A Preliminary Review of Self-management Strategies Used with Persons with

Diabetes

By

Celine Hildack

Submitted in Partial Fulfillment of the Requirements

For the Degree of

Master of Science

in the

Applied Behavior Analysis

Program

YOUNGSTOWN STATE UNIVERSITY

May 2023

The Effectiveness of ABA Therapy Implementation Regarding Type I Diabetes

Celine Hildack

I hereby release this thesis to the public. I understand that this thesis will be made available from the Ohio LINK ETD Center and the Maag Library Circulation Desk for public access. I also authorize the University or other individuals to make copies of this thesis as needed for scholarly research.

Signature:

_____

Celine Hildack, BA, Student   Date

Approvals:

_____

Kristopher Brown, PsyD, BCBA-D Thesis Advisor   Date

_____

Joseph Corpa, MS, BCBA Committee Member   Date

_____

Gina Vance, EdD, Committee Member   Date

_____

Salvatore A. Sanders, PhD, Dean, College of Graduate Studies   Date

ABSTRACT

Diabetes is a chronic condition that results in too much sugar in a person's blood. As of June 2022, 37.3 million people (11.3% of the US population) are reported to have diabetes. With 1.4 million people being diagnosed each year and with no cure, diabetes, and its management is a significant health risk for a growing number of individuals. Several different methods exist for managing symptoms and risks associated with diabetes. For instance, medications, diet changes, and exercise have all been shown to be beneficial for lowering blood sugar in affected individuals. One common theme among these strategies is the need for self-management on the part of the individual with diabetes. Once diagnosed, diabetics are responsible for behaviors necessary to survive (e.g., glucose control, insulin adjustments, and administration, carbohydrate counting). Self-management (sometimes called self-monitoring) is also a common behavioral analytic intervention that has been shown to be an effective means for tracking and modifying the behavior of individuals for several decades. The purpose of the current study was to review existing research on self-management strategies to determine their evidence-base with respect to managing diabetes and identify suggestions and best practices for those managing diabetes. Results indicated that self-management is an effective strategy when managing diabetes.

Keywords: *applied behavior analysis, self-management, diabetes*

Table of Contents

Applying Self-Management Theories to Interventions for Persons with Diabetes

Diabetes mellitus (diabetes) is a chronic health condition that affects how the body turns food into energy (Centers for Disease Control and Prevention [CDC], 2022). As of June 2022, 37.3 million people have diabetes (11.3% of the US population). With 1.4 million people being diagnosed each year and with no cure, diabetes is a significant part of daily life for a growing number of individuals. Diabetes is the number one cause of kidney failure, lower-limb amputations, and adult blindness, while also being the seventh leading cause of death in the United States (American Diabetes Association [ADA], 2023; CDC, 2022). Diabetes occurs when your blood glucose, also called blood sugar, is too high in an individual's bloodstream. Blood glucose is the body's main source of energy and comes from food eaten. Insulin, a hormone made by the pancreas, helps glucose from food get into your cells to be used for energy (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2016). For some individuals, their body doesn't make enough, or any, insulin or doesn't use insulin as well as it should. When this occurs glucose then stays in your bloodstream and doesn't reach your cells (NIDDK, 2016). Over time, this can cause serious health problems, such as heart disease, vision loss, and kidney disease. There are three main types of diabetes which include Type 1 diabetes, Type 2 diabetes, and Gestational diabetes.

Type 1 Diabetes

Type 1 diabetes is thought to be caused by an autoimmune reaction that involves the body attacking and destroying the cells in the pancreas that make insulin (ADA, 2023; CDC, 2022). In return, the pancreas stops producing insulin entirely. People with type 1 diabetes need to take insulin every day to stay alive (NIDDK, 2016). Although type 1 diabetes can appear in any age, type 1 diabetes is typically diagnosed among children and young adults. There is

currently no known way of how to prevent type 1 diabetes and the development of the condition

has been heavily linked to genetics (NIDDK, 2016). Having a parent or sibling with the disease

may increase your chance of developing type 1 diabetes (NIDDK, 2016). In the United States,

about 5 percent of people with diabetes have type 1 diabetes (NIDDK, 2016). Symptoms to be

aware of with type 1 diabetes includes increased thirst and urination, increased hunger, blurred

vision, fatigue, and explained weight loss (NIDDK, 2016). Symptoms of type 1 diabetes can

sometimes take months, even years before being noticed. Untreated diabetes can lead to very

serious health problems including death. A life-threatening condition called diabetic ketoacidosis

(DKA) is often one of the first symptoms of type 1 diabetes (CDC, 2022; NIDDK, 2016). DKA

develops when the body does not have enough insulin to let blood sugar into the cells, which

leads to very high levels of blood sugar (CDC, 2022). Symptoms of DKA include breath that

smells fruity, dry, or flushed skin, nausea or vomiting, stomach pain, trouble breathing, and

trouble paying attention or feeling confused (NIDDK,2016). If any of these symptoms are being

experienced, individuals are encouraged to receive medical attention immediately.

As previously mentioned, individuals diagnosed with type 1 diabetes no longer can

produce insulin on their own. This requires individuals with type 1 diabetes to take insulin.

