Received: 29 October 2018 | Revised: 17 May 2019 | Accepted: 27 June 2019

DOI: 10.1111/jjns.12289

JAPAN JOURNAL OF NURSING SCIENCE WILEY

REVIEW ARTICLE

Diabetes self-care behaviors in adults with disabilities: A systematic review

Eunjin Yang[1] | **Hee Jung Kim**[1] | **Hyunju Ryu**[1] | **Sun Ju Chang**[2]

[1]College of Nursing, Seoul National University, Seoul, South Korea

[2]College of Nursing & The Research Institute of Nursing Science, Seoul National University, Seoul, South Korea

Correspondence
Sun Ju Chang, College of Nursing & The Research Institute of Nursing Science, Seoul National University, Seoul, South Korea.
Email: changsj@snu.ac.kr

Funding information
Seoul National University, Grant/Award Number: 2017 SNU invitation program for the distinguished

Abstract

Aim: The integrated evidence on diabetes self-care behaviors in people with a disability is not commensurate with the growing number of people with both diabetes and a disability. This study aims to identify factors influencing self-care behaviors in adults with diabetes and a disability based on a thorough review of the current evidence.

Methods: This review followed the Cochrane guidelines for systematic review research and complies with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis. To find eligible articles, five electronic databases—PubMed, Embase, CINAHL, Psych-articles, and the Cochrane Library—were searched, from the beginning of the chronological period covered by each database to June 2017. Four researchers independently conducted study selections, extracted data, and assessed the data quality.

Results: Twenty studies were reviewed to identify barriers to and facilitators of diabetes self-care behaviors. For people with developmental disabilities, the most prominent facilitator of self-care behaviors was the support they received for the behaviors. For people with visual impairments, that facilitator was the use of helpful assistive devices that take advantage of another sense. The main barriers to self-care behaviors were mobility limitation for people with physical disabilities and lack of accessibility for people with visual impairments.

Conclusions: This review has identified barriers to and facilitators of diabetes self-care behaviors by type of disability. Healthcare services need to be tailored to these facilitators and barriers, and differentiated by type of disability.

KEYWORDS
diabetes mellitus, disabilities, self-care

1 | INTRODUCTION

Worldwide, approximately 15% of people have disabilities (World Health Organization, 2011). In the USA, 12.8% of people had at least one disability in 2016, and the healthcare cost associated with disabilities was about $397.8 billion in 2006 (Anderson, Armour, Finkelstein, & Wiener, 2010; Kraus, Lauer, Coleman, & Houtenville, 2018). In the past, people with disabilities were typically not recognized as a distinct group of beneficiaries of health-related services (National Council on Disability, 2009). However, recently greater attention has been paid to the quality of life of adults with disabilities and the related health disparities in this population (Koh, Piotrowski, Kumanyika, & Fielding, 2011). Unfortunately, in most countries other than the USA, interest in adults with disabilities and the health-related welfare

policy services for this population remain insufficient (Kim, Hwang, & Park, 2016).

Not only are people with disabilities more likely to have secondary conditions, they are also more vulnerable to health-related risk factors than people without disabilities (Havercamp & Scott, 2015). Data show that people with disabilities are also less active due to physical and mental impairment, are in relatively poorer health, have less healthy behaviors, and are more likely to be obese and to smoke than those without disabilities (Carroll et al., 2014; Courtney-Long, Stevens, Caraballo, Ramon, & Armour, 2014; Froehlich-Grobe, Lee, & Washburn, 2013). In addition, chronic illnesses, such as myocardial infarction, stroke, diabetes, hypertension, and arthritis, are highly prevalent among individuals with disabilities (Reichard, Stolzle, & Fox, 2011).

In terms of chronic health conditions, individuals with disabilities are three to five times more likely to develop diabetes than individuals without disabilities (McDermott, Moran, Platt, & Dasari, 2007). Although relevant medical technologies are more advanced and levels of healthcare services have increased, the long-term characteristics of diabetes can still lead to a decreased health-related quality of life (Solli, Stavem, & Kristiansen, 2010). In addition, diabetes can cause organ dysfunction due to cellular and molecular impairment, which can result in new disabilities (Lotfy, Adeghate, Kalasz, Singh, & Adeghate, 2017). For these reasons, careful management of diabetes, which includes the improvement of diabetes self-care behaviors in adults with disabilities, is essential.

Secondary conditions and health status among adults with disabilities may differ depending on the type of disability (Horner-Johnson, Dobbertin, Lee, & Andresen, 2013). In addition, the purpose of regular visits to medical professionals (e.g., secondary condition prevention, health maintenance, rehabilitation) varies by disability type and status (Kwon, 2015). For disabled people with diabetes, such differences might also exist in diabetes self-care behaviors and other related factors. In order to enhance diabetes self-care behaviors in people with disabilities, those affected, their caretakers and medical professionals, and medical researchers must understand the factors that affect these behaviors in accordance with the type of disability. Unfortunately, little effort has been expended to explore comprehensively what factors could facilitate or hinder diabetes self-care behaviors in disabled people with diabetes. Thus, this systematic review aims to identify these factors by thoroughly examining the current evidence on diabetes self-care behaviors in adults with disabilities.

2 | METHODS

This review followed the Cochrane guidelines for systematic review (Higgins & Green, 2011), which required research methodology and reporting compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (Moher, Liberati, Tetzlaff,, & Altman, 2009).

2.1 | Review question

The review question was specified using the PICO (Population, Intervention, Comparison, and Outcome) framework. The target population was adults, aged 18 years or older, with a disability who had been diagnosed with diabetes. In accordance with the aims of this systematic review, intervention and comparison were not considered. As outcomes, factors influencing diabetes self-care behaviors were set.

2.2 | Eligibility criteria

Randomized controlled trials (RCTs), quasi-experimental studies, cohort studies, cross-sectional studies, observational studies, and qualitative studies were included if they met the following eligibility criteria: (1) participants were adults (18 years of age or older) with diabetes; (2) study was published in a peer-reviewed journal or as a dissertation; and (3) study was written in English. There was no limitation on the geographic location or setting (i.e., clinic, hospital, community setting) of the study, or on the type of disability that the participant had.

Discussion papers, literature reviews, single case studies, case reports, guidelines, and policy statements were excluded. In addition, as children and youths (i.e., aged <18 years) with a disability were not the intended target population in this research, they were also excluded.

