerly done studies associated to the topic of choice (Parahoo, 2014:118-119). The purpose of a literature review is to find significant studies, critically audit and analyse the results, thereafter produce the known evidence on a specific topic of interest (Coughlan, Cronin & Ryan, 2013).

The process of literature review involves five stages which identification of the research question; identification of studies relevant to the research question; selection of the studies which will be included in the review; noting of data and information within the included studies; collating, summarizing and reporting the result of the literature review (Kennedy-Martin et al, 2015). Further understanding of a particular topic is enhanced by the synthesis and analysis of published articles in a review, either by describing a fresh interpretation on a given topic, or amalgamating a systematic connection amidst the research result (Coughlan, Cronin & Ryan, 2013). This sort of review illustrates the most recent stages of development in a research domain (Yang & Tate 2009; Kahjoogh et al, 2016: 45-49).

The descriptive literature review presents an extensive approach of choosing literature, which can involve quantitative or qualitative research. Despite the fact that this method does not conform to a precise and specifically established review process, it can aspects of the highly structured systematic literature review method disregarding its constraints (Coughlan, Cronin & Ryan, 2013). By completely explaining and stating the methods in which a review was carried out, this type of review can be considered a systematic approach and therefore can be duplicated (Aveyard, 2010; Stolt, Axelin & Suhonen, 2016).

4.2 Search Strategy

Literature review requires the researcher to conduct an extensive search from reliable sources, in order to gather comprehensive information from peer-reviewed journals, academic journals and up-to-date journals to work with (Parahoo, 2014). Data collection for this thesis focused on answering the study question, using evidence base scientific literature. It involved transparent data collecting processes, data recording, databases, date and time (Gerrish & Lacey, 2011:22-23.)

The data for this study was derived from reliable electronic databases such as PubMed and CINAHL. These well-established and acknowledged databases were chosen, due to their assortment of literature and research related to nursing, medicine and healthcare science. The search terms (table 1) were Patient education OR education OR patient counseling OR counselling. I further combined my search word with AND lifestyle OR lifestyle change OR lifestyle modification AND diabetes OR diabetes type 2. The same search terms were used for both CINAHL and PubMed databases.

Table 1. Database searches

Database	Search terms	Limits	Hits	Reviewed from title & abstract	Reviewed by content	Final
CINAHL 21.06.2019	Patient education OR education OR patient counseling OR counselling AND Lifestyle OR lifestyle change OR lifestyle modification AND Diabetes OR Diabetes type 2	2009- 2019 English language	331	95	19	7

PubMed 29.06.2019	Patient education OR education OR patient counseling OR counselling AND Lifestyle OR lifestyle change OR lifestyle modification AND Diabetes OR Diabetes type 2	2009- 2019 English language	274	73	13	4
TOTAL			605	168	32	11

4.3 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were set and used during this review to create boundaries for the review, serve as a guide and also used to determine what can be included or excluded from the study (Parahoo, 2014:126). Research article sampling are carried out to eliminate the possibility of sample contamination, and/or bias that can dwindle the strength of the evidence. The scrupulous planning and development of the inclusion and exclusion criteria will aid sharpen and strengthen the data, by so doing, the researcher boost the veracity of the finding (Haber & Lobiondo-Wood, 2010:223-224.)

The inclusion criteria include Patients with T2DM, Adult patient excluding Children, Adolescents and People with gestational diabetes. Furthermore, this review is limited to academic journals, scientific journals, peer-reviewed, available in full-text and are written in English language. Professional journals and literature review articles were excluded. The research period for literature that were reviewed were limited to resent publications between 2009-2019. Using the above listed criteria, The title, abstracts, content were reviewed and the relevant articles that specifically answered the study question were selected. PICO framework, which is a guide designed to assist health

care professionals and students become effective and efficient users of the medical literature, as a criterion for considering the articles.

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> ❖ Full-text ❖ 2009-2019 ❖ English language ❖ Researched article ❖ Academic journals ❖ Peer-reviewed ❖ Patient with T2DM ❖ Adult patient 	<ul style="list-style-type: none"> ❖ Literature reviewed articles ❖ Patients with Gestational diabetes ❖ Not related to lifestyle modification ❖ Professional journals
PICO Framework	
Patient (P)	Patients with T2DM
Intervention (I)	Educational intervention on lifestyle change
Control (C)	
Outcome (O)	Positive lifestyle change

4.4 Study Selection Process

The search yielded 605 articles, of which 168 were selected for further review of titles and abstracts, according to an initial set of inclusion and exclusion criteria as well as PICO framework described above in table 2. Furthermore, articles that were not accessible through the metropolia databases and required payment were excluded from the literature review. Duplicates were removed, leaving 32 articles for further evaluation for relevance. Then full text was read following strictly the established inclusion and exclusion criteria and the PICO framework, to identify the studies that answered the research question. After carefully reading through the titles, abstracts and contents, eleven articles were selected and used for data analysis. The process of identifying and selecting the relevant articles for this literature review are illustrated in Figure 1 below.