Insulin can be injected into the body via a syringe, insulin pen, or by insulin pump (CDC, 2022;

NIDDK, 2016). There are several different types of insulin that serve different purposes. Some

insulin types are intended to be used overnight (long-lasting insulin), while others are intended to

be used before or after consuming a meal (fast-acting insulin). Some individuals may use one

type of insulin, or a combination of both (NIDDK, 2016). In addition to insulin, type 1 diabetics

will need to conduct regular blood sugar checks (CDC, 2022). This can be done by a glucose

monitor or continuous glucose monitor. Keeping glucose as close to target levels helps eliminate

the worry of diabetes-related health issues. When diagnosed with diabetes, lifestyle changes are necessary. Type 1 diabetics are highly encouraged to not only take medicine as prescribed and regularly perform blood sugar checks, but to also stay physically active and maintain a healthy diet, all of which are lifestyle changes that are usually conducted by the individual themselves.

Type 2 Diabetes

With type 2 diabetes, the body does not respond correctly or normally to insulin (CDC, 2022) and blood sugar enters the cells. Consequently, the body produces a lesser amount of insulin to keep blood sugar at a normal level. This creates high levels of glucose in the body that the pancreas cannot keep up with. Thus, blood sugar rises to dangerous levels. Type 2 diabetes can affect anyone at any age, but people are considered more likely to get it at the age of 45 or older, if there is a family history of diabetes, or if the individual is obese (NIDDK, 2016). Out of the 37 million people affected by diabetes, approximately 90% of those people are living with type 2 diabetes (CDC, 2022). Type 2 diabetes is caused by several factors including overweight and obesity, not being physically active, insulin resistance, and genes (NIDKK, 2016). Additional symptoms of diabetes include feeling tired, blurred vision, numbness or tingling in the feet or hands, and sores that do not heal (CDC, 2022; NIDDK, 2016). The National Institute of Diabetes and Digestive and Kidney Diseases recognized that symptoms of type 2 diabetes develop at a typically slow rate (2016). The rate is often so slow and mild that people may often not even notice the changes. It is also common for people with type 2 diabetes to receive a diagnosis after they already have been diagnosed with a diabetes-related health problem (NIDDK, 2016).

In terms of management, type 2 diabetes varies from type 1 diabetes. Type 2 diabetics struggle with insulin outputs for the body are irregular by still producing insulin, but not

producing enough. Therefore, type 2 diabetics could be treated with medicines which could include pills or insulin injections (NIDDK, 2016). Pills are not an option for type 1 diabetics because the stomach acid in the body would destroy them before they could reach the bloodstream (CDC, 2022). Type 2 diabetics are also encouraged to manage their glucose, blood pressure, and cholesterol levels (NIDDK, 2016). The day-to-day management for type 1 and type 2 diabetics is relatively the same: following healthcare provider instructions and making the necessary lifestyle changes to ensure a healthy life.

Gestational Diabetes

According to the American Diabetes Association, nearly 10% of pregnancies are affected by gestational diabetes per year (2022). Gestational diabetes is a type of diabetes that only occurs during pregnancy. Being diagnosed with gestational diabetes does not mean an individual had diabetes before their pregnancy, or that they will have it after their pregnancy, but it could have long-term health effects for mom and baby if not managed (NIDDK, 2016). When a woman is diagnosed with gestational diabetes, it is usually because they cannot overcome *insulin resistance* (NIDDK, 2016) after becoming pregnant. The NIDDK defines insulin resistance as "when cells in the muscles, fat, and liver don't respond well to insulin and can't easily take glucose from the blood" (2016). Generally, there are no symptoms for gestational diabetes, if there are symptoms, they may include being thirstier or urinating more frequently (NIDDK, 20216). Being diagnosed with gestational diabetes leads to a greater risk of developing type 2 diabetes after pregnancy as well as the baby developing type 2 diabetes. Obesity is another risk factor after gestational diabetes as well. As with type 1 and 2 diabetes, management with gestational diabetes includes managing blood glucose levels and following a healthy eating regimen. Sometimes medicine may be needed, but not always (NIDDK, 2016).

Applied Behavior Analysis

Applied behavior analysis (ABA) is the application of operant behavior to deal with problems of social significance. The field was first defined by Bear, Wolf, and Risley in the article *Some Current Dimensions of Applied Behavior Analysis* (1968). In the article, the authors discuss what ABA is and define it as "the process of systematically applying interventions based upon the principles of learning theory to improve socially significant behaviors to a meaningful degree, and to demonstrate that the interventions employed are responsible for the improvement of behavior" (Bear et al., 1968). They continue to explain that there are 7 dimensions of ABA. Therefore, for an evaluation to be considered ABA, the study must be applied, behavioral, analytic, technological, conceptually systematic, effective, and must display generality (Bear et al., 1968). These 7 dimensions of ABA are still used today but have since been refined. Applied originally centered around vague concepts of social problems, social interest, and the immediate importance of the behavior (Bear et al., 1987). Currently applied in an ABA study signals the commitment to effecting improvements in behaviors that enhance and improve the lives of individuals (Bear et al., 1987; Cooper et al., 2019). In short, applied is intended to focus on behaviors of social importance and significance. When examining the behavior dimension Bear and colleagues addressed three points to consider; 1.) the behavior chosen for study must be the behavior in need of improvement, 2.) the behavior must be measurable, and 3.) when changes in behavior are observed during an investigation, it is necessary to ask whose behavior has changed (Bear et al., 1987; Cooper et al., 2019). When considering the behavioral criterion in an ABA study, it is important that the behavior is objective and measurable. An ABA study is analytic when the experimenter has demonstrated a functional relation between the manipulated events and a reliable change in some measurable dimension of the targeted behavior; the experimenter

must be able to control the occurrence and nonoccurrence of the behavior (Bear et al., 1987; Cooper et al., 2019. Therefore, the experimenter must be able to control the occurrence and non-occurrence of the behavior and demonstrate a functional relationship.

