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**Relationship Between Diabetic Self-Management Education and Microvascular
Complications in Adults with Type II Diabetes: An Integrative Review**

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Abstract

Aims. The aim of this integrative review is to explore the impact of diabetic self-management education on reduction or delay in progression of microvascular complications in adults age 18 and older.

Background. According to the Center of Disease Control, more than 34 million Americans have diabetes. Between 90 and 95% of them have type II diabetes making it the most prevalent type of diabetes. Microvascular complications are a sad reality for people diagnosed with diabetes with poor glycemic control. Microvascular complications of diabetes are long term complications that affect small blood vessels including neuropathy, nephropathy and retinopathy. These microvascular complications can be life-altering disease processes and cannot be reversed once the damage is done. Proper glycemic control requires knowledge, training, and practice from trained healthcare professionals. Diabetic self-management education can potentially reduce the risk for these microvascular complications by helping patients have better control on their blood glucose levels over an extended period of time.

Data Sources. Research studies that examined the relationship between diabetes self-management education and microvascular complications in type II Diabetes were included in the literature review. The electronic databases searched include PubMed, ScienceDirect and Google Scholar.

Review Method. An integrative literature review was carried out using Whittemore and Knafl's (2005) framework for data collection, analysis and synthesis.

Results. Three themes were identified that included health literacy level, variability of participants and educational interventions and individualization of education.

Conclusion. More research is needed to determine the effectiveness of DSME in reducing and delaying microvascular complications in patients with type II diabetes.

Keywords: Type II Diabetes, Self-management education, Microvascular complications

Relationship Between Diabetic Self-Management Education and Microvascular Complications in Adults with Type II Diabetes: An Integrative Review

Millions of people around the world have diabetes mellitus and millions more are diagnosed each day. According to the Center of Disease Control (CDC), more than 34 million Americans have diabetes with 90-95% of them having type II diabetes making it the most prevalent type of diabetes (CDC, 2019). The CDC annual reports for new diagnoses of diabetes reveal that this number is increasing by 1.5 million Americans 18 years or older every year. Diabetes can be a very challenging chronic illness to manage. It poses many challenges as integrating the complex self-management into everyday life can cause emotional distress leaving people feeling discouraged and overwhelmed. Maintaining proper glycemic control requires specialized education and effort. If proper glycemic control is not maintained it can cause many complications ranging from short-term to long-term. To assist in disease management, diabetic self-management education can be provided to patients to support them in maintaining health and reducing potential complications from diabetes.

Background

Life-Altering Disease Processes

Type II diabetes is a chronic disease that impacts the way the body metabolizes sugar or glucose (Mayo Clinic, n.d.). It is important for patients diagnosed with diabetes to understand the purpose of glucose and insulin in order to understand the impact of diabetes and importance of management. Without proper glycemic control, long-term complications can arise and begin to affect the microvasculature. Microvasculature includes tiny capillaries consisting of venules and arterioles that perfuse the body's tissues (Merriam-Webster, n.d.). Areas that include microvasculature include the kidneys, retina and vascular endothelium.

When prolonged hyperglycemia starts to affect the microvasculature, it translates to diabetic nephropathy, neuropathy and retinopathy. Each of these microvascular complications have different impacts within the body. Diabetic nephropathy can lead to kidney failure, neuropathy can lead to nerve peripheral nerve damage and retinopathy can lead to blindness.

When the microvasculature is compromised from a chronic illness like diabetes, the complications can have crippling effects that can decrease quality of life. The irreversible damage done to the microvasculature is why prevention through proper glycemic control is so crucial. Proper glycemic control requires knowledge, training, and practice from trained healthcare professionals which is accomplished through diabetic self-management education. Although the education-health relationship is well documented, pathways through which education influences health are not well understood which could contribute to the high prevalence of poor management microvascular complications from diabetes (Ayyagari, et al., 2011).

Diabetic Self-Management Education

Patient education and awareness are most important in order to manage diabetes. This education can be completed through diabetic self-management education (DSME). Much research has been conducted to develop national standards for DSME. These standards are the cornerstone of DSME. They are designed to define what quality DSME should be and to also assist those who provide DSME with evidence-based standards to reference and utilize (Haas et al., 2012). The definition of DSME is an ongoing process of facilitating the knowledge, skill, and ability necessary for diabetic self-care by incorporating the needs, goals, and life experiences for those with diabetes through evidence-based standards (Haas et al., 2012). The standards are recognized by the American Diabetes Association (ADA) and are accredited by the American

Association of Diabetic Educators (AADE). The accreditation and recognition processes are important as they ensure that services are offering quality education and also makes the services eligible for reimbursement from Medicare, many private health plans, and some state Medicaid agencies (CDC, 2018).