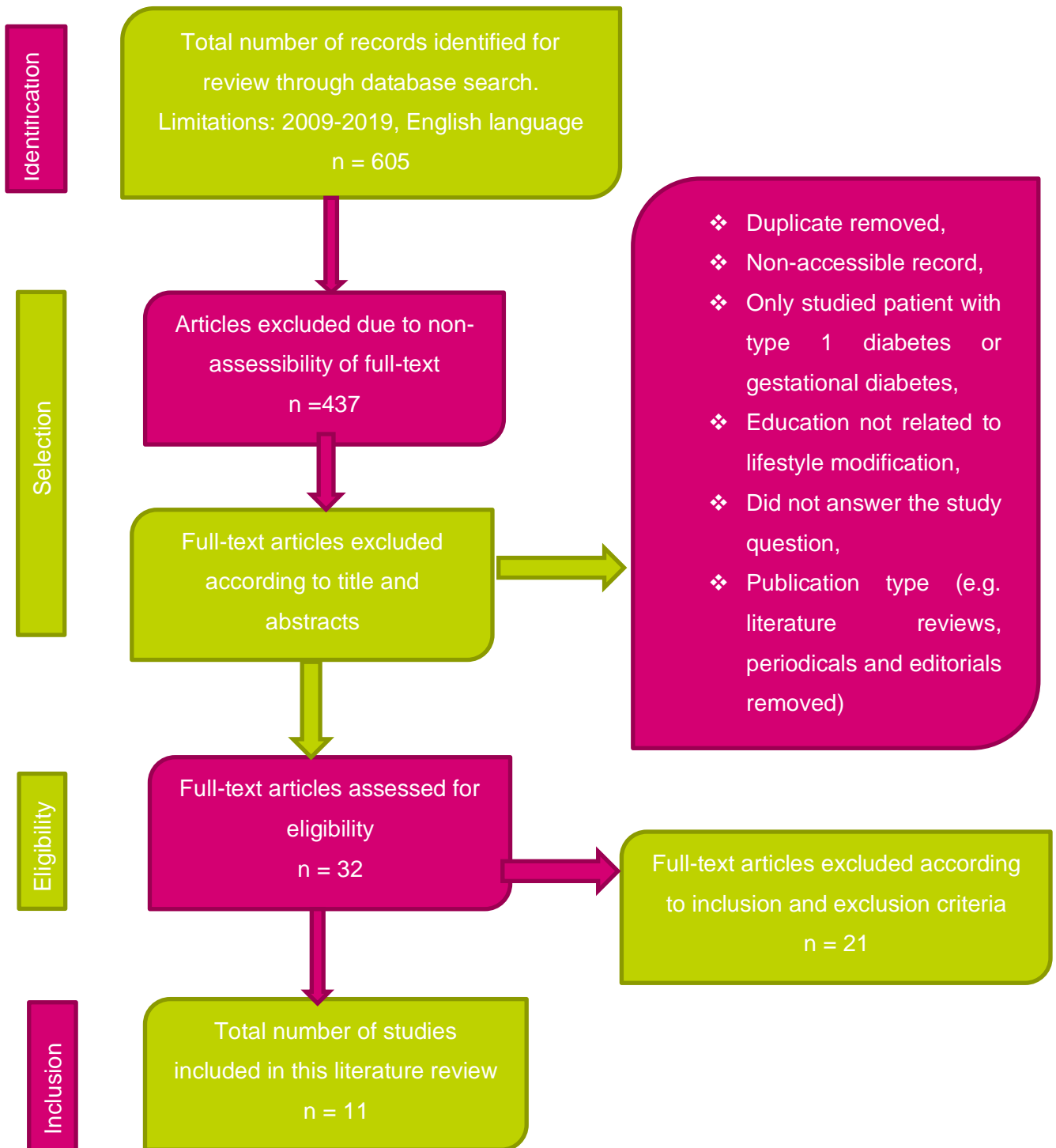


Figure 1. Study Selection Process

The 11 selected studies were conducted using quantitative research methods. The selected articles were based on research conducted in various countries: two (n=2) in Japan, one (n=1) in Korea, one (n=1) in India, one (n=1) in Brazil, one (n=1) in Iran,

one (n=1) in Australia, one (n=1) in New Zealand, one (n=1) in USA, one (n=1) in Germany and one (n=1) in United Kingdom. During the selection process, no article from Finland was identified to answer the study question. The reviewed articles were all recently published within the last seven years in professional journals and concerned lifestyle modification educational interventions for adult patients with T2DM. The selected articles are presented in Appendix 1.

4.5 Data Analysis

The chosen literature was analyzed using a modified content analysis technique. This is a type of technique that is used in research for qualitative, objective and systematic explanation of evidence for categorization of concepts, words and themes and primarily presented by an edited analytical style or through a template (Burn & Grove, 2005; Libiondo-Wood & Haber, 2006; Polit, 2006). Furthermore, content analysis can also be described as a method which can be invoked deductively or inductively in either quantitative or qualitative data to categorize and /or classify words, theme and phrases in accordance to theoretical importance (Elo & Kyngäs, 2008).

In this thesis, inductive content analysis was used to identify the theme from the chosen studies as well as categorize the themes. This is a known system of extracting theme from raw data in a systematic and consistent way and then further categorize the themes into similar smaller categories. Thereby enabling similarly grouped theme to have a common meaning, thus making the studied subject to be clearly understood. The goal is to conceptualize or summarize a phenomenon by developing themes and coding, with the sole aim of expanding understanding and procuring understanding (Elo & Kyngäs 2008.)

For this review, the principle of inductive content analysis was used to group the 10 identified interventions. The study question guided in the formation of one main category which is lifestyle education methods. Then, similar findings which answered the study question were grouped together into four sub categories; experiential, telemedicine, multimedia and web-based interventions. Lastly, the sub categories were divided into individual findings as shown in figure 2 below.