The next dimension defined of ABA defined by Baer and colleagues was technological. For an ABA study to be considered technological the study must identify all its operative procedures and describe them with sufficient detail and clarity (Bear et al., 1987; Cooper et al., 2019). An ABA study must be clear and precise to ensure replication, it can be compared to making a recipe. Research of ABA must also be conceptually systematic, this means that the procedures for changing the behavior and any interpretations of how or why those procedures were effective should be described in terms of the relevant principles from which they are derived; all studies must tie back to a basic principle of behavior (Bear et al., 1987; Cooper et al., 2019). Effective ABA studies must produce behavior changes that reach clinical or social significance (Bear et al., 1987; Cooper et al., 2019). Lastly, for an ABA study to display generality, it must "last over time, appears in environments other than the one in which the intervention that initially produced it and/or spreads to other behaviors not directly treated by the intervention" (Bear et al., 1987; Cooper et al., 2019). The purpose of this criterion is to ensure that behavior has adapted across different contexts and over time. After examining the dimensions of ABA in dept, Cooper and colleagues defined applied behavior analysis as "the science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change" (2019, p.19).

Self-Management

These 7 dimensions provided a guide for researchers using ABA. ABA has been applied in a variety of different contexts such as education, business, and the treatment of behavioral health conditions. In addition to using ABA to change the behavior of others, ABA contained research on the use of some procedures to maintain one's own behavior. This specific area of application, in which individuals can work to monitor and change their own behavior, is referred to as self-management or self-control. When viewing self-management from an ABA perspective, it is important to mention the philosophy of radical behaviorism and how it relates to self-control. Radical behaviorism is the philosophy that informs ABA and is defined as "a form of behaviorism that attempts to understand all human behavior, including private events such as thoughts and feelings, in terms of controlling variables in the history of the person and the species" (Cooper et al., 2019). BF Skinner was the first to apply the idea of radical behaviorism to behavior typically considered to be controlled by the self. Skinner discussed self-control in his book, *Science and Human Behavior* (1953). In the book, Skinner (1953) conceptualized self-control as a two-response phenomenon:

> One response, the controlling response, affects variables in such a way as to change the probability of the other, the controlled response. The controlling response may manipulate any of the variables of which the controlled response is a function; hence there are a good many different forms of self-control. (p. 231; Cooper et al., 2019, p. 682)

In Skinner's chapter covering self-control, he went on to explain several different techniques, which have since been extended by other researchers (Cooper et al., 2019). Cooper and colleagues suggest that all self-management tactics can be operationalized in terms of two behaviors: 1. The target behavior of concern (Skinner's *controlled* response) and 2. The self-

management behavior (Skinner's *controlling* response) is produced to change the target behavior

of concern (2019, p. 682). For the purpose of this paper, the definition proposed by Cooper and

colleagues will be utilized. Cooper and colleagues define self-management as the "personal

application of behavior change tactics that produce a desired improvement in behavior" (2019, p.

683).

     Self-management has numerous applications, advantages, and benefits (Cooper et al.,

2019). Cooper and colleagues suggest the application of self-management to living a more

effective and efficient daily life, breaking bad habits and acquiring good ones, accomplishing

difficult tasks, and achieving personal goals (2019, p. 685, p. 686). Self-management can

promote the generalization and maintenance of behavior change, a small repertoire of self-

management skills can control many behaviors, people with diverse abilities can learn self-

management skills, and self-management feels good (Cooper et al., 2019, p. 687-689). Self-

management has been demonstrated to be an effective treatment strategy for individuals with

ASD and other developmental disorders, in organizational contexts, and with managing chronic

conditions. Previous research has demonstrated self-management to be effective in areas such as

autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), and achieving

any goal an individual may want to set for themselves. Panagioti and colleagues conducted a

systematic review and meta-analysis to determine if self-management could have significant

reductions in health services (2014). Results indicated that self-management had significant

improvement in health outcomes, in patients with respiratory, cardiovascular, and depression

(Panagioti et al., 2014). Self-management interventions have also been examined in general

education classrooms with children with ASD, ADHD, and problem behaviors. Regarding

children with ADHD in the classroom, a multiple baseline across participants design

demonstrated positive results, indicating that self-management was effective (Gureasko-Moore et al., 2006). Busacca and colleagues results indicated that self-management interventions were effective across behaviors, disability categories, and grades (2015).

Self-Management Applied to Diabetes

Science and research have made it possible for individuals with diabetes to live quality lives. In the last 20 years, the number of adults diagnosed with diabetes has more than doubled (CDC, 2022; ADA, 2023). There is no cure for diabetes, but there are several suggestions from health professionals which include, losing and maintaining a healthy weight, eating healthy food, taking medicine as prescribed, making, and keeping health care appointments, and receiving diabetes self-management education and support (CDC, 2022). A well-supported type of program for diabetes management is self-management education (SME) programs. There are several different variations of SME programs but for the current review, two will be reviewed. The two programs are Diabetes Self-Management Education and Support (DSMES) and Diabetes Self-Management Program (DSMP).