2.3 | Information sources

A systematic search was conducted to identify studies in several electronic databases, including PubMed, Embase, CINAHL, Psych-articles, and Cochrane Library, from the chronological beginning of each database to June 2017. Gray literature were not included due to a lack of information, and we did not employ additional manual searches.

2.4 | Search strategy

The search strategy (Appendix I) was developed after creating a clearly defined review question and identifying the search terms through a term-harvesting process using standard indexing terms (MeSH, Emtree) and free terms. The three key aspects were diabetes, disabilities, and self-care behaviors. The terms for self-care behaviors were based on the American Association of Diabetes Educators' seven recommended self-care behaviors (AADE7): diet, exercise,

glucose monitoring, taking diabetes medication, problem-solving, risk management, and coping (AADE, 2018).

2.5 | Study selection

In order to find eligible articles, the researchers searched databases using a term list identified through term-harvesting. Articles identified through primary literature search were exported into EndNote, a reference manager. We removed duplicates and screened potentially relevant articles based on title and abstract. When the title and abstract demonstrated that the studies (a) focused on adults with disabilities and (b) indicated diabetes self-care behaviors or behavioral intervention, the studies were selected for initial review. Next, four researchers reviewed the full-text articles for eligibility. This selection process revealed the eligible articles used in this study.

2.6 | Data extraction and synthesis

Four independent researchers extracted the following data using a formal data extraction instrument: author, publication year, country, study design, aims, type(s) of disability, type(s) of diabetes, sample size, mean age of participants, type of diabetes self-care behaviors based on AADE7, and factors (barriers and facilitators) related to diabetes self-care. Each researcher checked for similarities and differences in extracted data and, when required, the researchers came to a consensus. The intraclass correlation coefficient (ICC) in the data was 0.95 in this study. Following this extraction, the narrative analysis was conducted by type of disability.

2.7 | Methodological quality appraisal

We used the Joanna Briggs Institute Critical Appraisal tools to assess the methodological quality of the studies. The checklists for qualitative research, cohort studies, cross-sectional studies, and quasi-experimental studies were used because the included study designs varied (Joanna Briggs Institute, 2016). The methodological quality appraisal tools, according to the study design, are presented in Table 1.

The quality assessment of the research methodology was performed by four researchers independently; these assessments were then discussed in order to reach consensus. The investigators answered "yes," "no," "unclear," and "not applicable" about each item, and the total sum of "yes" answers is presented in Table 2. The ICC in the quality appraisal was 0.92 in this study, which indicated excellent reliability (Koo & Li, 2016).

3 | RESULTS

3.1 | Study selection

A total of 11,074 articles were identified through the database search, and 721 duplicates were removed. By examining titles and abstracts of the articles, 10,277 articles were excluded, so that the full text of 76 articles were assessed for eligibility. Out of those, 20 articles were included in this systematic review. The number of articles and the reasons for exclusion in each step were presented using a PRISMA flowchart (Moher et al., 2009; Figure 1).

3.2 | Study characteristics

The general characteristics of the 20 included articles are shown in Table 2. The sample size of the articles ranged from four (Oehler-Giarratana & Fitzgerald, 1980) to 3,722 (Reichard et al., 2012). Regarding type of disability, seven articles were focused on people with developmental disabilities, eight articles on people with visual impairment, four articles on people with physical disabilities, particularly amputees, and one did not mention the type of disability.

In terms of study designs, seven articles used a qualitative design (Cardol et al., 2012; Hale et al., 2011; Kaminsky et al., 2014; Livingstone et al., 2011; Rouse & Finlay, 2016; Whitehead et al., 2016; Williams, 2002) and 12 used a quantitative design including quasi-experimental studies (Bernbaum et al., 1989; Carrington et al., 2001; Oehler-Giarratana & Fitzgerald, 1980; Prior et al., 1984; Trozzolino et al., 2003; Windecker et al., 1997), retrospective cohort studies (Patel et al., 2016; Reichard et al., 2012; Shireman et al., 2010; Tseng et al., 2006), and cross-sectional studies (Pham et al., 1996; Taggart et al., 2013). One article used participatory action research (Williams, 2005).

Among the AADE7 diabetes self-care behaviors, the most frequent researched area was "glucose monitoring," and the least studied area was "problem-solving." Outside of these AADE7 categories, two articles dealt with education about diabetes self-care behaviors (Williams, 2002; Williams, 2005).

3.3 | Methodological quality appraisal

To assess the methodological quality of qualitative studies, we checked for the presence of 10 different items. Items 2, 3, 4, 5, and 8 were related to the congruity of the research methodology—research question, data collection method, analysis, interpretation, and conclusion. Item 10 was concerned with adequately representing the participants' voices. These six items were rated "yes" for seven of the qualitative studies (Cardol et al., 2012; Hale et al., 2011; Kaminsky et al., 2014; Livingstone et al., 2011; Rouse & Finlay, 2016;

TABLE 1 Items of the methodological quality appraisal tool according to the study design based on the Joanna Briggs Institute (2016)

No.	Qualitative studies (10 items)	Quasi-experimental studies (9 items)	Cross-sectional studies (8 items)	Retrospective cohort studies (11 items)
1	Congruity between philosophical perspective and qualitative methodology	Clearly defined cause and effect	Clearly defined inclusion criteria	Similar participants
2	Congruity between research questions and qualitative methodology	Similar participants	Detailed descriptions of subjects and setting	Exposure measured similarly in both groups
3	Congruity between data collection and qualitative methodology	Controlled exogenous variable	Reliable and valid exposure measurement	Reliable and valid exposure measurement
4	Congruity between data analysis and qualitative methodology	Control group exists	Standard criteria used for condition measurement	Identified confounding factors
5	Congruity between interpretation of results and qualitative methodology	Repeated measures (pre-and post-intervention)	Identified confounding factors	Strategies dealing with confounding factors
6	Theoretical or cultural statement	Follow-up completion or strategies to deal with loss were reported	Strategies dealing with confounding factors	Whether all participants are free of the outcomes at the study start or not
7	Statement of influences from researchers, and vice versa	Same way of outcome measurement between two groups	Reliable and valid outcome measurement	Reliable and valid outcome measurement
8	The participants' voices were adequately represented	A reliable way of outcome measurement	Appropriate statistical analysis	Whether the follow-up period sufficient or not
9	Compliance with ethical standard	Appropriate statistical analysis	-	Described the reasons for incomplete follow-up
10	Congruity between conclusion and qualitative methodology	-	-	Strategies utilizing for incomplete follow-up
11	-	-	-	Appropriate statistical analysis