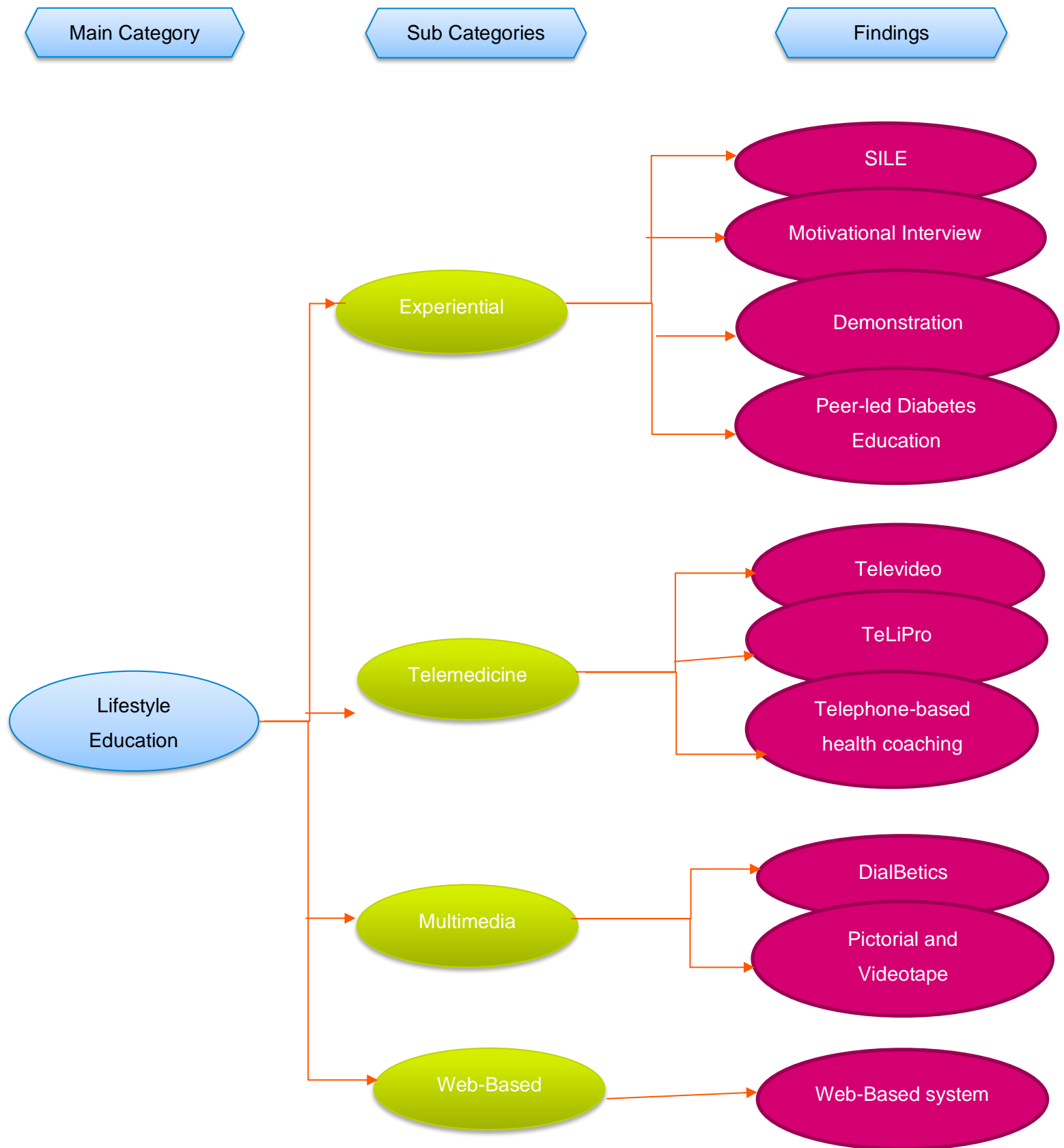


Figure 2. Analysis according to categories

5 Findings

5.1 General Findings

In this literature review, eleven articles were analyzed as shown previously in the data collection following the inclusion and exclusion criteria as well as the PICO framework. The overall findings of the reviewed data are as follows:-

Of the eleven articles, seven had a control group to support their findings (Adachi et al., 2013; Ahmachi et al., 2017; Kempf et al., 2017; Waki et al., 2012; Kumari et al., 2018; Agular et al., 2016 and Cha et al., 2017). Questionnaires were used in nine of the reviewed studies (Do Valle Nascimento et al., 2017; Higgs et al., 2016; Ahmadi et al., 2017; Nuovo, 2013; McGloin et al., 2014; Waki et al., 2012; Kumari et al., 2018; Agular et al., 2016 and Cha et al., 2017) and appeared to be a popular method of collecting data pre- and post- intervention.

The subject of patient education was Lifestyle or Lifestyle-related, but one of the articles focused specifically on nutrition (Adachi et al., 2013) and another one focused mainly on exercise (Higgs et al., 2016). Six of the studies had Patient Education sessions at least weekly (Do Valle Nascimento., 2017; Higgs et al., 2016; Ahmadi et al., 2017; Kempf et al., 2017; McGloin et al., et al and Cha et al., 2017) Length of educational intervention varied in the studies:- four articles (Do Valle Nascimento., 2017; Kempf et al., 2017; Kumari et al., 2018 and Agular et al., 2016) had educational sessions of 15-30 minutes duration, four articles had teaching interventions of 40 minutes or longer (Higgs et al., 2016; Ahmadi et al., 2017; Nuovo, 2013 and Cha et al., 2017) and three did not state any length of time at all (Adachi et al., 2013; McGloin et al., 2014 and Waki et al., 2012). Nine of the articles conducted the educational intervention for up to three months or more (Adachi et al., 2013; Do Valle Nascimento et al., 2017; Higgs et al., 2016; Ahmadi et al., 2017; Kempf et al., 2017; McGloin et al., 2014; Kumari et al., 2018; Agular et al., 2016 and Cha et al., 2017). Only five of the articles had follow up after six months to twelve months post education (Kempf et al., 2017; McGloin et al., 2014; Kumari et al., 2018; Agular et al., 2016; Cha et al., 2017). All the studies involved both genders except one (Agular et al., 2016) that involved only male patients.

5.2 Experiential Interventions

According to Roger's experiential learning theory, learning addresses the needs and wants of the learner and is equivalent to personal changes and growth. This type of learning involves the optimum participation of the learners, they have control over the direction and nature of the process, it involves practical, social, personal and/or research problems, and lastly, self-evaluation is considered the principal method of assessing progress or success (Rogers & Freiberg, 1994.) The studies grouped under this intervention involved face to face meeting with patient or group of patients to encourage them take responsibility for their health by empowering them through health education to make lifestyle modifications to improve T2DM, delivered either by health professionals or peer (Adachi et al, 2013; Do Nascimento et al, 2017; Higgs et al, 2016; Ahmadi et al, 2017).

5.2.1 Structured Individual-based Lifestyle Education (SILE)

Contact or face to face method of education either in group or individually is an effective way of delivering lifestyle education to T2DM patients (Adachi et al 2013; Do Valle Nascimento et al, 2017). The individual-based method allowed the education intervention to be personalized to the lifestyle of the patient. Lifestyle modification education as related to diet, exercise and stress management is given by a health personnel. It entailed the complete involvement of the patient during the education sections, as well as planning the lifestyle modification intervention and allowed for question asking from the patient. It showed to potentially improve blood glucose control (Adachi et al, 2013.)

5.2.2 Motivational Interview

Motivational interview is an evidenced-based counselling that centralizes on motivating patient to change unhealthy behaviour and adhere to treatment plan as well as allow the patient to set own goals (involve in making meal plan, plan type of exercise, suggest own ways of managing stress, set on goals and expectations) with the guidance of a health profession. This intervention which also entail the identification of the participants' self-management goal (for instance increasing physical activities, eating healthier etc.) and then formulate specific short time action plan (small steps) to incorporate the healthier behaviors in their daily lives, was also proven to be an effective method for encouraging

T2DM patients to make positive lifestyle modification. As there was improvement in physical activity, eating fruits and vegetables as well as HbA1c level (Do Valle Nascimento et al, 2017).

5.2.3 Demonstration

Lifestyle modification intervention given by different health professionals such as nurses who gave advice on foot care, oral health, quitting smoking and goal setting, dietician who gave advice on healthy diet, physiotherapist who give advice on physical activities and its' benefits was also shown to be an effective patient education method. Better outcome in terms of adhering to the exercise routine was achieved, when education is accompanied with the demonstration of the types of exercise that can be done by the patients at home and encouraging patients to actively participate in the 45minutes exercise session (Higgs et al, 2016.)

5.2.4 Peer-Led Diabetes Education

Furthermore, Peers with T2DM who have made lifestyle modification changes successfully with positive outcome can be used as a cost-effective alternative to deliver lifestyle modification education. Peers were trained to deliver education on healthy diet, physical activities, foot care and were also encouraged to share their own experience. This group sections also allowed the patients to ask questions and be reassured about their condition as they are being educated by their peer who have successfully made lifestyle changes. This is an effective low budget way of delivering lifestyle modification education and relieving healthcare professionals of their tedious workload, as there was a significant improvement in the lifestyle of the patient educated by peers and is equivalent to the lifestyle changes seen in patients educated by health professionals (Ahmadi et al, 2017.)