Diabetes Self-Management Education and Support (DSMES)

DSMES programs provide information and skills for people to manage their diabetes and related conditions (CDC, 2022; ADA, 2023). DSMES is tailored to your individual needs, goals, and life experiences and is guided by evidence-based standards. DSMES services are individualized, meaning they are tailored to the diabetics' individualized needs, goals, and experiences (CDC, 2022). Because of this, there are many benefits which include education on healthy eating, physical activity, monitoring glucose levels, problem-solving, enhance self-efficacy and empowerment, increase healthy coping, and risk reduction for other health

conditions (CDC, 2022; ADA, 2023). The CDC states, that the price of DSMES is dependent on the individuals' insurance status (2022; ADA, 2023).

Diabetes Self-Management Program (DSMP)

The Centers for Disease Control and Prevention explained DSMPs as a 6-week program specifically for type 2 diabetics (2022). The goal of this program is to help manage diabetes symptoms as well as, tiredness, pain, and emotional issues (CDC, 2022). The program is run by either one or two individuals living with diabetes themselves and includes topic coverage on dealing with diabetes symptoms, fatigue, pain, hyper/hypoglycemia, stress, and emotional problems (CDC, 2022; ADA, 2023). DSMPs price varies by organization but usually does not cost more than $50 (CDC, 2022).

Statement of the Problem

ABA is a well-established and long-standing method for behavior change. ABA is defined by its adherence to data-based decision-making, demonstration of functional relations, and generative behavior change. ABA strategies also include self-management. Diabetes is a complex health condition that requires self-management to be effectively monitored to prevent major health issues. The purpose of the current study was to review existing diabetes and diabetes self-management interventions, identify their similarity with ABA principles, to determine their evidence base with respect to managing diabetes, and identify suggestions and best practices for those managing diabetes and attempting to incorporate ABA methods into self-management.

Method

Search and Inclusion Criteria

The literature review consisted of computer-based searches for relevant literature and was conducted using the EBSCOhost database using the following keywords: diabetes, behavior analysis, and self-management. The keywords "diabetes" and "self-management" were limited to be included in the title while "behavior analysis" was to be included anywhere within the article text. To be included in the current review, articles had to be published within the last ten years, written in English, and appeared in peer-reviewed journals. The articles must include evaluation and/or self-monitoring of diet, exercise, and/or glucose, monitoring. The articles must also discuss self-management, self-monitoring, or some other term indicating the use of self-management strategies with diabetes. Journals included in the current review can be found in Table 1.

Initially, a total of 24 articles were found using the search procedures identified above. Of these, 10 were removed during the screening process because they discussed self-management through electronic applications. This left a total of 14 articles that were included in the current review.

Data Collection

A list of questions was identified by the author to identify information from each article (see Table 2). The author reviewed each article and selected what information was enclosed in the article with respect to the question of interest. For example, to answer the question "What were participants managing in each article?", the author read the article to find out what aspect of care regarding diabetes was being analyzed for self-management. The author would then indicate

the response to the specific question regarding the article. This process was repeated for all articles for each question. For questions that could be answered with a Yes or No response, the author indicated which applied on a data collection sheet. For questions that required a less uniform response (i.e., "participants managed carbohydrate intake"), the author summarized the pertinent information that answered the question. Questions being utilized in the current review can be found in Table 2.

Results

Management Target

The first question in the current review addresses what participants self-managed in each study. Answers included different combinations of the following: diet, exercise (or physical activity), blood-glucose monitoring (or glucose control, glucose monitoring), foot-care, hyperglycemia/hypoglycemia, spiritual practices, coping strategies, self-efficiency, healthy lifestyle, weight control, medication (or medication adherence, medication adjustment), HbA1c, friend/family support, self-efficacy, and smoking. Ten out of fourteen (71%) articles observed self-management of diet. Nine out of fourteen (64%) articles observed self-management of exercise. Eleven out of fourteen (79%) articles observed self-management of blood-glucose monitoring. Four out of fourteen (29%) articles observed self-management of foot care. One (7%) article observed self-management of hyperglycemia/hypoglycemia. One (7%) article observed self-management of spiritual practices. One (7%) article observed self-management of coping strategies. One (7%) article observed self-management of self-efficiency. One (7%) article observed self-management of a healthy lifestyle. One (7%) article observed self-management of weight control. Four out of fourteen (29%) articles observed self-management of medication. Two out of fourteen (14%) articles observed self-management of HbA1c. One (7%)

article observed self-management of friend/family support. One (7%) article observed self-management of self-efficacy. One (7%) article observed self-management of smoking. Refer to Table 3 for further description and location in each article.

Keywords

The second question in the current review addresses what keywords each article used. All articles presented keywords except for two. Terms included different combinations of the following: type 2 diabetes (or diabetes mellitus type 2), self-management, social supports, health outcomes, structured diabetes self-management, education programs, diabetes mellitus (or diabetes), self-management behavior, population-based study, adult nursing, decision-making, diabetes patients' experience, qualitative study (or qualitative), diet and eating, ethnicity, exercise, spirituality, T1DM, PRISMA education, level of compliance, cholesterol, chronic disease, focus groups, hypercholesterolemia, hypertension, nursing (or nurses), precede-proceed-model, distress, mindfulness-based stress reduction, randomized controlled trial, meta-analysis, mHealth, mobile apps, self-management, smartphone application, systematic review, dyslipidemia, health behavior, health lifestyle, family, glycemic control, social support, latent profile analysis, transtheoretical model, theoretical model, lifestyle modification, lay-led, glycated hemoglobin, self-efficacy, emergency visit rates, peer group, and systematic review. Refer to Table 4 for further description and location in each article.