Whitehead et al., 2016; Williams, 2002). Item 7, which represents the influence of the investigators on studies, was rated zero. For the cross-sectional articles, Pham et al. (1996) rated "yes" to all items, and Taggart et al. (2013) rated four out of a total of eight points. The item related to confounding factors and handling strategies of cohort studies had the lowest score; only one article met these criteria (Patel et al., 2016). Among quasi-experimental articles, the item that concerned clearly defined cause and effect, follow-up completion, same outcome measurement, and appropriate statistical analysis had the highest score. Item 3, which was related to a controlled exogenous variable (Carrington et al., 2001; Oehler-Giarratana & Fitzgerald, 1980) and item 4, which was related to existing control groups (Carrington et al., 2001; Trozzolino et al., 2003), both received the lowest score.

The quality appraisal results are presented in Table 2. The one article that utilized a participatory action research design was not evaluated for methodological quality, because participatory action research, although a type of qualitative research, has unique characteristics, making it unsuitable for applying quality appraisal tools that are used for conventional qualitative study.

3.4 | Factors influencing self-care behaviors in adults with disabilities

We analyzed the factors influencing self-care behaviors based on the type of disability (i.e., developmental, physical, and visual impairment). Participants with an intellectual disability, cerebral palsy, autism, Down's syndrome, a cognitive disability, or a seizure disorder were classified as people with a developmental disability as these people face similar difficulties with language, learning, and independent living (Carulla et al., 2011). Participants with limitations on their mobility were classified as people with a physical disability. Participants with vision loss were classified as people with visual impairment. These three categories were selected because the majority of the articles examined these disability types. Moreover, these categories align with the

TABLE 2 Data extraction from the included articles ($n = 20$)

Disability	Authors (year)	Country	Design	Purpose	Type of diabetes	Sample size	Age (mean)	Areas of diabetes self-care behaviors based on AADE7™	Barriers	Facilitators	QA (total score)
Developmental	Hale, Trip, Whitehead, and Conder (2011)	New Zealand	Qualitative	To explore the understanding of diabetes and how the diabetes self-care behaviors are carried out	T1DM (n = 6) T2DM (n = 8)	14	50.9	Diet exercise glucose monitoring	-	Support education	7 (10)
	Cardol, Rijken, and van Schrojenstein Lantman-de Valk (2012)	Netherland	Qualitative	To examine diabetes perceptions and related factors	T1DM T2DM	17	52	Diet glucose monitoring coping	Special occasions: party, weekends, having visitors, etc. health conditions: age, comorbidity negative feelings: lonesome, gloom, dread social contextual factors: low socioeconomic status, communal living, transportation problem	Support knowledge motivation confidence	8 (10)
	Whitehead, Trip, Hale, and Conder (2016)	New Zealand	Qualitative	To explore experience and autonomy negotiation for diabetes self-care behaviors	T1DM (n = 8) T2DM (n = 6)	14	50.9	Diet taking medication glucose monitoring	-	Successful autonomy negotiation between supporters and people with diabetes	8 (10)
	Rouse et al. (2016)	UK	Qualitative	To explore the responsibility related to diabetes self-care behaviors	T1DM (n = 2) T2DM (n = 5)	7	20–54	Diet exercise glucose monitoring taking medication risk management coping	-	Support competence autonomy responsibility	9 (10)

(Continues)

TABLE 2 (Continued)

Disability	Authors (year)	Country	Design	Purpose	Type of diabetes	Sample size	Age (mean)	Areas of diabetes self-care behaviors based on AADE7™	Barriers	Facilitators	QA (total score)
	Taggart, Coates, and Truesdale-Kennedy (2013)	UK	Cross-sectional	To examine the demographics and care indicators regarding health and diabetes	T1DM (n = 61) T2DM (n = 125)	186	54.02	Exercise·glucose monitoring risk management	Age: 50 years or older hypertension mild cognitive impairment (A1c check) T1DM age: 30 years or younger living with parents, obesity high level of A1c (more visit the emergency department due to diabetes-related events)	T1DM (A1c check) mild cognitive impairment (exercise)	4
	Shireman, Reichard, Nazir, Backes, and Greiner (2010)	USA	Retrospective cohort study	To investigate the quality of diabetes self-care behaviors	Not stated	666	43.1	Glucose monitoring risk management	Dual Medicare eligibility age: 18 to 30 years ethnic minority: non-Caucasians (microalbuminuria test)	Hypertension ethnic minority: non-Caucasians (eye check-up)	9 (11)
	Patel et al. (2016)	USA	Retrospective cohort study	To investigate the racial disparities regarding taking diabetes medications	T2DM	1,529	18–64	Taking medication	Gender: female ethnic minority: African Americans	-	11 (11)
Visual impairment	Williams (2002)	USA	Qualitative	To explore accessibility of diabetes education, and psychosocial matters	T1DM (n = 3) T2DM (n = 13)	16	54.8	Not specific: education	Deficiency in accessibility of latest diabetes knowledge limited awareness of needs and abilities of the disabled	Accessibility	7 (10)

(Continues)

TABLE 2 (Continued)

Disability	Authors (year)	Country	Design	Purpose	Type of diabetes	Sample size	Age (mean)	Areas of diabetes self-care behaviors based on AADE7™	Barriers	Facilitators	QA (total score)
									persons with diabetes in healthcare professionals deficiency of accessible non-visual equipment		
	Kaminsky, Mitchell, Thompson, Dudgeon, and Powell (2014)	USA	Qualitative	To investigate supports and barriers of people with diabetic vision loss	T1DM T2DM	8	36–73	Not specific	Disease complications blindness mobility limitation fear about illness progression· physical environment: stairs, corner, dark, weak contrast, dynamic space social environment: wrong attitude and acts of the non-blinded person lack of accessibility to low-vision service negative feelings: suffering, loss	Assistive device behavioral change to adapt to the blind environment using other senses such as sound, touch, and smell modification of the physical environment support low-vision service buddy positive feelings: determination	7 (10)
	Williams (2005)	USA	Participatory action research	To make diabetes instructional materials and program easily accessible	Not stated	5	42–79	Not specific: education	-	Recording version of educational materials· guideline to enhance accessibility instruction to help speakers who need to present in front	N/A