5.3 Telemedicine

According to World Health Organization (WHO), telemedicine simply means hearing from a distance. They further defined telemedicine as the use of information and communication technology to overcome geographical barriers, by all healthcare professionals for the exchange of valid information for prevention, diagnosis, treatment

of diseases and injuries, evaluation and research as well as for the continuing education of health care providers, all in the interests of improving the health of individuals and their communities. Studies grouped under telemedicine intervention include the use of tele video (that is life-video teaching), telephone calls and skype call to educate patients on life-style modification necessary to improve the quality of life and prevent complication in patients with T2DM (Nuovo 2013; Kempf et al, 2017; McGloin et al, 2014).

5.3.1 Tele video

Telemedicine allows lifestyle modification coaching to be given to patients with T2DM from a distance and does not require the educator and patient to be at a stipulated place together, hence, ensuring that location is not a barrier to health education. Televideo, which involve a live presentation given by two healthcare workers through a telemedicine link on basic lifestyle modification such as basic understanding of diabetes, nutrition, footcare, and physical activity required of T2DM patients demonstrated to be an effective education method for eliciting lifestyle changes as the patients reported exercising and checking their feet more frequently (Nuovo, 2013.)

5.3.2 Telemedical Lifestyle Intervention Program (TeLiPro)

Furthermore, lifestyle coaching on diet and exercise via a telephone call or skype was also found to be an effective and convenient way of giving individualized education on lifestyle modification needed in T2DM (Kempf et al, 2017; McGloin et al, 2014). TeLiPro involved coaching patients with T2DM through a phone call and encompass aspects such as telemedical coaching, telemonitoring, structured lifestyle intervention program including dietary with a protein-rich meal replacement (PRMR) therapy, evaluated mental motivational training and self-monitoring of blood glucose. Although TeLiPro entail delivering lifestyle modification education from a distance, distance had no adverse effect on the outcome of the intervention, as it showed to improve body weight, BMI, blood pressure, quality of life, fasting blood glucose, eating habit as well as improve blood glucose (Kempf et al, 2017).

5.3.3 Telephone-Based health coaching

McGloin et al (2014), examined the productiveness of the use of telephone empowerment-based health coaching as an affordable alternative to changing health

behavior of adult patients with T2DM. Coaching call was made through skype educating patients on exercise, smoking and diet with the aim of improving their weight, BMI, waist circumference and HbA1c. This intervention required the participants set own weekly goals to serve as a motivation. The calls were recorded and transcribed using powergramo, also coaching note regarding goals, goal achievement, obstacles and approach used by the participants were noted. The study showed that skype-based coaching intervention can be used to move patients along the stage of change as well as achieve behavioral/lifestyle change in adult with T2DM.

5.4 Multimedia Intervention

Multimedia intervention involves sharing or communicating information in the form of picture, sound, video as well as text (Cambridge dictionary). The interventions categorized together as multimedia intervention involved making use of media such as voice message, pictures, text, pre-recorded video and DVD recording as a means of giving lifestyle modification education (Waki et al, 2012; Kumari et al, 2018; Aguiar et al, 2016)

5.4.1 DialBetics

Lifestyle modification education can also be delivered through an application (DialBettics) specifically designed for patients with T2DM which can be downloaded on a smartphone and use to log all consumed diet and fluid, weight, BMI, blood glucose, waist circumference as well as physical activity. The recorded data are evaluated following the Japan Diabetes Society (JDS) guideline and based on the values the patient gets instant advice on necessary modifications needed. Also, the application has the capability of converting voice messages to text, match it to the text in the application and also give needed advice to the patient. Controlled trial of this method (Dailbetic) as an effective tool for lifestyle modification showed it to be promising application as there was an improvement in the blood statistics of the DialBetic group compared to control group (Waki et al, 2012.)

5.4.2 Pictorial and Videotape

There was an improvement in diet, time spent on physical activities, tobacco and alcohol cassation when Picture, videos and leaflet in local languages are in cooperated in the

lifestyle modification education session of T2DM patients. The combination of pictures and video helps in the clarity of the teaching and makes it easy to understand. Providing T2DM patient with leaflets which is their local languages gives them the opportunity to refer to it at any needed time (Kumari et al, 2018.)

Furthermore, this blended method of self-administered lifestyle education through multimedia involved a short contact session, aimed to educate and orient the patients about the process. After which they are offered necessary equipment needed to enlighten themselves and make lifestyle modifications such as an exercise DVD, a weight loss hand book, a diet plan, a pedometer, a tape, weight lost log book and a user guide for an online self-monitoring tool (Aguiar et al, 2016.) Therefore, the use of multimedia can be considered an effective way to elicit positive lifestyle modification in T2DM as there was a significant reduction in waist circumference, weight and body fat percentage as well as an improvement in blood statistics (Kumari et al 2018; Aguilar et al, 2016).

5.5 Web-Based system

Lastly, Web-based program was also identified to be one of the effective ways of lifestyle modification education for T2DM patients. Cha et al, (2017) examined the effectiveness of intensive lifestyle modification education focusing on encouraging weight loss, sustenance of weight loss, increasing physical activity, eating a healthy diet, as well as quitting smoking and alcohol use, delivered through a web-based program for T2DM. This intervention involved one contact orientation session to explain about the website and how to use it as well as encourage then to visit the website at least once a week. The website contained video files, education contents, visit schedule and inter-communicable keeping track sites for the patients. This intervention was not just effective in eliciting positive lifestyle modifications but also improved the quality of life which is crucial for T2DM prevention and management.