Research Design

The third question in the current literature review addresses if a research design was used, and if so, what type. All articles reviewed in the current study utilized a research design. Research designs included the following: cross-sectional design, qualitative exploratory design, biographic

narrative interpretive method, quasi-experimental design, qualitative and action research design, parallel-group design, systematic review and meta-analysis, cohort study, mixed methods research, latent profile analysis, and multilevel analysis. The most utilized design was a cross-sectional design which was utilized by 21% of articles in the current review. Refer to Table 5 for further description and location in each article.

Behavior Change Interventions

The fourth question was examining the literature for if and what behavior change interventions were utilized. Five out of the fourteen (36%) articles utilized an intervention within one of the following categories or intervention types: PRISMA education, MBSR therapy, self-management questionnaire, a group-based self-management support program. Refer to Table 6 for further description and location in each article.

Effectiveness

The fifth and final question in the current study identifies if the article found self-management effective. Thirteen out of the fourteen (93%) articles found self-management to be effective. Several articles found that the effectiveness of self-management is heavily reliant on factors such as individuals knowing how to interpret different glucose levels and their symptoms as well as having different coping strategies, one of which can be mindfulness-based stress reduction (MBSR) (Despins & Wakefield, 2020, Duke, 2021; Guo et al., 2021). From different self-management levels, different profiles can be created for individuals. Alexandre and colleagues used cluster analysis to reveal four distinctive DSM profiles (high self-appraisal, limited engagement, strained, distressed), which "combine high/low levels of engagement in diabetes care activities and good/poor psychological adjustment to the disease" (2020). Results

from this study concluded that individuals falling into the high self-appraisal profile were

utilizing self-management completely with diabetes-induced activities (diet, exercise, glucose

monitoring) (Alexandre et al., 2020). Shen and colleagues investigated medication-taking and

lifestyle habits (2019). The author used a self-management questionnaire to evaluate

participants' current level of self-management. Results from this study concluded that patients

who had good medication-taking/good lifestyle habits and poor medication-taking/good lifestyle

habits had significantly lower HbA1c (Shen et al., 2019). Other articles examined aspects that

could hinder the effectiveness of self-management. Some of these factors are the patients'

beliefs, level of diabetes education, support from family/friends, professionals/care team,

attractive-looking meals for diet change, and feel-good feeling after physical activity (Gorina et

al., 2019; Tay et al, 2019; Mayberry et al., 2019). One article in the present study examined

different social support dimensions regarding self-management of type 2 diabetes. Al-Dwaitkat

and colleagues results from their study indicated that various social support dimensions were

positively correlated with self-management (2020). Education has proven to be one of the top

suggested entities by healthcare professionals when managing diabetes. For individuals to

properly conduct self-management they must first be educated about what they are managing.

Several articles in the current review discuss the benefits of education on diabetes self-

management for patients. The results concluded that education did increase more effective self-

management implementation (Carmienke et al., 2021; Emiliana et al., 2019). In another study,

van Puffelen and colleagues explored an intervention involving a group-based self-management

support program (2019). Once the program ended, the intervention group immediately showed a

significantly higher increase in physical activity and diet (van Puffelen et al., 2019).

Although most of the articles in the current study found self-management as an intervention to be effective, one article examined did not. He and colleagues aimed to "address the knowledge gaps by identifying and synthesizing evidence on smartphone application-based intervention and determining its effect on glycemic control, self-management behaviors, psychological well-being, quality of life, and cardiometabolic risk factors" (2021). For the current study, self-management behavior results were reviewed. The results concluded a statistically significant improvement regarding medication adherence, but nonsignificant improvements in diet management, exercise engagement, blood glucose monitoring, and foot care (He et al., 2021). Meaning that self-management was only partially effective as an intervention. Refer to Table 7 for summaries of all article results and locations in the article.

Discussion

The current study sought to examine the literature on diabetes self-management and examine how these interventions relate to those in the ABA literature. A review of the journals in which the articles were published indicates that much of the research on self-management and diabetes does not occur in traditional behavior analytic journals. Most of the journals that contained articles included in the current review were those in health care, specifically focusing on nursing or diabetes in general. This indicates that there is, at least, an issue with dissemination between the two domains even though they share self-management in their lexicon. The results of this review indicated that self-management is an effective intervention for persons with diabetes. But self-management is most effective when key factors are met. Key factors such as education, coping strategies, and support from family and friends. High levels of these factors result in better self-management of important skills diabetics must obtain, diet, physical activity, and glucose monitoring.

Limitations and Future Research

There were several limitations to the current review. First, no articles in the current review examined self-management of gestational diabetes. This could be due to several factors including but not limited to the difficulty of conducting studies with pregnant women and receiving approval. This is something that can be investigated for future research as well. Second, focusing on many article journals. This could be considered a limitation because it was not entirely refined. Additionally, ABA-specific research methodology was not used in any of the articles in the current review. Using ABA-specific research methodologies such as multiple baselines across participants, alternating treatment designs, withdrawal, or reversal designs, or changing criterion design. Although these designs are usually utilized for single-subject or small-group sample sizes, future researchers could examine utilizing one of these designs in terms of larger sample sizes. Doing so will start to create a connection between diabetes self-management with ABA intervention further.

References

Al-Dwaikat, T. N., Chlebowy, D. O., Hall, L. A., Crawford, T. N., & Yankeelov, P. A. (2020).