(Continues)

TABLE 2 (Continued)

Disability	Authors (year)	Country	Design	Purpose	Type of diabetes	Sample size	Age (mean)	Areas of diabetes self-care behaviors based on AADE7™	Barriers	Facilitators	QA (total score)
										of visually impaired person· helping staff to understand effective communication methods, and information about people with visual impairment's lives	
	Oehler-Giarratana et al. (1980)	USA	Quasi-experiment	To investigate psychological reactions to blindness and to examine the effectiveness of group therapy	Not stated	4	19–36	Coping	-	Group therapy	2 (9)
	Prior, Alojado, Hunt, and Begg (1984)	Canada	Quasi-experiment	To teach tactile methods for glucose monitoring and to measure the effectiveness	T1DM	28	36	Glucose monitoring	-	Tactile techniques for blood glucose monitoring	7 (9)
	Bernbaum et al. (1989)	USA	Quasi-experiment	To evaluate the effectiveness of model clinical program	T1DM (n = 20) T2DM (n = 9)	29	38	Exercise glucose monitoring coping	-	The 12-week model clinical program, which included education, group support, and exercise program	7 (9)
	Windecker, Heinemann, and Sawicki (1997)	Germany	Quasi-experiment	To investigate the effectiveness of a blood glucose self-monitoring intervention	T1DM (n = 23) T2DM (n = 3)	26	45	Glucose monitoring	-	Blood glucose self-monitoring training using talking glucose meter	7 (9)

(Continues)

TABLE 2 (Continued)

Disability	Authors (year)	Country	Design	Purpose	Type of diabetes	Sample size	Age (mean)	Areas of diabetes self-care behaviors based on AADE7™	Barriers	Facilitators	QA (total score)
	Trozzolino, Thompson, Tansman, and Azen (2003)	USA	Quasi-experiment	To evaluate the effectiveness of a psychoeducational group program	T1DM (n = 2) T2DM (n = 46)	48	Experimental group :63.5 Control group: 61.4	Glucose monitoring coping	-	The 12-week psychoeducational group therapy	5 (9)
Physical	Livingstone, Van De Mortel, and Taylor (2011)	Australia	Qualitative	To describe the experiences of amputation	Not stated	5 (and care givers)	61.6	Coping	Lack of information co-existing complications perception of adverse health service lack of education mobility limitation financial problem negative feelings: uncertainty, fear, sadness, loss, shock	Sense of hope	8 (10)
	Pham, Fortin, and Thibaudeau (1996)	Canada	Cross-sectional	To investigate the relationship between belief and self-care behaviors	T1DM	76	35–80	Diet exercise taking medication glucose monitoringrisk management	Perceived barriers	Perceived social support	8 (8)
	Reichard, Stolzle, Sella, and Shireman (2012)	USA	Retrospective cohort	To investigate the quality of diabetes self-care behaviors	Not stated	3,722	56.25	Risk management	Living in medically underserved area	Gender: female hypertension dual Medicare eligibility age: 31 to 51 years	9 (11)
	Carrington et al. (2001)	UK	Quasi-experiment	To evaluate the effectiveness of foot care program in preventing opposite site amputation	Not stated	143	Bilateral amputee 64 unilateral amputee 65.4	Risk management	Specialist foot care program: N/A	Specialist foot care program: N/A	7 (9)

(Continues)

TABLE 2 (Continued)

Disability	Authors (year)	Country	Design	Purpose	Type of diabetes	Sample size	Age (mean)	Areas of diabetes self-care behaviors based on AADE7™	Barriers	Facilitators	QA (total score)
Not stated	Tseng et al. (2006)	USA	Retrospective cohort	To examine predictors of diabetes care	T2DM	2,344	<64	Risk management	Ethnic minority: Latina divorced/separated marital status	Age: 45 years or older (LDL-C check) age: 50 years or older (A1c/glucose check) physical comorbidity Medicare utilization above 25%	9 (11)

AADE7, American Association of Diabetes Educators 7 Self-Care Behaviors; LDL-C, low-density lipoprotein-cholesterol; QA, quality assessment

classifications found in the "Act on welfare of persons with disabilities" in Korea (Ministry of Government Legislation, 2019).

3.4.1 | Developmental disability

For people with a developmental disability, some sociodemographic factors, such as age, female gender, ethnic minority (e.g., non-Caucasians, African Americans), low socioeconomic status, dual Medicare eligibility, and communal living, were identified as barriers to self-care behaviors (Cardol et al., 2012; Patel et al., 2016; Shireman et al., 2010; Taggart et al., 2013). In addition, health conditions such as comorbidities (e.g., hypertension, obesity), high levels of glycated hemoglobin (HbA1c), and mild cognitive impairments were also barriers to some diabetes self-care behaviors (Cardol et al., 2012; Taggart et al., 2013). Interestingly, special occasions (e.g., party, weekend, having visitors, etc.), which made participants feel that they were permitted to break from their diabetes regimens, and negative feelings (e.g., lonely, depressed, and afraid) were both reported as barriers (Cardol et al., 2012; Rouse & Finlay, 2016).

In contrast, the most powerful facilitator of diabetes self-care behaviors in people with a developmental disability was support (Cardol et al., 2012; Hale et al., 2011; Rouse & Finlay, 2016). Other factors including education, motivation, confidence, successful negotiation of autonomy between supporters and people with an intellectual disability, and responsibility helped participants engage in diabetes self-care behaviors (Cardol et al., 2012; Hale et al., 2011; Rouse & Finlay, 2016; Whitehead et al., 2016).

Among the factors related to diabetes self-care behaviors, some acted as barriers and facilitators simultaneously depending on the self-care behaviors in question. For example, patients with mild cognitive impairments were more likely to take part in exercise but less likely to engage in glucose monitoring (Taggart et al., 2013). In addition, non-Caucasians were more likely to check microalbuminuria but less likely to have eye examinations (Shireman et al., 2010). Regarding age as a barrier, the articles reported differences across age groups in different self-care behaviors. For example, people aged 50 years or older less frequently checked HbA1c and were less likely to exercise (Taggart et al., 2013), while people aged 18 to 30 years were less likely to check their cholesterol (Shireman et al., 2010). As a result of these differences, certain observations were reported; for example, one article reported that people with comorbid hypertension were more likely to check their HbA1c/glucose level (Shireman et al., 2010), and another article reported that people with comorbid hypertension checked their HbA1c level less frequently (Taggart et al., 2013).