Table 3. Analysis of the study findings

Intervention	Characteristics	Content	Outcome
Structured Individual-based lifestyle Education (SILE)	<ul style="list-style-type: none"> • Contact teaching • Individual session 	6-months study involving 213 T2DM patient on health diet, exercise and stress management.	Improved HbA1c level
Motivational Interview	<ul style="list-style-type: none"> • Contact teaching • Individual session 	6-months autonomy based motivational interview to encourage health diet and exercise.	Improved HbA1c level. Achieved positive lifestyle modifications
Demonstration	<ul style="list-style-type: none"> • Contact teaching • Individual and group session 	Involved weekly 45 minutes of education on healthy eating, home exercise, foot care, oral health, quitting smoking as well as 45 minutes of group, coached exercise	Achieved positive lifestyle modifications.
Peer-Led Diabetes Education	<ul style="list-style-type: none"> • Contact teaching • Group session 	12-week study to compare education given by health professionals and peer to separate groups on healthy diet, foot care, physical activity, and medication adherence	Achieved positive lifestyle modification.
Televideo	<ul style="list-style-type: none"> • Distance teaching • Group session • Education through live video 	2 hour presentation covering understanding of diabetes, nutrition, foot care, exercise, and self-management	Achieved positive lifestyle modification
TeLiPro	<ul style="list-style-type: none"> • Distance teaching 	12 weeks study involving 202 obese T2DM patient. Education include eating healthy diet, increasing	Improved HbA1c level,

	<ul style="list-style-type: none"> • Individual session • Education through telephone call 	physical activity and knowledge on anti-diabetics medication	Reduced body weight,
Telephone-Based health coaching	<ul style="list-style-type: none"> • Distance teaching • Individual sessions • Skype-based intervention coaching 	A 12 week program, involving education of T2DM patients through skype call on exercise, healthy diet and quitting smoking.	Achieved positive lifestyle modification.
DialBetics	<ul style="list-style-type: none"> • Blended teaching • Individual sessions • Smartphone based educational application 	Entails recording diet, drinks and physical activity on the DialBetics server which return gives advice on needed modification.	Improved HbA1c level
Pictorial and Videotape	<ul style="list-style-type: none"> • Blended teaching • Group and individual sessions • Used pictures, pre-recorded video, DVD 	Content of the education given include advice on diet and offered diet chart, advice on exercise and offered an exercise DVD to be used at home, alcohol and tobacco use and stress management techniques	Improved HbA1c, QUICKI levels. Achieved positive lifestyle modification.
Web-Based system	<ul style="list-style-type: none"> • Contact teaching • Individual sessions 	Web-based program included video clip, visit schedule and education slides focusing on exercise, healthy diet, quitting smoking and	Achieved positive lifestyle modification.

	<ul style="list-style-type: none"> • Web-based modules 	alcohol use in T2DM patient.	
--	---	------------------------------	--

6 Discussion

6.1 Discussion of the Findings

Glycemic control is considered the main treatment target in the management of T2DM because it is associated with reduced rate of severe complications, co-morbidities as well as improved health outcome (Kumari et al, 2018). Lifestyle intervention is the cornerstone of treatment for patients with T2DM (Adachi et al, 2013), and the T2DM prevention trials, such as Finnish Diabetes Prevention Study and U.S. Diabetes Prevention Program (DPP), also demonstrated that lifestyle intervention can reduce the incidence of T2DM by as much as 58% (Aguilar et al, 2016). Therefore, the purpose of this literature review is to describe education methods effective in eliciting positive behavioural or lifestyle modifications which can invariably aid glycaemic control in patients with T2DM.

The results indicate that there are several effective methods for giving lifestyle modification education. Individual session is arguably the most common form of patient education but does not essentially mean it's the most effective. As individual sessions; motivational interview, SILE or telephone-based counselling appear to have positive and measurable benefits to the patients, as shown in this thesis, however might not be sensible on a long-run basis due to sheer number of patients needing lifestyle modification education. It certainly need planning by the educator, who ideally should be a person well versed in lifestyle modifications (Adachi et al, 2013; Do Valle et al, 2017; McGloin et al 2014.)

Peer-led diabetes education is cost-effective as it educates many people at the same time and utilizes the services of peer in place of health workers, but does not allow for those whose learning strengths are predominantly one on one based. This particular study also involved an interactive support group with the peer where the peer uses the

opportunity to share own experience, which may have contributed to the overall improvement of the peer groups' lifestyle outcome. Education session in a group can make the patient to feel that they are not alone in their situation and by interacting with peers they can gain understanding and new knowledge of their condition. It might also boost positive feelings, reduce the possible risk of isolation and depression (Ahmadi et al, 2017.)

Information and communication technology (ICT) systems for promoting lifestyle modification and self-management of diabetes are assisting patients better cope with diabetes. An ICT platform helps patient improve behavior, improving their health status as well as help minimax medical cost somewhat by providing cost effective support and intervention (Waki et al, 2012.) Education over the telephone, skype or life-video have their place in modern teaching methods (Nuovo, 2013; Kempf et al, 2017; McGloin et al, 2014). While this educational method is convenient, these may lack the openness and feeling of belonging attributed to contact teaching.

Furthermore, multimedia such as leaflets, pictures and videotapes was a popular way to impact knowledge to patients. This method may be expensive and time consuming to produce in bulk and might not be suitable for all patients. It is reasonable to assume that some of these patients have problem with sight, as a progression of diabetic retinopathy. In this situation, it is imperative that the educator consider how the information is displayed. Therefore, large prints and appropriate colouring may help (Kumari et al, 2018). On the other hand, having something concrete that a patient can hold in their hand and can refer to at home is useful and can serve as a remainder. It can also serve as a reference for the relative who take care of the patient (Aguar et al 2016.) Pictures are useful in cases where patients require knowledge in a non-native language or have lower literacy skills (Kumari et al, 2018). No matter how simply phrased, reading printed materials may pose a challenge to those with low literacy or educational standard. It is evident from this review that DVD, pictures/printed material is still prevalent in patient education, therefore it is appropriate that the educator check the level of understanding of the patients before offering written education material.

Finally, the idea of an application (DialBetics) which is readily available when needed to easily record activities, diet as well as blood glucose was highly valued by patients who need to monitor their lifestyle closely, and indeed much research and technology is geared towards creating such application (Waki et al, 2012). But this is beneficial if the

patients have a solid knowledge about the use of the application. Although, the patient in this study were given training, it still depends to a large extent how computer-literate and competent the patient feels operating new technology. It may not be suitable for patient with neuropathy in their hands due to advanced diabetes but on the contrary may be more suitable for younger patients who are competent with mobile technology.

6.2 Discussion on Validity

It is important that the validity of research instrument and the research result is ensured. The researcher can ensure the validity if the review is conducted in a reasonable and ethical format (Mohammad, 2013). In this whole literature review, starting from choosing the topic, planning and coming up with a study question to assortment of knowledge and its review, the researcher should show the reader in a simple and concise manner the way the review progress evolved. In the course of this thesis, the findings were gotten from the data but not from researcher's own personal expectation or presuppositions.

Every process undergone in search of data and reviewed articles were carried out, written and presented in a way that the process could be replicated by any other person. Used databases, which included PubMed and CINAHL, are reliable, recognized and credible data sources for research work in nursing, medicine, life science and biomedicine field. The formation of the search phrase (table 1) used in this review resulted from conducting numerous searches in each of the database in order to the identify all article that could possibly answer the study question. The outlined inclusion and exclusion criteria that is stated in table 2 were strictly observed during the process for selecting the articles for this thesis. The chosen articles were therefore an outcome of careful and detailed appraisal, in order to ascertain that they are of required standard and relevant to the review (Aveyard, 2010).