Self-management as a mediator of the relationship between social support dimensions

and health outcomes of African American adults with type 2 diabetes. *Western Journal of*

Nursing Research, *42*(7), 485–494.

https://doi-org.eps.cc.ysu.edu/10.1177/0193945919867294

Alexandre, K., Vallet, F., Peytremann-Bridevaux, I., & Desrichard, O. (2021). Identification of

diabetes self-management profiles in adults: A cluster analysis using selected self-

reported outcomes. *PLoS ONE*, *16*(1).

https://doiorg.eps.cc.ysu.edu/10.1371/journal.pone.0245721

American Diabetes Association (ADA) (Ed.). (2023). Diabetes Overview. American Diabetes

Association. Retrieved February 18, 2023, from https://diabetes.org/diabetes.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior

analysis. *Journal of applied behavior analysis*, *1*(1), 91–97.

https://doi.org/10.1901/jaba.1968.1-91

Baer, D. M., & Wolf, M. M. (1987). Some still-current dimensions of applied behavior

analysis. *Journal of applied behavior analysis*, *20*(4), 313–327.

https://doi.org/10.1901/jaba.1987.20-313

Busacca, M.L., Anderson, A. & Moore, D.W. Self-Management for Primary School Students

Demonstrating Problem Behavior in Regular Classrooms: Evidence Review of Single-

Case Design Research. *J Behav Educ* **24**, 373–401 (2015).

https://doi.org/10.1007/s10864-015-9230-3

Carmienke, S., Fink, A., Baumert, J., Heidemann, C., Du, Y., Frese, T., & Heise, M. (2021).

   Participation in structured diabetes self-management education programs and its

   associations with self-management behaviour – a nationwide population-based

   study. *Patient Education and Counseling*.

   https://doiorg.eps.cc.ysu.edu/10.1016/j.pec.2021.07.017

Centers for Disease Control and Prevention (Ed.). (2022, July 7). *What is Diabetes?* Centers for

   Disease Control and Prevention. Retrieved January 29, 2023, from

   https://www.cdc.gov/diabetes/basics/diabetes.html

Cooper, J. O., Heron, T. E., & Heward, W. L. (2019). *Applied Behavior Analysis (3rd

   Edition)*. Hoboken, NJ: Pearson Education.

Despins, L. A., & Wakefield, B. J. (2020). Making sense of blood glucose data and self-

   management in individuals with type 2 diabetes mellitus: A qualitative study. *Journal of

   Clinical Nursing*, *29*(13–14), 2572–2588.

   https://doiorg.eps.cc.ysu.edu/10.1111/jocn.15280

Duke, N. (2021). Type 2 diabetes self-management: Spirituality, coping and responsibility.

   Journal of Research in Nursing, *26*(8), 743–760.

   https://doiorg.eps.cc.ysu.edu/10.1177/17449871211026958

Emiliana, P., Agustini, N., Allenidekania, & Rustina, Y. (2019). A Preliminary Study on

   "PRISMA" Education in Improving Self-Management and Level of Compliance in

   Children with Type-1 Diabetes Mellitus. *Comprehensive Child & Adolescent

   Nursing*, *42*, 115–121. https://doi-org.eps.cc.ysu.edu/10.1080/24694193.2019.1578432

Gorina, M., Limonero, J. T., & Álvarez, M. (2019). Educational diagnosis of self-management

behaviours in patients with diabetes mellitus, hypertension and hypercholesterolaemia

based on the PRECEDE model: Qualitative study. *Journal of Clinical Nursing*, *28*(9–10),

1745–1759. https://doi-org.eps.cc.ysu.edu/10.1111/jocn.14794

Guo, J., Wang, H., Ge, L., Valimaki, M., Wiley, J., & Whittemore, R. (2022). Effectiveness of a

nurse-led mindfulness stress-reduction intervention on diabetes distress, diabetes self-

management, and HbA1c levels among people with type 2 diabetes: A pilot randomized

controlled trial. *Research in Nursing & Health*, *45*(1), 46–58.

https://doiorg.eps.cc.ysu.edu/10.1002/nur.22195

Gureasko-Moore, S., Dupaul, G. J., & White, G. P. (2006). The effects of self-management in

general education classrooms on the organizational skills of adolescents with

ADHD. *Behavior modification*, *30*(2), 159–183.

https://doi.org/10.1177/0145445503259387

He, Q., Zhao, X., Wang, Y., Xie, Q., & Cheng, L. (2022). Effectiveness of smartphone

application–based self-management interventions in patients with type 2 diabetes: A

systematic review and meta-analysis of randomized controlled trials. *Journal of

Advanced Nursing*, *78*(2), 348–362. https://doi-org.eps.cc.ysu.edu/10.1111/jan.14993

Kang, E., Kim, K. H., Cho, Y. M., Park, S. M., Kim, Y.-J., Lee, H.-Y., Rhee, Y. E., Kim, S., &

Yun, Y. H. (2021). Effect of Changes in Patient's Self-management Strategies on Clinical

Outcomes: Evidence from a Cohort Study of Patients with Diabetes, Hypertension, and

Hyperlipidemia. *International Journal of Behavioral Medicine*, *28*(4), 479–487.

https://doi-org.eps.cc.ysu.edu/10.1007/s12529-020-09937-x

Mayberry, L. S., Berg, C. A., Greevy, R. A., Jr., & Wallston, K. A. (2019). Assessing helpful

and harmful family and friend involvement in adults' type 2 diabetes self-

management. *Patient Education and Counseling*, *102*(7), 1380–1388.

https://doiorg.eps.cc.ysu.edu/10.1016/j.pec.2019.02.027

Panagioti, M., Richardson, G., Small, N. *et al.* Self-management support interventions to reduce

health care utilisation without compromising outcomes: a systematic review and meta-

analysis. *BMC Health Serv Res* **14**, 356 (2014).