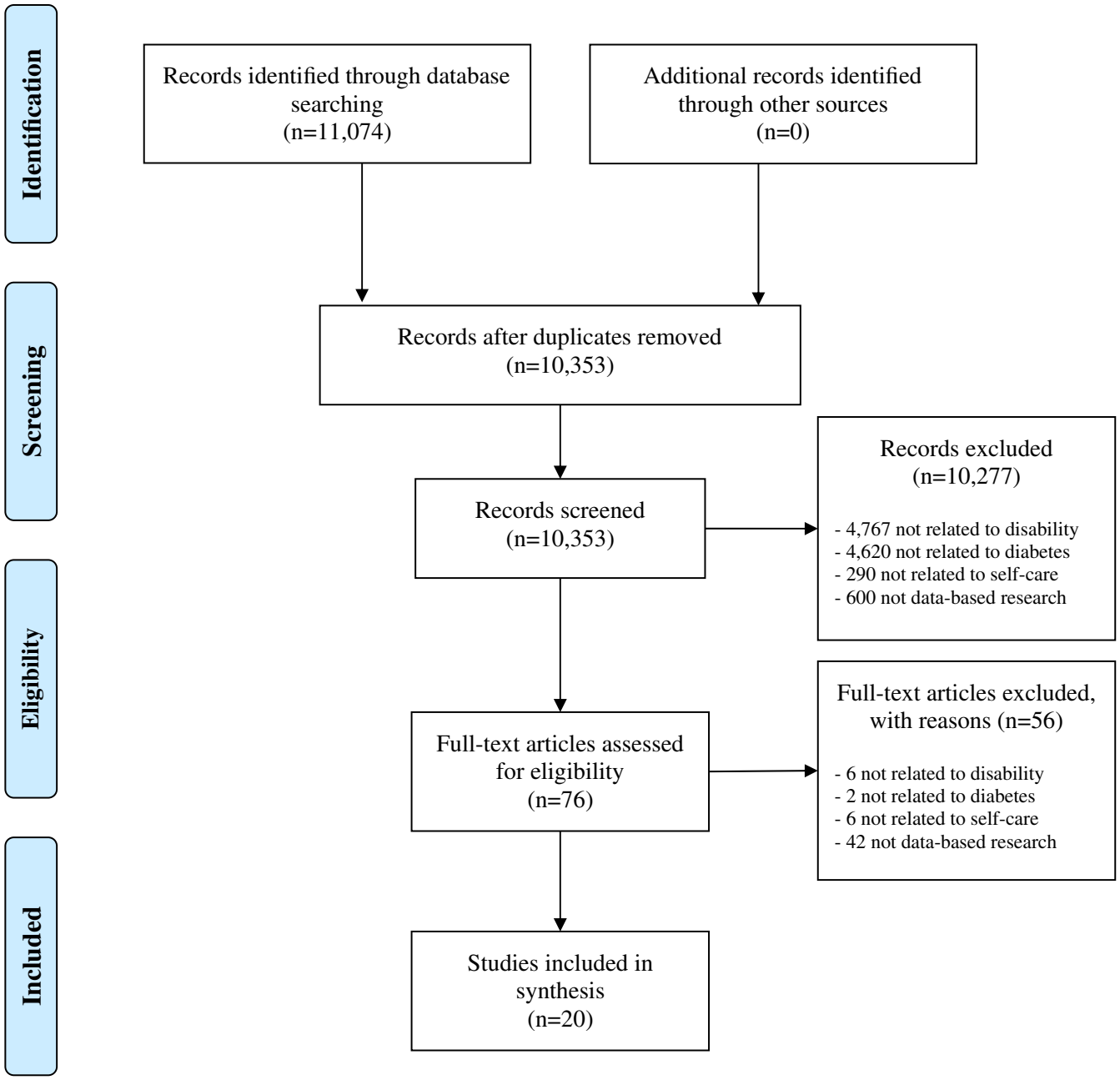

FIGURE 1 Flowchart of the data search and selection phases of the systematic review

3.4.2 | Visual impairment

For people with visual impairment, the most noticeable barrier to diabetes self-care behaviors was the lack of accessibility. In particular, studies revealed that the latest knowledge regarding diabetes was not readily shared in accessible ways and that diabetes educational forums attended by visually impaired people often lacked accessible non-visual technologies. One study demonstrated that healthcare professionals often have a limited awareness of the needs and abilities of this population, which impedes effective diabetes education (Williams, 2002). Participants' poor health, fear about disease progression, grief, and loss were also reported as barriers to diabetes self-care behaviors (Kaminsky et al., 2014).

Factors reported as facilitators of diabetes self-care behaviors included behavioral changes to adapt to the blind environment and using other senses such as sound, touch, and smell. Assistive devices, modifications to the physical environment, low-vision services, voice-recorded versions of educational materials, guidelines to enhance accessibility, and instructions to improve medical professionals' understanding of people with visual impairments were also regarded as facilitators (Kaminsky et al., 2014; Williams, 2005).

According to the five quasi-experimental articles, interventions, including group therapy, tactile techniques for blood glucose self-monitoring, blood glucose self-monitoring training, the 12-week model clinical program, and psychoeducational group therapy, positively impacted improvements in diabetes self-care behaviors (Bernbaum et al., 1989; Oehler-Giarratana & Fitzgerald, 1980; Prior et al., 1984; Trozzolino et al., 2003; Windecker et al., 1997).

3.4.3 | Physical disability

For people with a physical disability, reported barriers to diabetes self-care behaviors included living in medically underserved areas, feeling overwhelmed by perceived barriers, and experiencing mobility limitations (Livingstone et al., 2011; Pham et al., 1996; Reichard et al., 2012). Co-existing complications, perceptions of an adverse health service, the lack of information, and uncertainty, fear, sadness, loss, and shock were also barriers (Livingstone et al., 2011). On the other hand, sociodemographic factors such as age, comorbid hypertension, dual Medicare eligibility, female gender, and perceived social support and sense of hope were reported as facilitators (Livingstone et al., 2011; Pham et al., 1996; Reichard et al., 2012). One article attempted to prove the effectiveness of specialist foot care programs for diabetes risk management, but reported no significant differences in people with a physical disability (Carrington et al., 2001).