6.3 Discussion on Ethical Consideration

In Nursing research, the term ethics can be described as a theory of discipline comprising the principles of moral conduct and moral values (LoBiondo-Wood & Haber, 2010). Ethical principles to consider when conducting a study includes; autonomy, justice,

beneficence and non-maleficence. In this thesis, the principles of justice and beneficence were fully taken into consideration. Which entails that the review should be fair and beneficial to either the participants or the society in general (Maltby, McGarry & Day, 2010).

This thesis which is done as a literature review is in accordance to the set ethical guideline by the Finnish Advisory Board on Research Integrity (TENK, 2014). In order to ensure the ethical acceptability of this thesis and give credibility to the findings, I ensured that all aspects of the research were displayed in an ethically appropriate scientific manner in accordance to the ethical guideline by TENK. The thesis was accurately carried out, meticulously focusing attention to integrity and honesty. The principle of specific scientific criteria that is recognised and acknowledged in the research field were conformed to during the process of collecting, analysing and reporting data. Every data reviewed and/or used were published responsibly and communicated openly. Efforts was made as much as possible to avoid all manner of research misconduct which includes but not limited to fabrication which is “fixing result to suit”, falsification and plagiarism. Work by other researchers and accomplishments were adequately referenced, as well as credited respectfully and appropriately. All data sources were acknowledged. The literature review was written in an objective and abstract manner, and not subjecting it to the author’s interpretations.

7 Conclusion

The literature review resulted in a list of synthesised patient education interventions that were effective to elicit lifestyle modifications as well as improve laboratory statistics in patients with T2DM. Diabetes which is a common disease affecting people around the world and have detrimental complications when not managed effectively undoubtedly require the attention of health professionals to prevent these complications that could consequently lead to death.

Lifestyle intervention is considered the cornerstone of treatment for patients with T2DM (Adachi et al, 2013), as the T2DM prevention trials, such as Finnish Diabetes Prevention Study and U.S. Diabetes Prevention Program (DPP), also demonstrated that lifestyle intervention can significantly reduce T2DM by as much as 58% (Aguiar et al, 2016).

Furthermore, since lifestyle interventions have been identified to significantly reduce T2DM, patients are required to make challenging lifestyle modification which is usually different from long-established routines.

The help from caregivers to the patients through education to understand how to care for themselves can favourable advance their total T2DM care (American Association of Diabetes Educators, 2011; American Diabetes Association, 2014). The identified educational interventions can be given on face to face bases or given through ICT mediums, whereby the patient is in the comfort of their home. Also, patients can be provided with T2DM educational materials such as educational application, DVD, handbooks and leaflet which they can use at their convenient time. Different methods that can be adapted to the patients' schedule were proven to be effective through the controlled trails, however studies that explore the long-time (after 2 years or more post intervention) effect of this educational interventions are needed.

8 References

Adachi, M., Yamaoka, K., Wariko, W., Nishikawa, M., Kobayashi, I., Hida, E., & Tango, T., (2013). Effects of lifestyle education program for type 2 diabetes patients in clinics: a cluster randomized controlled trial. *BMC Public Health*, 13:467.

Aguiar, E.J., Morgan, P.J., Collins, C.E., Plotnikoff, R.C., Young, M.D. & Callister, R., (2016). Efficacy of the T2DM prevention using lifestyle education program RCT. *American Journal of Preventive Medicine*, 50(3): 353-364.

Ahmadi, Z., Sadeghi, T. & Loripoor, M., (2017). The outcomes of peer-led diabetes education in comparison to education delivered by health professionals in Iranian Patients. *Health Education Research*, 33(1): 64-72.

American Diabetes Association, (2014). Standards of medical care in diabetes. *Diabetes Care*, 37: pp. 14-80.

American Diabetes Association, (2018). Living with Diabetes. Complications. Available at <<http://www.diabetes.org/living-with-diabetes/>> accessed 15.03.2019.

Anderson, R.M., Funnell, M.M., (2010). Patient empowerment: myths and misconceptions. *Patient Education Counselling*. 79: 277–82.

Aveyard, H., 2010. *Doing A Literature Review In Health And Social Care: A Practical Guide*. 2nd ed. [ebook] McGraw-Hill Education. Available at: <<https://ebookcentral.proquest.com/lib/metropolia-ebooks/detail.action?docID=771406>> Accessed 8 September 2018.

Burns, N. and Grove, S. (2005) *The Practice of Nursing Research: Conduct, Critique, & Utilization*. 5th ed. St. Louis: Elsevier Saunders.

Cambridge dictionary. Multimedia. Available at <<https://dictionary.cambridge.org/dictionary/english/multimedia>> access 09.09.2019.

Cha, S.A., Lim, S.Y., Kim, K.R., Lee, E.Y., Kang, B., Choi, Y.H., Yoon, K.H., Ahn, Y.B., Lee, J.H. & Ko, S.H., (2017). Community-based randomized controlled trial of diabetes prevention study for high-risk individuals of T2DM: Lifestyle intervention using web-based system. *BMC Public Health*, 17:387-396.

- Cooper, H., Booth, K. and Gill, G., (2008). A trial of empowerment-based education in type 2 diabetes global rather than glycaemic benefits. *Diabetes Research and Clinical Practice*. 8: pp. 165–171.
- Coppola, A., Sasso, L. and Bagnasco, A, (2015). The role of patient education in the prevention and management of type 2 diabetes: an overview. *Endocrine* 53(1):18–27.
- Coughlan, M., Cronin, P. and Ryan, F., 2013. *Doing a Literature Review in Nursing, Health and Social Care*. London: SAGE Publications Ltd.
- Do Valle Nascimento, T.M.R., Resnicow, K., Nery, M., Brentani, A., Kaselitz, E., Agrawal, P., Mand, S. & Heisler, M., (2017). A pilot study of a community health agent-led type 2 diabetes self-management program using motivational interviewing-based approaches in a public primary care centre in Sao Paulo, Brazil. *BMC Health Service Research*, 17-32.
- Elaine, N. (2018). Integrated care: evaluation of patient satisfaction with education provided by the diabetes specialist nurse. *Journal of Diabetes Nursing*. 20(2): 1-5.
- Elo, S. and Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*. 62(1), pp. 107-115.
- Gerrish, K. & Lacey, A. (2010). *The Research Process in Nursing 6th edition*. West Sussex: Wiley-Blackwell.
- Haber, J. & Lobiondo-Wood, G. (2010). *Nursing Research 7th ed. Methods and Critical Appraisal for Evidence-Based Practice*. St. Louis: Mosby Elsevier.
- Higgs, C., Skinner, M. & Hale, L., (2016). Outcomes of a community-based lifestyle programme for adults with diabetes or pre-diabetes. *Journal of Primary Health Care*, 8(2): 130-139.
- Inzucchi, S.E., Bergenstal, R.M. and Buse, J.B., (2012) Management of hyperglycaemia in type 2 diabetes: a patient-cantered approach. Position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care* 35: 1364–79.
- Jain, P.K., (2012). Knowledge & Attitude of Diabetic Patients Regarding Diabetic diet, Exercise and Foot care. *International Journal of Nursing Education*, 4(2): pp. 141-145.
- Kempf, k., Altpeter, B., Berger, J., Reub, O., Fuchs, M., Schneider, M., Gärtner, B., Niedermeier, K., & Martin, S., (2017). Efficacy of the Telemedical lifestyle intervention program Telipro in advanced stage of Type 2 Diabetes: *A randomized control trial*. *Diabetes care*, 40: 863-871.