https://doi.org/10.1186/1472-6963-14-356

Shen, Y., Wang, T., Gao, M., Wang, F., Zhu, X., Zhang, X., Li, D., Gan, Y., Zhang, Y., Gao, Y.,

& Sun, X. (2020). Association of glucose control and stages of change for multiple self-

management behaviors in patients with diabetes: A latent profile analysis. *Patient*

Education and Counseling, *103*(1), 214–219.

https://doiorg.eps.cc.ysu.edu/10.1016/j.pec.2019.08.020

Tay, J. H. T., Jiang, Y., Hong, J., He, H., & Wang, W. (2021). Effectiveness of lay-led, group-

based self-management interventions to improve glycated hemoglobin (HbA1c), self-

efficacy, and emergency visit rates among adults with type 2 diabetes: A systematic

review and meta-analysis. *International Journal of Nursing Studies*, *113*.

https://doiorg.eps.cc.ysu.edu/10.1016/j.ijnurstu.2020.103779

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). (2016, December).

What is Diabetes? National Institute of Diabetes and Digestive and Kidney Diseases.

Retrieved February 18, 2023, from https://www.niddk.nih.gov/health-

information/diabetes/overview/what-is-diabetes

Skinner, B. F. 1. (1953). *Science and human behavior.* New York, Macmillan.

van Puffelen, A. L., Rijken, M., Heijmans, M. J. W. M., Nijpels, G., & Schellevis, F. G. (2019).

    Effectiveness of a self-management support program for type 2 diabetes patients in the

    first years of illness: Results from a randomized controlled trial. *PLoS ONE*, *14*(6).

    https://doi-org.eps.cc.ysu.edu/10.1371/journal.pone.0218242

Table 1

Location of Articles in The Current Review

Journal	Frequency	Percentage
Patient Education and Counseling	4	17%
Journal of Clinical Nursing	3	13%
PLOS ONE	2	8%
Leading Global Nursing Research	2	8%
JMIR MHEALTH AND UHEALTH	1	4%
Western Journal of Nursing Research	1	4%
Journal of Research in Nursing	1	4%
Comprehensive Child and Adolescent Nursing	1	4%
Journal of Psychologists and Counsellors in Schools	1	4%
Research in Nursing & Health	1	4%
International Journal of Behavioral Medicine	1	4%
Health Communication	1	4%
Journal of Nursing Scholarship	1	4%
American Journal of Health Promotion	1	4%
Scandinavian Journal of Caring Sciences	1	4%
International Journal of Nursing Studies	1	4%
The Diabetes Educator	1	4%

Table 2

Questions in the Current Review

Item	Question
1	What were participants managing in each article? (I.e., diet, exercise, glucose)
2	What terms were used in the article? (i.e., diabetes, self-management)
3	Was a research design used?
4	Were behavior change interventions analyzed?
5	Was self-management found effective?

Table 3

Question 1 Results

Citation	Management	Location in Article
Al-Dwaitkat et al. (2020)	Diet, exercise, blood-glucose monitoring	Pg. 487
Alexandre et al. (2020)	Diet, exercise, blood-glucose monitoring, foot-care	Pg. 3
Carmienke et al. (2021)	Diet, blood-glucose monitoring, foot-care	Pg. 844
Despins and Wakefield (2020)	Hyperglycemia/hypoglycemia, glucose control	Pg. 2577
Duke (2021)	Diet, exercise, spiritual practices, coping strategies	Pg. 747
Emiliana et al. (2019)	Glucose monitoring	Pg. 116
Gorina et al. (2019)	Self-efficiency, healthy lifestyle, physical activity, diet	Pg. 1750
Guo et al. (2021)	Diet, exercise, weight control, blood-glucose monitoring, medication adjustment	Pg. 48
He et al. (2021)	Diet, exercise, medication adherence, blood-glucose monitoring, foot-care	Pg. 350
Kang et al. (2021)	HbA1c, glucose-monitoring	Pg. 481
Mayberry et al. (2019)	Friend/family support, medication, diet, exercise, blood-glucose monitoring	Pg. 1382
Shen et al. (2019)	Medication, diet, exercise, glucose-monitoring	Pg. 215
Tay et al. (2020)	HbA1c, self-efficacy	Pg. 2
van Puffelen et al. (2021)	Glucose monitoring, foot care, diet, exercise, smoking	Pg. 5

Note: *HbA1c (Hemoglobin A1c) = blood test that measures your average blood sugar levels over the past 3 months;
*Hyperglycemia = high blood glucose;
*Hypoglycemia = low blood glucose