4 | DISCUSSION

This systematic review provides an overview of the factors associated with diabetes self-care behaviors for people with a disability. In this section, we will discuss the results of the methodological quality assessment; then, we will examine the barriers and facilitators by disability type.

In this review, one-third of the included studies were qualitative. With regard to research quality, there are many critics of qualitative research—as scholars question the trustworthiness of the conclusions. Accordingly, many qualitative studies attempt to comply with strategies for ensuring reliability (Shenton, 2004). When we reviewed the included studies using qualitative methodological quality tools, all of the qualitative studies met seven out of 10 criteria (Cardol et al., 2012; Hale et al., 2011; Kaminsky et al., 2014; Livingstone et al., 2011; Rouse & Finlay, 2016; Whitehead et al., 2016; Williams, 2002). However, none of the qualitative studies addressed researcher influence and vice versa. These potential influences must be discussed to obtain credibility (Williams, Boylan, & Nunan, 2019). The lowest score—according to the results of the methodological quality appraisal among cohort studies—corresponded to identifying and dealing with confounding factors. Because a confounding factor distorts the association between exposure and outcome, and can lead to misinterpretation, it must always be mentioned in studies that explore causality (McNamee, 2003).

Support was a frequently reported facilitator for people with a developmental disability. This finding is consistent with previous studies that have found that assistance from family, friends, and healthcare professionals generally has a positive influence on self-care behaviors in other population groups (Gallant, 2003). Moreover, the ability to successfully negotiate autonomy between caregivers and people with a disability was a facilitator. Appropriate daily support is an important protective factor, particularly during health-related transitions, such as treatment regime change, and for achieving healthy goals (Whitehead et al., 2016). Characteristics such as cognitive impairments, learning difficulties, and communication barriers in this population make them more dependent on others (Taggart et al., 2013), which—in turn—makes receiving support essential.

None of the articles included experimental studies on enhancing diabetes self-care behaviors in people with a developmental disability; however, two articles discussed study protocols for a randomized trial (Taggart et al., 2015; Walwyn et al., 2015). One possible reason is that proper diabetes education or intervention programs targeting this population have not been developed. Despite supporters' prominent roles in the self-care process, previous studies have revealed that caregivers may also have limited knowledge and understanding of what a healthy lifestyle entails (Melville et al., 2009). Therefore, ensuring participation from both the person with a disability and his or her supporters is important. In addition, efforts should be employed to create a healthcare service tailored in this population that includes individualized education programs that permit supporter involvement and consider patients' diabetes self-care-related facilitators and barriers.

More studies on diabetes self-care behavior have been conducted among people with visual impairment than among people with other disabilities. One of the reasons is that diabetic retinopathy is a common complication of diabetes that can cause permanent visual impairment (Tarr, Kaul, Chopra, Kohner, & Chibber, 2013). However, diabetes-related visual impairment can be prevented by keeping blood glucose levels controlled and engaging in risk management practices (Wang, Lau, & Chalmers, 1993). In the interest of preventing additional complications, some diabetes self-care management programs reported the use of self-care facilitators for people with visual impairments. Intervention to enhance blood glucose self-monitoring using other senses, including touch and hearing, were helpful in maintaining appropriate glucose levels or in increasing the quality of blood glucose monitoring (Prior et al., 1984; Windecker

et al., 1997). The model clinical program and psycho-educational group therapy program improved glucose control, exercise, diabetes knowledge, and psychological parameters (Bernbaum et al., 1989; Trozzolino et al., 2003). However, even with these efforts, it is not clear how long the program's effects persist, how to create a follow-up service after the program, or how to import these facilitators into daily life (Bernbaum et al., 1989; Trozzolino et al., 2003). Moreover, the people with diabetes and visual impairment still felt that they were excluded from high-quality diabetes care, and the most frequently reported self-care barrier was limited accessibility to healthcare services and education (Kaminsky et al., 2014; Williams, 2002). Continuous efforts focused not only on glucose monitoring but also AADE7 areas, through a multidisciplinary approach, could be a way to bridge the gap. In addition, making diabetes education or programs more easily accessible, taking into consideration the barriers and facilitators in daily functioning, is necessary.

The factors related to diabetes self-care behaviors in people with a physical disability were similar to those for other disability types in this review. Most non-traumatic amputations occur in people with diabetes (Centers for Disease Control and Prevention, 2014), which not only means that physical disabilities affect the maintenance of diabetes self-care behaviors but also that inappropriate diabetes self-care can lead to diabetes-related limb amputations. Perceived barriers and physical impairments are reported as negative predictors of exercise in people with a physical disability (Livingstone et al., 2011; Pham et al., 1996); however, this systematic review did not specifically look at exercise. Another systematic review specifically examining barriers to and facilitators of exercise in people with a physical disability reported many associated factors, both personal and environmental (Jaarsma, Dijkstra, Geertzen, & Dekker, 2014). Therefore, further studies focusing on exercise-related factors in people with a disability would be helpful in developing strategies to improve activity levels as a form of diabetes self-care behavior.

This review identified barriers to and facilitators of diabetes self-care behaviors for people with a disability. The findings of this review may be helpful for adapting healthcare services and health policies to this population. To improve healthcare for this population, nurses must act as advocates to promote equality in disability-specific healthcare service (Scullion, 2010). In this context, the results of this study, which consolidates current evidence on patient self-care behaviors, provides a foundational basis of information that nurses, other medical professionals, and caretakers may use to care for diabetic people with a disability. Moreover, researchers can use this information to develop research questions that further explore diabetes self-care behaviors.

This review has two major limitations. First, we analyzed the AADE7 areas according to research outcome variables in the case of quantitative studies and according to interview contents in the case of qualitative studies. Therefore, the analysis process used in this study is somewhat subjective and limited. Extracting and categorizing information from methodologically heterogeneous studies can be challenging, particularly when the original articles did not detail specific areas of self-care behaviors clearly or were not focused on barriers and facilitators as categorized in this study. Second, this review included articles published in English only. Despite these limitations, to our knowledge, this is the first review of diabetes self-care behavior barriers and facilitators according to AADE7 areas targeting all disability types. Ergo, this initial study may help to expand our knowledge and perspectives about this vulnerable population.

5 | CONCLUSIONS

People with a disability have different self-care needs based on the disability type. This review identified associated factors—barriers and facilitators—of diabetes self-care behaviors according to disability type. To improve diabetes self-care behaviors, it is essential to consider the characteristics of various disabilities and the gaps or weaknesses in current health services or programs. In addition, healthcare services need to be tailored and individualized according to facilitators and barriers differentiated by disability type.