Kennedy-Martin, T., Curtis, S., Faries, D., Robinson, S. and Johnston, J., (2015). A literature review on the representativeness of randomized controlled trial samples and implications for the external validity of trial results. *Trials*. 16(1): 495.

Kumari, G., Singh, V., Jhingan, A.K., Chajer, B. & Dahiya, S., (2018). Effectiveness of Lifestyle Modification Counselling on Glycaemic Control in Type 2 Diabetes Mellitus Patients. *Current Research in Nutrition & Food Science*, 06(1): pp. 70-82.

Kumari, G., Singh, V., Jhingan, A.K., Chhajaj, B. & Dahiya, s., (2018). Effectiveness of lifestyle modification counselling on glycaemic control in Type 2 Diabetes Mellitus patients. *Current Research in Nutrition and Food Science*, 6(1): 70-82.

LoBiondo-Wood, G. and Haber, J. (2006) Nursing research: methods and critical appraisal for evidence-based practice. 6th ed. St. Louis, Mo. Mosby Elsevier. pp 559-575.

LoBiondo-Wood, G. and Haber, J. (2010) *Nursing research: methods and critical appraisal for evidence-based practice*. 7th ed. St Louis, Mo: Mosby Elsevier.

Maltby, J., Williams, G., McGarry, J. and Day, L., (2010). Research Methods for Nursing and Healthcare. Harlow: Pearson Education.

McGloin, H., Timmins, F., Coates, V. & Boore, J., (2014). A case study approach to the examination of a telephone-based health coaching intervention in facilitating behaviour change for adults with T2DM. *Journal of Clinical Nursing*, 24: 1246-1257.

Meer, J., (2015). Empowering Patients with Diabetes. *British Journal of Nursing* 24 No 16.

Mohammad, Z., (2013). Mixed method Research: Instruments, Validity, Reliability and reporting Findings. *Theory and Practice in Language Studies*. 3 (2): 254-262.

Nuovo, j., (2013). The impact of a diabetes self-management education program provided through a telemedicine link to rural California health care clinics. *Health Services Insights*, 6: 1-7.

Parahoo, K. 2014. Nursing Research Principles, Process and Issues 3rd edition. Hampshire.

Parry Strong, A., Lyon, J., Stern, K., Vavasour, C. and Milne, J., (2014). Five-year survey of Wellington practice nurses delivering dietary advice to with type 2 diabetes. *Nutrition & Dietetics*, 71(1): pp. 22-27.

Polit, D. and Beck, C. (2006). Essentials of Nursing Research: Methods, Appraisal, and Utilization. 6th ed. Philadelphia: Lippincott Williams & wilkins.

Porntip, T., Runya, P., Hataiporn, T., Rungrudee, J., Chatvara, A., Rangsim, R., Orawan P., Khaemane, J., Nampeth, S., Sawitree, C., Araya, H., Prapai A., Patcharavee T., Piyanuch M., Chanyaphat P., Jariya B., Kanokporn P., Oraluck P., Sirimon R. and Ratanaporn J., (2019). Effectiveness of Diabetes Self-Management Education in Thais with Type 2 Diabetes. *Pacific Rim International Journal of Nursing Research*, 23(1): pp. 74-86.

Roger, C.R & Freiberg, H.J. (1994) *Freedom to learn*. 3rd ed. Columbus OH: Merrill.

Stolt, M., Axelin, A. and Suhonen, R., 2016. *Kirjallisuuskatsaus hoitotieteessä*. 2nd ed. Turku: Juvenes Print.

Thankappan, K.R., Salhish, T., Tapp, R.J., Shaw, J.E., Loffaliany, M., Wolfe, R., Absetz, P., Mathews, E., Aziz, Z., Williams, E.D., Fisher, E.B., Zimmet, P.Z., Mahal, A., Balachandran, S., D'Esposito, F., Sajeev, P., Thomas, E. & Oldenburg, B., (2018). A Peer-Support Lifestyle Intervention for Preventing Type 2 Diabetes in India: A Cluster Randomized Controlled Trail of the Kerala Diabetes Prevention Program. *PLoS Medicine*, 15(6): pp. 1-23.

The Finnish Advisory Board on Research Integrity, TENK (2012) *The responsible conduct of research*. [Online] Available at: <<http://www.tenk.fi/en/responsible-conduct-research-guidelines/responsible-conduct-research>> Accessed 01 October 2019.

Waki K., Fujita, H. & Ohe K., (2012). DialBetics: Smartphone-based self-management for T2DM patients. *Journal of Diabetes Science and Technology*, 6(4): 983-985.

Warwick, K.W., (2018). Diabetes Nutrition Throughout the Lifecycle. *Today's Dietitian*, 20(8): pp. 33-36.

WHO, (2016). 10 facts on Diabetes. Available at <http://www.who.int/features/factfiles/diabetes/en/> Accessed 07.10.2018.

WHO, (2016). Regional office for Europe, Diabetes. Available at <<http://www.euro.who.int/en/health-topics/noncommunicable-diseases/diabetes/diabetes>> Accessed on 08.10.2018.

WHO. Telemedicine Opportunities and development in Member States. Available at <https://www.who.int/goe/publications/goe_telemedicine_2010.pdf> Accessed 02.10.2019.

Yang, H., & Tate, M. (2009). Where are we at with Cloud Computing?: A descriptive literature review. *ACtS Proceedings*, 26: 806- 8.

Appendix 1

Summary of the reviewed literature.