The standards highlight commonalities based on evidence based DSME strategies as opposed to endorsing any one specific approach (Haas et al., 2017). The ten broad areas addressed within the standards include the internal structure, stakeholder input, evaluation of the population served, quality coordinator overseeing the services, the DSME team, curriculum, individualization, ongoing support, participant progress and quality improvement. If implemented correctly, DSME should support patient autonomy through informed decision making, self-care behaviors, problem solving, and active collaboration with the health care team. DSME has shown to help with diabetic management and can lead to better health outcomes and quality of life for patients with diabetes.

The Problem

Diabetes is a well-researched topic due to its high prevalence and global impact. Multiple studies have been published that describe diabetic management, diabetic education, microvascular complications, and glycemic control. Research has revealed that proper DSME, through utilization of the national standards, can help patients have better glycemic control (Norris et al., 2002, Funnel et al., 2010, Gagliardino et al., 2019, Powers et al., 2016). Despite the extensive amount of research and support of DSME, the impact and prevalence of microvascular complications from diabetes is astounding. It is estimated that about 48% of all adults with type 2 diabetes have never attended a DSME course (Strine et al., 2005). Even those who have received education, the nonadherence to therapy is estimated at more than 40%

(Debussche, 2014). This non-compliance to therapeutic self-management is perceived as a major barrier for improving prognosis and complications despite therapeutic advances (Debussche, 2014).

Self-management non-compliance appears to be multifactorial issue as there are numerous barriers potentially leading to self-management non-adherence. These barriers include lack of access to care, low health literacy levels, insurance and financial barriers such as cost of care and medications, and psychosocial barriers (Dyck et al., 2018; Grant & Steadman, 2016; and Glasgow et al., 2001). This raises the question: Does DSME actually reduce the risk or delay the progression of microvascular complications by helping patients have better glycemic control? There appears to be a gap in literature that must be explored as the devastating impact of microvascular complications can be crippling. The purpose of this integrative review is to explore the role of DSME in reducing or delaying microvascular complications in adults with type II diabetes.

Methods

This integrative review is based on the updated methodological approach written by Whittmore and Knaffl (2005). They suggest that all methodologies be included in order to conduct a quality, unbiased review of research studies. The integrative approach framework has five stages including problem identification, literature search, data evaluation, data analysis and presentation. A rigorous online search was conducted using the five stages as listed by Whittmore and Knaffl (2005) to gather information on the topic of diabetic self-management education in reduction or delay of microvascular complications. This approach allows for inclusion of multiple different studies with a variety of research designs. This integrative review includes both qualitative and quantitative research studies and grey literature. Grey

literature is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers. Grey literature can include items such as academic papers, including theses and dissertations, research and committee reports, government reports, conference papers, and ongoing research, among others (Paez, 2017).

The data collected from the searches were limited by a period of 15 years, reviewing articles published between 2005-2020. Data reviewing took place from January 2020 to May 2020 to ensure any new publications could be included. The databases utilized for this search included PubMed, Google Scholar, and ScienceDirect. Search terms included: reducing microvascular complications, Hemoglobin A1c (HbA1c), delaying microvascular complications, reducing microvascular complications, diabetic self-management education, and DSME. Articles were selected if the focus of the research included adults (age 18 or older), type II diabetes, self-management education, HbA1c, and microvascular complications. Because there is substantial research and pathophysiological evidence demonstrating the direct relationship between hyperglycemia, HbA1c and microvascular complications, studies were included if they analyzed DSME and its impact on HbA1c and glycemic control. Articles from outside the United States were accepted to create a more comprehensive compilation of data. Only articles written in English were included. Research that explored type I diabetes or a combination of type I and type II, or contained pediatric subjects were excluded. Bibliography management, citations and analysis were managed using a web-based bibliography manager.