ACKNOWLEDGMENTS

This study was supported by the 2017 SNU invitation program for distinguished scholars at Seoul National University.

DISCLOSURE

No conflicts of interest have been declared by the authors.

AUTHORS' CONTRIBUTIONS

EY and SJC contributed to the conception and design of this study, and critically reviewed the manuscript. EY, HJK, HR, and SJC collected the data and reviewed the included studies. All authors read and approved the final manuscript.

ORCID

Sun Ju Chang https://orcid.org/0000-0001-6967-1564

REFERENCES

Act on Welfare of Persons with Disabilities (2019). Ministry of Government Legislation. Retrieved from http://www.law.go.kr/LSW//lsInfoP.do?lsiSeq=206693&efYd=20190115#0000

American Association of Diabetes Educators. (2018). *AADE7 Self-care behaviors™*. Retrieved from https://www.diabeteseducator.org/living-with-diabetes/aade7-self-care-behaviors

Anderson, W. L., Armour, B. S., Finkelstein, E. A. & Wiener, J. M. (2010). Estimates of state-level health-care expenditures associated with disability. *Public Health Reports*, 125(1), 44–51. https://doi.org/10.1177/003335491012500107.

Bernbaum, M., Albert, S. G., Brusca, S. R., Drimmer, A., Duckro, P. N., Cohen, J. D. *et al.* (1989). A model clinical program for patients with diabetes and vision impairment. *The Diabetes Educator*, 15(4), 325–330. https://doi.org/10.1177/014572178901500413.

Cardol, M., Rijken, M. & van Schrojenstein Lantman-de Valk, H. (2012). People with mild to moderate intellectual disability talking about their diabetes and how they manage. *Journal of Intellectual Disability Research*, 56(4), 351–360. https://doi.org/10.1111/j.1365-2788.2011.01472.x.

Carrington, A. L., Abbott, C. A., Griffiths, J., Jackson, N., Johnson, S. R., Kulkarni, J. *et al.* (2001). A foot care program for diabetic unilateral lower-limb amputees. *Diabetes Care*, 24(2), 216–221. https://doi.org/10.2337/diacare.24.2.216.

Carroll, D. D., Courtney-Long, E. A., Stevens, A. C., Sloan, M. L., Lullo, C., Visser, S. N. *et al.* (2014). Vital signs: Disability and physical activity–United States, 2009–2012. *Morbidity and Mortality Weekly Report*, 63(18), 407–413.

Carulla, L. S., Reed, G. M., Vaez-Azizi, L. M., Cooper, S. A., Leal, R. M., Bertelli, M. *et al.* (2011). Intellectual developmental disorders: Towards a new name, definition and framework for "mental retardation/intellectual disability" in ICD-11. *World Psychiatry*, 10(3), 175–180. https://doi.org/10.1002/j.2051-5545.2011.tb00045.x.

Centers for Disease Control and Prevention. (2014). *National diabetes statistics report, 2014: Estimates of diabetes and its burden in the United States*. Atlanta, GA: US Department of Health and Human Services.

Courtney-Long, E., Stevens, A., Caraballo, R., Ramon, I. & Armour, B. S. (2014). Disparities in current cigarette smoking prevalence by type of disability, 2009–2011. *Public Health Reports*, 129(3), 252–260.

Froehlich-Grobe, K., Lee, J. & Washburn, R. A. (2013). Disparities in obesity and related conditions among Americans with disabilities. *American Journal of Preventive Medicine*, 45(1), 83–90.

Gallant, M. P. (2003). The influence of social support on chronic illness self-management: A review and directions for research. *Health Education & Behavior*, 30(2), 170–195.

Hale, L. A., Trip, H. T., Whitehead, L. & Conder, J. (2011). Self-management abilities of diabetes in people with an intellectual disability living in New Zealand. *Journal of Policy and Practice in Intellectual Disabilities*, 8(4), 223–230.

Havercamp, S. M. & Scott, H. M. (2015). National health surveillance of adults with disabilities, adults with intellectual and developmental disabilities, and adults with no disabilities. *Disability and Health Journal*, 8(2), 165–172.

Higgins, J. P. & Green, S. (2011). *Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0)*. USA: The Cochrane Collaboration.

Horner-Johnson, W., Dobbertin, K., Lee, J. C. & Andresen, E. M. (2013). Disparities in chronic conditions and health status by type of disability. *Disability and Health Journal*, 6(4), 280–286.

Jaarsma, E. A., Dijkstra, P. U., Geertzen, J. H. B. & Dekker, R. (2014). Barriers to and facilitators of sports participation for people with physical disabilities: A systematic review. *Scandinavian Journal of Medicine & Science in Sports*, 24(6), 871–881.

Joanna Briggs Institute. (2016). Critical appraisal tools. Retrieved from http://joannabriggs.org/research/critical-appraisal-tools.html

Kaminsky, T. A., Mitchell, P. H., Thompson, E. A., Dudgeon, B. J. & Powell, J. M. (2014). Supports and barriers as experienced by individuals with vision loss from diabetes. *Disability and Rehabilitation*, 36(6), 487–496.

Kim, H., Hwang, J. & Park, I. (2016). Analysis of unmet medical need determinants of the disabled beneficiaries for national basic livelihood using the actual survey data on the disabled. *Journal of Disability and Welfare*, 31, 5–28.

Koh, H. K., Piotrowski, J. J., Kumanyika, S. & Fielding, J. E. (2011). Healthy people: A 2020 vision for the social determinants approach. *Health Education & Behavior*, 38(6), 551–557.

Koo, T. K. & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155–163.

Kraus, L., Lauer, E., Coleman, R. & Houtenville, A. (2018). *2017 Disability Statistics Annual Report*. Durham, NH: University of New Hampshire.

Kwon, S. (2015). Health care for people with disabilities: Current state and policy implications. *Health and Welfare Policy Forum*, 226, 16–26.

Livingstone, W., Van De Mortel, T. F. & Taylor, B. (2011). A path of perpetual resilience: Exploring the experience of a diabetes-related amputation through grounded theory. *Contemporary Nurse*, 39(1), 20–30.