Title	Authors, year of publication & location	Objective	Methodology	Findings
A case study approach to the examination of a telephone-based health coaching intervention in facilitating behaviour change for adults with T2DM.	McGloin, H., Timmins, F., Coates, V. & Boore, J., 2014. United Kingdom	To examine how effective a telephone empowerment-based health coaching is as a cost-effective alternative to aid behaviour change of adult with T2DM.	Data collection was by means of physiological measurements survey and focus group interview both before and after the telephone call.	Telephone coaching showed to be a cost effecting way of supporting health behaviour change of adult with T2DM. Patients also showed greater responsibility for their health.
A pilot study of a community health agent-led type 2 diabetes self-management program using motivational interviewing-based approaches in a public primary care center in Sao Paulo, Brazil	Do Valle Nascimento, T.M.R., Resnicow, K., Nery, M., Brentani, A., Kaselitz, E., Agrawal, P., Mand, S. & Heisler, M., 2017. Brazil	To examine the acceptability, feasibility and outcome of training health agents motivational interviewing-based counselling for patients with poorly controlled diabetes.	The study was implemented in a primary health care health unit located in the low income area in the western region of the city of Sao Paulo. 24 health workers were trained to give motivational interview to 83 participants with A1c greater than 7.0%	Participants reported improvement in the quality of care received. They reported increased physical activities, consumption of fruits and vegetables, medication adherence but no change in the consumption of high fat food or sweets.

Community-based randomized controlled trial of diabetes prevention study for high-risk individuals of T2DM: Lifestyle intervention using web-based system.	Cha, SA., Lim, SY., Kim, KR., Lee, EY., Kang, B., Choi, YH., Yoon, K.H., Ahn, YB., Lee, JH. & Ko, SH., 2017. Korea	To explore the effective of intensive lifestyle modification using web based program in preventing T2DM	This 6-months program involved 420 participants who received lifestyle modification education through the web and were followed up after the study for up to 22 months.	C-KDPS trial show a significant improvement in lifestyle behaviour and quality of life of the intervention group.
DialBetics: Smartphone-based self-management for T2DM patients.	Waki K., Fujita, H. & Ohe K., 2012. Japan	To assess the safety, usability and impact of DialBetics on T2DM patients' HbA1c outcomes and home blood pressure monitoring inorder to detect complications associated with diabetes.	A 1-month study involving T2DM adult patients with average BMI 24,6 and HbA1c 6.79.	There was a significant decrease in mean HbA1c after one month of using DialBetic to advise T2DM patient.
Effectiveness of lifestyle modification counselling on glycaemic control in T2DM patients.	Kumari, G., Singh, V., Jhingan, A.K., Chhajer, B. & Dahiya, s., 2018. India	To assess the effectiveness of using lifestyle holistic model in lifestyle modification counselling and its adherences towards glycaemic control in T2DM.	This was a quasi-experimental study involving 224 T2DM patients. The participants were divided into 2 groups lifestyle modification counselling (LMC) group and usual care(UC) group.	This model proved to be an effective non-invasive approach for glycaemic control of T2DM and showed improvement in the fasting blood sugar and postprandial blood sugar.

Effects of lifestyle education program for type 2 diabetes patients in clinics: a cluster randomized controlled trial.	Adachi, M., Yamaoka, K., Wariko, W., Nishikawa, M., Kobayashi, I., Hida, E., & Tango, T., 2013. Japan	To evaluate the effectiveness of a structured individual-based lifestyle education program to reduce the haemoglobin A1c level in patients with type 2 diabetes delivered by registered dietitians in primary care clinical settings.	A 6-month cluster randomized controlled trial of 193 adults (100 IG & 93 CG) in 20 clinics. Structured individual based lifestyle education (SILE) was given to the IG. Mixed-effect liner models were used to examine the effect of the treatment.	The mean change at 6 months from baseline in HbA1c was 0.7% decrease in the intervention group and a 0.2% decrease in the control group. The SILE program that was provided in primary care setting for patient with type 2 diabetes resulted in greater improvement in HbA1c levels than usual diabetes care and education.
Efficacy of the T2DM prevention using lifestyle education program RCT.	Aguiar, EJ., Morgan, PJ., Collins, CE., Plotnikoff, RC., Young, MD. & Callister, R., 2016. Australia	To investigate the effective of a self-administered and gender tailored lifestyle intervention program known as PULSE for men at high risk of developing T2DM.	A 6-months RCT comprising of 53 intervention group and 43 waitlist control group. The intervention group received a 15-minutes orientation and were offered all equipment need for the lifestyle intervention.	There was a reduction in weight, BMI and waist circumference after 6 month of the program.
Efficacy of the Telemedical lifestyle intervention program Telipro in advanced stage of T2DM: A randomized control trial.	Kempf, k., Altpeter, B., Berger, J., Reub, O., Fuchs, M., Schneider, M., Gärtner, B., Niedermeier, K., & Martin, S., 2017. Germany	To evaluate the efficacy of TeLiPro in improving metabolic control in the advanced stage of T2DM.	A 12-week randomized control trial involving 202 group divided into 2 groups. The control group received a weighing scale, step counter while the TeLiPro group received a medial-mental motivation, a diet plan and self-monitored blood glucose in addition to that.	There was a significant HbA1c reduction in the TeLiPro group compared to the control group. And also an improvement in weight, BMI, systolic blood pressure, quality of life and eating behaviour were observed.

Outcomes of a community-based lifestyle programme for adults with diabetes or pre-diabetes.	Higgs, C., Skinner, M. & Hale, L., 2016. New Zealand	To investigate clinical outcomes as well as the acceptability of a community-based lifestyle programme organized for adult with diabetes.	A 12-weeks prospective observational study of an intervention involving 36 participants with baseline and repeated quantitative outcome measure and qualitative data collection on acceptability.	At the end of the programme results indicates there was a clinical benefit from mean improvement of cardiorespiratory fitness, waist circumference, exercise behaviour and self-efficacy. This also remained at 3 months post programme.
The impact of a diabetes self-management education program provided through a telemedicine link to rural California health care clinics.	Nuovo, j., 2013 USA	To investigate the impact of DM self-management education provided through a telemedicine link	239 patients participated in 1 of the 43 2-hour diabetes education and self management class given through a telemedicine	Patient reported a noticeable change in there self-care behaviour and it persisted over the 8-week follow-up period.
The outcomes of peer-led diabetes education in comparison to education delivered by health professionals in Iranian Patients.	Ahmadi, Z., Sadeghi, T. & Loripoor, M., 2017. Iran	To compared health education by peer to education by health professionals on self-care behaviours among diabetes patients.	120 patients with T2DM were randomly divided into 3 groups. Care professional group, peer educational group and control group.	Data collected at the beginning and after three months showed that PEG had the greatest improvement followed by CPG and CG did not change significantly.