Data Analysis

The initial search yielded a total of 838 articles. Out of the 838 articles, 602 came from Google Scholar while the other 236 came from PubMed and ScienceDirect. After refining and

removing duplicates, 698 articles were remaining. Abstracts were carefully analyzed for relevance and 28 articles remained. Upon further analysis, only 7 articles met all inclusion criteria. The full text of these 7 articles were analyzed further for relevance. The 7 articles that met all inclusion criteria consist of the following: one cross-sectional study, four randomized controlled trials (RCT), one systematic review and meta-analysis and one grey literature. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flowchart is used to provide visual representation of the selection process and can be found in the Appendix.

Literature Analysis and Quality Appraisal

All selected research was evaluated using the Johns Hopkins Nursing Evidence-Based Practice Evidence Appraisal (JHNEBP) tool and were examined by the primary researcher (Dang & Dearholt, 2017). The cross-sectional study was a level II with good quality. All 4 RCT were level I and were a combination of good and high quality. The systematic review is a level II and is high quality. The grey literature was level III and good quality. Major themes were identified through exploration of the results and supported findings from each article. The evidence summary in table 1 includes each artifact's author(s), literature type and journal, location, participants, aim of the study and major findings.

Table 1*Summary of Reviewed Articles.*

Study	Aim, Sample, Setting	Major Findings	Limitations	Johns Hopkins Rating
<p>Mehravar, F., Mansournia, M. A., Holakouie-Naieni, K., Nasli-Esfahani, E., Mansournia, N., & Almasi-Hashiani, A. (2016). Associations between diabetes self-management and microvascular complications in patients with type 2 diabetes. <i>Epidemiology and Health</i>, 38</p>	<p>Cross-sectional study from the journal of epidemiology and health. This study included 562 Iranian patients older than 30 years of age with type 2 diabetes. The purpose of this study was to examine associations between diabetes self-management and microvascular complications in patients with type 2 diabetes.</p>	<p>In this study, lower glucose management scores were associated with a higher prevalence of nephropathy and neuropathy. This study found no associations between diabetes self-management and retinopathy. The results may be explained by the fact that unlike diabetic neuropathy, diabetic nephropathy and retinopathy are associated with certain unchangeable factors, such as genetic susceptibility.</p>	<p>This study had several limitations. The primary source of biases and limitations in cross-sectional studies is the temporal relationship between the exposure and outcome variables. Therefore, it is impossible for us to determine if a lower diabetes self-management score was present before the onset of the complications of diabetes or vice versa.</p>	<p>Evidence level: II Quality: Good</p>
<p>Yuan, C., Lai, C. W., Chan, L. W., Chow, M., Law, H. K., & Ying, M. (2014). The effect of diabetes self-management education on body weight, glycemic control, and</p>	<p>RCT from the journal of diabetes research. A total of 88 adult (>18 years) patients with type 2 diabetes in</p>	<p>The primary outcome of this study is improved glycemic (in terms of reduced HbA1c) and</p>	<p>This study had several limitations. The time interval of the baseline and follow-up assessments was relatively short. Therefore, possible</p>	<p>Evidence level: I Quality: Good</p>

<p>other metabolic markers in patients with type 2 diabetes mellitus. <i>Journal of Diabetes Research, 2014</i></p>	<p>China. The purpose of this study was to investigate the effect of DSME on metabolic markers and atherosclerotic parameters in patients with type 2 diabetes.</p>	<p>body weight control of patients after receiving the DSME. It is mentioned that any reduction in the HbA1c level decreases the risk of diabetes-related complications.</p>	<p>changes of CIMT, CAS, and some metabolic markers that are related to the DSME are not demonstrated. In addition, the long-term effect of the low intensity self-management education on diabetic patients was not fully evaluated in the present study. Moreover, the sample size of the present study was small with only 36 patients in the intervention group and 40 patients in the control group. Further investigations of the long-term effect of the DSME and with a larger sample size are suggested.</p>	
<p>Gathu, C. W., Shabani, J., Kuniya, N., & Ratansi, R. (2018). Effect of diabetes self-management education on glycaemic control among type 2 diabetic patients at a family medicine clinic in Kenya: A randomised controlled trial. <i>African Journal of Primary Health Care & Family Medicine, 10</i>(1), 1-9.</p>	<p>RCT from the african journal of primary healthcare and family medicine. This study included 96 patients who had sub-optimally controlled type 2 diabetes, defined as HbA1c \geq 8% and were aged 18–65 years in Kenya. The objective of this study was to evaluate</p>	<p>In this study, six months of individualized DSME did not significantly improve the glycemic and metabolic control of the sub-optimally controlled type 2 diabetes patients.</p>	<p>This study had some important limitations that may have contributed to the negative outcome. First, the study was entirely carried out in one setting, with a significant risk of ‘cross-contamination’ between control and intervention groups. Second, the follow-up period was only 6 months which is shorter than most of the</p>	<p>Evidence level: I Quality: High</p>