Table 4

Question 2 Results

Citation	Terms	Location in Article
Al-Dwaitkat et al. (2020)	Type 2 diabetes, self-management, social support, health outcomes	Pg. 485
Alexandre et al. (2020)	−	−
Carmienke et al. (2021)	Structured diabetes self-management, education programs, Diabetes mellitus, self-management behavior, populations-based study	Pg. 843
Despins and Wakefield (2020)	Adult nursing, decision-making, diabetes, patients' experience, qualitative study, self-management	Pg. 2573
Duke (2021)	Diet and eating, diabetes, ethnicity, exercise, qualitative, self-management, spirituality	Pg. 743
Emiliana et al. (2019)	T1DM, self-management, PRISMA education, level of compliance	Pg. 115
Gorina et al. (2019)	Cholesterol, chronic disease, diabetes mellitus Type 2, education program, focus groups, hypercholesterolemia, hypertension, nursing, precede-proceed-model	Pg. 1746
Guo et al. (2021)	Diabetes, distress, mindfulness-based stress reduction, nurses, randomized controlled trial, type 2 diabetes	Pg. 46
He et al. (2021)	Meta-analysis, mHealth, mobile apps, self-management, smartphone application, systematic review, type 2 diabetes	Pg. 349
Kang et al. (2021)	Diabetes, hypertension, dyslipidemia, self-management, health behavior, health lifestyle	Pg. 479
Mayberry et al. (2019)	Family, glycemic control, health behavior, social support, type 2 diabetes	Pg. 1380
Shen et al. (2019)	Latent profile analysis, transtheoretical model, self-management behaviors, lifestyle modification, diabetes	Pg. 214
Tay et al. (2020)	Type 2 diabetes, lay-led, glycated hemoglobin, self-efficacy, emergency visit rates, peer group, systematic review	Pg.1
van Puffelen et al. (2021)	−	−

Table 5

Question 3 Results

Citation	Yes/No	Research Design	Location in Article
Al-Dwaitkat et al. (2020)	Yes	Cross-sectional design	Pg. 486
Alexandre et al. (2020)	Yes	Cross-sectional design	Pg. 3
Carmienke et al. (2021)	Yes	Cross-sectional design	Pg. 844
Despins and Wakefield (2020)	Yes	Qualitative exploratory design	Pg. 2575
Duke (2021)	Yes	Biographic narrative interpretive method	Pg. 746
Emiliana et al. (2019)	Yes	Quasi-experimental design	Pg. 116
Gorina et al. (2019)	Yes	Qualitative and action research design	Pg. 1747
Guo et al. (2021)	Yes	Parallel-group design	Pg. 47
He et al. (2021)	Yes	Systematic review and meta-analysis	Pg. 350
Kang et al. (2021)	Yes	Cohort study	Pg. 480
Mayberry et al. (2019)	Yes	Mixed-methods research	Pg. 1381
Shen et al. (2019)	Yes	Latent profile analysis	Pg. 215
Tay et al. (2020)	Yes	Systematic review	Pg. 2
van Puffelen et al. (2021)	Yes	Multilevel analysis	Pg. 3

Table 6

Question 4 Results

Citation	Yes/No	Intervention	Location in Article
Al-Dwaitkat et al. (2020)	No	–	–
Alexandre et al. (2020)	No	–	–
Carmienke et al. (2021)	No	–	–
Despins and Wakefield (2020)	No	–	–
Duke (2021)	No	–	–
Emiliana et al. (2019)	Yes	PRISMA education	Pg. 116
Gorina et al. (2019)	No	–	–
Guo et al. (2021)	Yes	MBSR* therapy	Pg. 48
He et al. (2021)	No	–	–
Kang et al. (2021)	Yes	Self-management questionnaire	Pg. 480
Mayberry et al. (2019)	No	–	–
Shen et al. (2019)	Yes	Self-management questionnaire	Pg. 215
Tay et al. (2020)	No	–	–
van Puffelen et al. (2021)	Yes	Group-based support program	Pg. 3

Note: *MBSR = mindfulness-based stress reduction

Table 7

Question 5 Results

Citation	Yes/No	Results	Location in Article
Al-Dwaitkat et al. (2020)	Yes	Various social support dimensions were positively correlated with self-management	Pg. 490
Alexandre et al. (2020)	Yes	Cluster analysis revealed four distinctive DSM profiles (high self-appraisal, limited engagement, strained, and distressed). Outcomes were good in the high self-appraisal profile cluster; poor in the distressed profile cluster	Pg. 10, 13
Carmienke et al. (2021)	Yes	Participants who received DSME was strongly associated with keeping a diabetes passport, a diabetes diary, SMBG*, FSE*, and following a diet plan	Pg. 845
Despins and Wakefield (2020)	Yes	Self-management was dependent on individuals' capability of "making sense" of glucose data	Pg. 2583
Duke (2021)	Yes	Participants' beliefs influenced their coping strategies in T2D self-management.5 out of 8 participants improved their diet, exercise results were variable due to motivation levels	Pg. 752 – 754
Emiliana et al. (2019)	Yes	PRISMA education had significant effects on self-management	Pg. 117 – 118
Gorina et al. (2019)	Yes	Several factors can hinder self-management if they are not accounted for.	Pg. 1757
Guo et al. (2021)	Yes	MBSR improved diabetes self-efficacy, self-management, and HbA1c levels.	Pg. 53
He et al. (2021)	No	Statistically significant improvement in medication adherence, nonsignificant improvements in diet, exercise, blood glucose monitoring, and foot care.	Pg. 354

Kang et al. (2021)	Yes	Diabetic patients with improved self-management strategies showed a significantly greater change in HbA1c levels compared to patients without improvement of self-management strategies	Pg. 481 – 483
Mayberry et al. (2019)	Yes	Self-management is most effective with helpful support from family/friends	Pg. 1385
Shen et al. (2019)	Yes	Patients who had good medication-taking/good lifestyle and poor medication-taking/good lifestyle had significantly lower HbA1c	Pg. 216 – 217
Tay et al. (2020)	Yes	Results revealed a statistically significant effect for HbA1c levels lowering.	Pg. 5
van Puffelen et al. (2021)	Yes	The intervention group showed a significantly higher increase in physical activity and diet immediately after the program	Pg. 8

Note: *SMBG = self-monitoring blood glucose;
*FSE = foot self-examination