Lotfy, M., Adeghate, J., Kalasz, H., Singh, J. & Adeghate, E. (2017). Chronic complications of diabetes mellitus: A mini review. *Current Diabetes Reviews*, 13(1), 3–10.

McDermott, S., Moran, R., Platt, T. & Dasari, S. (2007). Prevalence of diabetes in persons with disabilities in primary care. *Journal of Developmental and Physical Disabilities*, 19(3), 263–271.

McNamee, R. (2003). Confounding and confounders. *Occupational and Environmental Medicine*, 60(3), 227–234.

Melville, C. A., Hamilton, S., Miller, S., Boyle, S., Robinson, N., Pert, C. *et al.* (2009). Carer knowledge and perceptions of healthy lifestyles for adults with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities*, 22(3), 298–306.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(7), e1000097.

National Council on Disability. (2009). The current state of health care for people with disabilities. Retrieved from https://files.eric.ed.gov/fulltext/ED507726.pdf.

Oehler-Giarratana, J. & Fitzgerald, R. G. (1980). Group therapy with blind diabetics. *Archives of General Psychiatry*, 37(4), 463–467.

Patel, I., Erickson, S. R., Caldwell, C. H., Woolford, S. J., Bagozzi, R. P., Chang, J. *et al.* (2016). Predictors of medication adherence and persistence in Medicaid enrollees with developmental disabilities and type 2 diabetes. *Research in Social and Administrative Pharmacy*, 12(4), 592–603.

Pham, D. T., Fortin, F. & Thibaudeau, M. F. (1996). The role of the health belief model in amputees' self-evaluation of adherence to diabetes self-care behaviors. *The Diabetes Educator*, 22(2), 126–132.

Prior, J. C., Alojado, N. C., Hunt, J. A. & Begg, I. S. (1984). Use of tactile techniques for self-monitoring of blood glucose in visually impaired patients with diabetes mellitus. *Diabetes Care*, 7(4), 313–317.

Reichard, A., Stolzle, H. & Fox, M. H. (2011). Health disparities among adults with physical disabilities or cognitive limitations compared to individuals with no disabilities in the United States. *Disability and Health Journal*, 4(2), 59–67.

Reichard, A., Stolzle, H., Sella, A. C. & Shireman, T. I. (2012). Quality of diabetes care for adults with physical disabilities in Kansas. *Disability and Health Journal*, 5(1), 34–40.

Rouse, L. & Finlay, W. (2016). Repertoires of responsibility for diabetes management by adults with intellectual disabilities and those who support them. *Sociology of Health & Illness*, 38(8), 1243–1257.

Scullion, P. A. (2010). Models of disability: Their influence in nursing and potential role in challenging discrimination. *Journal of Advanced Nursing*, 66(3), 697–707.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63–75.

Shireman, T. I., Reichard, A., Nazir, N., Backes, J. M. & Greiner, K. A. (2010). Quality of diabetes care for adults with developmental disabilities. *Disability and Health Journal*, 3(3), 179–185.

Solli, O., Stavem, K. & Kristiansen, I. (2010). Health-related quality of life in diabetes: The associations of complications with EQ-5D scores. *Health and Quality of Life Outcomes*, 8(1), 18.

Taggart, L., Coates, V., Clarke, M., Bunting, B., Davies, M., Carey, M. *et al*. (2015). A study protocol for a pilot randomised trial of a structured education programme for the self-management of type 2 diabetes for adults with intellectual disabilities. *Trials*, 16(1), 148.

Taggart, L., Coates, V. & Truesdale-Kennedy, M. (2013). Management and quality indicators of diabetes mellitus in people with intellectual disabilities. *Journal of Intellectual Disability Research*, 57(12), 1152–1163.

Tarr, J. M., Kaul, K., Chopra, M., Kohner, E. M. & Chibber, R. (2013). Pathophysiology of diabetic retinopathy. *ISRN Ophthalmology*, 2013, 1–13.

Trozzolino, L., Thompson, P. S., Tansman, M. S. & Azen, S. P. (2003). Effects of a psychoeducational group on mood and glycemic control in adults with diabetes and visual impairments. *Journal of Visual Impairment and Blindness*, 97(4), 230–239.

Tseng, C.-L., Sambamoorthi, U., Tiwari, A., Rajan, M., Findley, P. & Pogach, L. (2006). Diabetes care among veteran women with disability. *Women's Health Issues*, 16(6), 361–371.

Walwyn, R. E., Russell, A. M., Bryant, L. D., Farrin, A. J., Wright-Hughes, A. M., Graham, E. H. *et al*. (2015). Supported self-management for adults with type 2 diabetes and a learning disability (OK-diabetes): Study protocol for a randomised controlled feasibility trial. *Trials*, 16(1), 342.

Wang, P. H., Lau, J. & Chalmers, T. C. (1993). Meta-analysis of effects of intensive blood-glucose control on late complications of type I diabetes. *The Lancet*, 341(8856), 1306–1309.

Whitehead, L., Trip, H., Hale, L. A. & Conder, J. (2016). Negotiated autonomy in diabetes self-management: The experiences of adults with intellectual disability and their support workers. *Journal of Intellectual Disability Research*, 60(4), 389–397.

Williams, A. S. (2002). A focus group study of accessibility and related psychosocial issues in diabetes education for people with visual impairment. *The Diabetes Educator*, 28(6), 999–1008.

Williams, A. S. (2005). *Using participatory action research to make diabetes education accessible for people with visual impairment (doctoral dissertation)*. Oakland, CA: Saybrook Graduate School and Research Center.

Williams, V., Boylan, A.-M. & Nunan, D. (2019). Critical appraisal of qualitative research: Necessity, partialities and the issue of bias. *BMJ Evidence-Based Medicine*. https://doi.org/10.1136/bmjebm-2018-111132.

Windecker, R., Heinemann, L. & Sawicki, P. (1997). Self-monitoring of blood glucose in blind diabetic patients. *Diabetic Medicine*, 14 (8), 703–706. https://doi.org/10.1002/(SICI)1096-9136(199708)14:8<703::AID-DIA416>3.0.CO;2-N.

World Health Organization. (2011). World report on disability: Summary, 2011. Retrieved from http://www.who.int/disabilities/world_report/2011/report/en/

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Yang E, Kim HJ, Ryu H, Chang SJ. Diabetes self-care behaviors in adults with disabilities: A systematic review. *Jpn J Nurs Sci*. 2020;17:e12289. https://doi.org/10.1111/jjns.12289