	<p>whether a structured DSME in addition to usual care improved glycemic control as compared to usual care only among sub-optimally controlled type 2 diabetes patients.</p>		<p>similar studies which typically have a 1–3-year follow-up. Third, most of our study participants had very long-standing diabetes that may contribute to biomedical outcomes, diabetes education notwithstanding.</p>	
<p>Strine, T. W., Okoro, C. A., Chapman, D. P., Beckles, G. L., Balluz, L., & Mokdad, A. H. (2005). The impact of formal diabetes education on the preventive health practices and behaviors of persons with type 2 diabetes. <i>Preventive Medicine, 41</i>(1), 79-84.</p>	<p>RCT from the journal of preventative medicine. This study included 22,682 persons >18 years with type 2 diabetes. This study examined the associations between DSME, preventive health practices and behaviors among persons with type 2 diabetes through use of the Behavioral Risk Factor Surveillance System (BRFSS).</p>	<p>This study found that persons who received DSME were significantly more likely than those who had not received training to participate in prevention and management strategies. This study states that this shows the importance of DSME in the promotion of health practices that could prevent or delay potential diabetes complications among persons with type 2 diabetes</p>	<p>Because the BRFSS is a telephone survey, it excludes some people known to have a higher prevalence of diabetes, among these are residents of institutionalized settings, such as nursing homes and persons of lower socioeconomic status without a telephone. Furthermore, people with severely impaired physical or mental health might not have been able to complete the survey. It must also be considered that these data were self-reported and not validated by physical examination. Additionally, we did not have information on the time interval that had elapsed since</p>	<p>Evidence level: I Quality: Good</p>

			the last DSME, the number of times that the respondents attended training, or the training setting. Finally, our data are cross-sectional, and thus we were unable to infer causality between DSME and preventive health practices and behaviors.	
Pratuangtham, S. R., & Jerawatana, R. (2019). Effectiveness of Diabetes Self-Management Education in Thais with Type 2 Diabetes. <i>Pacific Rim International Journal of Nursing Research</i> , 23(1), 74-86.	RCT from the pacific rim international journal of nursing research. This study included 488 people with type 2 diabetes. The aim of this study was to evaluate the effectiveness of a structured DSME program on cost-benefit, medication utilization, glycemic control, diabetes knowledge, behavioral changes and satisfaction.	This study revealed that for the intervention group, diabetes knowledge increased significantly after the education session. Both groups had improvements in their glycemic control as reflected by a reduction in HbA1c levels. This study recognizes that This effect size could translate into a significant reduction in microvascular complications if maintained in the long term.	Several limitations were present in this study. This was not a RCT as they did not feel that not delivering DSME in research participants were appropriate. Despite the attempt to match the participants, the intervention groups appeared to have more severe disease, as they had more medication utilization at baseline despite having similar HbA1c levels to the non-intervention group. Nevertheless, the study revealed that they had a smaller increase in their medication utilization over the two-year period, compared to the non-intervention group. Data on diabetes medication utilization was not available in	Evidence level: I Quality: High

			<p>all participants, which could be due to the fact that they were diet controlled or received their medications outside our hospital. However, the numbers of participants without medication utilization information were similar between the two groups.</p>	
<p>Cunningham, A. T., Crittendon, D. R., White, N., Mills, G. D., Diaz, V., & LaNoue, M. D. (2018). The effect of diabetes self-management education on HbA1c and quality of life in African-Americans: a systematic review and meta-analysis. <i>BMC Health Services Research</i>, 18(1), 367.</p>	<p>A systematic review and meta-analysis from the BMC health services research. This study included randomized controlled trials, cluster-randomized trials, and quasi-experimental interventions. Fourteen studies were eligible for systematic review and 8 for HbA1c meta-analysis. This systematic review and meta-analysis examined the impact of DSME on HbA1c and QOL in African-Americans compared to usual care.</p>	<p>This meta-analysis found no significant impact of DSME on HbA1c in ehalAfrican American DSME participants.</p>	<p>Limitations included the high risk of bias in random sequence generation for the two quasi-experimental studies included in the systematic review, and the unclear risks of bias across several studies, particularly for allocation concealment. Additionally, the HbA1c results had significant heterogeneity, as reflected by the large CIs and I^2 value. Although subgroup analyses were performed, the small number of studies ($n = 8$) eligible for inclusion in the HbA1c meta-analysis limits the ability to draw conclusions about the optimal DSME intensity and</p>	<p>Evidence level: II Quality: High</p>

			<p>delivery methods for African Americans. The smaller number of articles measuring QOL ($n = 5$) and the inability to pool studies also warrants caution for drawing conclusions for the relationship between DSME and QOL in African Americans. Finally, the limited number of studies included in the meta-analysis precluded assessment of publication bias. However, publication bias typically results in studies with significant findings being more likely to be published. Since the HbA1c meta-analysis was non-significant, this may lessen the possibility of publication bias in the included studies.</p>	
<p>Kent, D., D'Eramo Melkus, G., Stuart, P. “ W., McKoy, J. M., Urbanski, P., Boren, S. A., Coke, L., Winters, J. E., Horsley, N. L., & Sherr, D. (2013). Reducing the risks of diabetes complications through diabetes self-management education and support. <i>Population Health</i></p>	<p>Grey literature from the population and health management journal. Participants involved were the Reducing Risks Interdisciplinary Symposium Panel. In 2011, the AADE</p>		<p>N/A</p>	<p>Evidence Level: III Quality: Good</p>

<p><i>Management, 16(2), 74-81.</i></p>	<p>convened an invitational Reducing Risks Symposium, during which an interdisciplinary panel of 11 thought leaders examined current knowledge about the reduction and prevention of diabetes-related risks and translated evidence into diabetes care and self-management education. This report summarizes the discussion and presents recommendations to incorporate into practice to improve outcomes.</p>			
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Results

All of the included studies have similar aims and populations. Each study recognized the life-altering microvascular complications that can arise from prolonged hyperglycemia that is seen in patients with type II diabetes. Each study explored the impact that DSME can have on glycemic control whether it’s through reduction in microvascular complications or reduction in HbA1c. Although the aims of the studies were similar, the results from each study vary and are divided. Two studies found that DSME did not have an impact on glucose control or microvascular complications (Gathu et al., 2018; Cunningham et al., 2018), four

found that it did (Yuan et al., 2014; Strine et al., 2005; Pratuangtham & Jerawatana, 2019; Kent et al., 2013) and one had mixed results (Mehravar, 2016). Mehravar et al. (2016) found a correlation between DSME and nephropathy but found no associations between diabetes self-management and retinopathy. Through exploration of the findings from the 7 different articles, 3 major themes were identified. Thematic analysis was conducted through reading and rereading the data from each article and identifying common findings. Two articles discussed the role of literacy level as a factor within the studies (Strine et al., 2004; Kent et al., 2013). Another commonly mentioned concept was the variability of individual disease processes, learning needs and performed education (Cunningham et al., 2018; Gathu et al., 2018; Kent et al., 2013; Mehravar et al., 2016; Strine et al., 2004; Pratuangtham & Jerawatana, 2019; Yuan et al., 2014). Multiple studies mentioned the influence of both cultural and racial factors and how that impacts health and learning. Given the commonalities among the findings, the 3 major themes were named health literacy level, variability of participants and educational interventions and cultural and racial considerations. Subthemes were identified and can be found in table 2. All studies represented the theme of variability of participants and educational interventions while some studies represented multiple themes.

Table 2

Themes and Subthemes Identified from the Findings of the Studies.

Theme	Subthemes	Studies
1. Health literacy level		Strine et al. (2004), Kent et al. (2013)
2. Variability of participants and educational interventions	2a) Varying health states of participant's 2b) Mode and content of education	Cunningham et al. (2018), Gathu et al. (2018), Kent et al. (2013), Mehravar et al. (2016), Strine et al. (2004), Pratuangtham & Jerawatana, (2019), Yuan et al. (2014)
3. Cultural and racial considerations		Cunningham et al. (2018), Gathu et al. (2018), Kent et al. (2013), Strine et al. (2004)

Theme 1: Health Literacy Level

The theme of health literacy was derived from two of the studies (Strine et al., 2004, and Kent et al., 2013). Health literacy level is the degree to which individuals have the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions (Office of Disease Prevention and Health Promotion, n.d.). Adequate health literacy closely relates to overall literacy in that adequate health literacy requires patients to have the ability to read and comprehend essential health-related materials (Office of Disease Prevention and Health Promotion, n.d.). Diabetes is a complex process and the management requires development of knowledge and skill; Therefore, health literacy is an important factor in management. Literacy level was associated with reducing the risks and complications of diabetes (Kent et al. 2013). Low health literacy was identified as a barrier and risk factor in receiving and understanding DSME (Kent et al. 2013). Strine et al. (2004) also discussed the correlation between low literacy levels and DSME. Those with less than a high school education were less likely to seek out and receive proper DSME while individuals with a higher education level are more likely to receive and understand DSME. Those who received proper DSME were more

likely to receive appropriate screening and check-ups for microvascular complications from their health care providers which can help identify, prevent and treat microvascular complications sooner. According to Strine et al. (2004), individual health accountability is related to the person's ability to understand the DSME and their total health care needs. This was identified as an important factor in adhering to DSME therefore delaying and preventing microvascular complications.

Theme 2: Variability in participants and educational interventions

All research articles discussed the role of variability between participants and educational interventions and how those impact DSME and development of microvascular complications. This theme is further split into 2 subthemes including varying health states of participants' and 'mode and content of education.

Varying Health States of Participants. Development of microvascular complications is a complex process and there are many individualized factors including genetics, comorbidities, duration of diagnosis, and baseline HbA1c. Multiple studies recognize the role of varying states of health of participants as a major factor in the results (Gathu et al., 2018; Kent et al. 2013; Strine et al., 2004; Yuan et al., 2014). The management for patients with type II diabetes is individualized and varies depending on their health status. Patients may need to better manage their weight through diet and exercise, medication regimens differ-some patients take oral medications, some patients take insulin, and some patients take a combination of oral medications and insulin. This can impact the complexity of the DSME and appeared to be a factor in compliance and adherence (Strine et al., 2004). Variations in the baseline HbA1c of participants impacted results as well. It was found that patients with a HbA1c >8% had a more significant improvement than those with an HbA1c <8% (Gathu et al., 2018). Along with

variations in HbA1c, type II diabetes is often accompanied by other metabolic markers including weight, cholesterol levels and BMI. These factors differ for all patients as well and are important aspects when considering DSME and development of microvascular complications (Yuan et al., 2014). Lastly, genetic susceptibility was a factor that could not be manipulated or changed and could have an impact on the development of some microvascular complications therefore impacting the results of DSME effectiveness (Mehravar et al., 2016).

Mode and Content of Education. Mode, content and delivery of DSME was identified as a major contributor to results. Diabetic self-management education can differ in content, method of instruction, personnel, setting and intervention duration which all play a role in its success (Gathu et al., 2018; Cunningham et al., 2018; Kent et al., 2013; Strine et al., 2004). Although there are published guidelines for DSME, patients still have individualized treatment plans which would require different content to be taught depending on the patient. Some studies took this into consideration (Cunningham et al. 2018) while other studies provided DSME in group classes (Yuan et al. 2014). When providing education, there are multiple delivery methods available. In-person classes, pamphlets and reading materials, videos, demonstrations etc. People learn and receive information in various ways, impacting the effectiveness of education. There are multiple healthcare disciplines that are qualified to provide aspects of DSME including registered nurses, diabetic educators, registered dietitians, behaviorists, exercise physiologists, optometrists, pharmacists, and physicians (Strine et al., 2004). Each one of these disciplines has a unique role in DSME and has the ability to impact the effectiveness of DSME. Variations existed across different studies regarding duration of the intervention. The duration of the DSME and the setting provided was recognized as a factor in compliance in different studies as it is important because it directly impacts how well patients received the information (Gathu et al.,

2018; Cunningham et al., 2018; Kent et al., 2013; Yuan et al., 2014). Readiness to learn is an important consideration for effective education and can be impacted heavily by setting and duration of intervention. Some patients may require longer intervention duration in order for DSME to be effective while others may not require as much time. These variable factors are identified across different studies as contributors to DSME effectiveness.

Theme 3: Cultural and Racial Considerations

Cultural and racial considerations are important in both disease management and education (Cunningham et al., 2018; Gathu et al., 2018; Kent et al., 2013; Strine et al., 2004). Diabetic self-management education should be patient-centered and population-specific highlighting the importance of cultural and racial considerations when approaching DSME methods. It is recognized that a culture-specific needs assessment is important prior to implementation of DSME to avoid ineffectiveness of DSME (Gathu et al., 2018). There are cultural variations in food practices and customs which must be taken into consideration when approaching DSME (Cunningham et al., 2018). Performing a cultural needs assessment is important because, patients are likely to be less interested and fail to show up in for education if they feel that their needs are not accounted for during the education sessions, or if the content is not useful to them (Gathu et al., 2018). Health disparities among different ethnicities and races must also be taken into consideration due to the higher prevalence of type 2 diabetes and poorer HbA1c control in different ethnic groups (Cunningham et al., 2018; Kent et al., 2013). Both African Americans and Hispanics are at a higher risk for development of microvascular complications due to the lower likelihood of receiving proper DSME and participating in preventative measures and disease management (Cunningham et al., 2018; Strine et al., 2004). There are disparities in socioeconomic status such as education and access to healthcare factors

of both African Americans and Hispanics which appears to impact treatment compliance (Cunningham et al., 2018; Strine et al., 2004).

Discussion

Strengths and Limitations

This review has both strengths and limitations. A strength of this review includes its systematic approach utilizing the five stages developed by Whittmore and Knaffl (2005): problem identification, literature search, data evaluation, data synthesis and presentation of results. Multiple databases were searched allowing for a comprehensive compilation of data. Data analysis and extraction was performed using the credible JHEBP tool. The rigorous research process employed in this integrative review, helped capture comprehensive information on the subject of the role of DSME in reducing and delaying microvascular complications.

Several limitations exist. These limitations include search words, language limitations, and potential bias. The key terms may have lacked specificity in that the term ‘microvascular complications’ can be named as neuropathy, retinopathy and nephropathy, which were not searched. Because of this, the search may have missed some relevant articles. Language limitations could have impacted the results seeing that the included studies were limited to the English language. This review includes the research of only one author, increasing the risk for bias.

Implications of Findings

Managing a chronic disease like diabetes is a challenge that requires skills and knowledge in order to prevent life-altering complications. Diabetic retinopathy is responsible for more than 10,000 new cases of blindness each year, nephropathy is the leading cause of kidney failure in the United States and neuropathy can increase morbidity and mortality in

patients with diabetes due to the neurologic dysfunction that can occur (Fowler, 2008).

Unfortunately, the current statistics of microvascular complications secondary to diabetes are astounding highlighting the need for an effective intervention. It is known that microvascular complications develop over an extended period of time, but it is unclear how long uncontrolled diabetes must go on before development of microvascular complications sets in which only adds to the complexity of the issue (Fowler, 2008). The research through this integrative review revealed mixed results on the role of DSME in reducing and delaying microvascular complications. As explored, DSME is a complex process and there are many factors that must be considered when educating patients on self-management: patient individuality, DSME content and guidelines, education personnel, culture and ethnicity, and literacy level. Although results varied, many studies did discuss the positive effects of DSME and how DSME still has the potential to aid in this issue and help those with type II diabetes better manage their disease. Even though the results of this review did not reveal if and how DSME can reduce or delay microvascular complications, DSME is still supported by the ADA and AAED as an important intervention to diabetes self-management. Because DSME can create positive outcomes for adults with type II diabetes, research is needed for the most effective methods. Research is needed to advance DSME and help it become more effective in helping those better manage diabetes to in turn lower the risk for developing the life-altering microvascular complications associated with the disease. More research regarding how to strengthen DSME is needed.

Conclusion

Due to the crippling impact of poorly managed diabetes, identifying appropriate and effective interventions is extremely important. More research is needed to determine the role

of DSME in delaying and reducing microvascular complications in patients with type II diabetes. The results identified through the research conducted were varied and inconsistent making it difficult to determine the effectiveness of DSME in reducing microvascular complications. Non-adherence to treatment plans and lack of knowledge regarding self-management appears to be the main cause of development of microvascular complications and should be the target of future research. There are many potential barriers to patient adherence ranging from psychosocial to socioeconomic. Established guidelines for proper DSME exist but implementation and distribution of these guidelines must be explored further to improve patient outcomes.

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Appendix

PRISMA Flowchart

