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Marianna S Wetherill

Ashten R Duncan

Hartley Bowman

Reagan Collins

Natalie Santa-Pinter

See next page for additional authors

Authors
Marianna S Wetherill, Ashten R Duncan, Hartley Bowman, Reagan Collins, Natalie Santa-Pinter, Morgan Jackson, Catherine M Lynn, Katherine Prentice, and Mary Isaacson

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Review Article

Promoting nutrition equity for individuals with physical challenges: A systematic review of barriers and facilitators to healthy eating

Marianna S. Wetherill[a,b,*], Ashten R. Duncan[b,1], Hartley Bowman[c], Reagan Collins[d], Natalie Santa-Pinter[b,2], Morgan Jackson[b], Catherine M. Lynn[b,3], Katherine Prentice[e,4], Mary Isaacson[d]

[a] University of Oklahoma Tulsa Schusterman Center, Hudson College of Public Health, Department of Health Promotion Sciences, 4502 E. 41st St., Tulsa, OK 74135, United States of America

[b] University of Oklahoma Tulsa Schusterman Center, OU-TU School of Community Medicine, 4502 E. 41st St., Tulsa, OK 74135, United States of America

[c] University of Oklahoma Tulsa Schusterman Center, College of Allied Health, Department of Rehabilitation Sciences, Physical Therapy Program, 4502 E. 41st St., Tulsa, OK 74135, United States of America

[d] University of Oklahoma Tulsa Schusterman Center, College of Allied Health, Department of Rehabilitation Sciences, Occupational Therapy Program, 4502 E. 41st St., Tulsa, OK 74135, United States of America

[e] University of Oklahoma Tulsa Schusterman Center, Schusterman Library, 4502 E. 41st St., Tulsa, OK 74135, United States of America

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ABSTRACT

Impaired mobility is the most common form of functional disability in the US, affecting one out of every sixteen working-age adults. Little is known about the barriers to and facilitators of healthy eating among people with impaired mobility (PWIM), who are at increased risk for diet-related chronic disease. The pathways by which impaired mobility influence dietary intake are unclear, yet likely involve a complex interplay between structural determinants of health and individual factors. To help advance nutrition equity initiatives for PWIM, this systematic review aimed to qualitatively synthesize factors associated with dietary intake across four levels of ecologic influence. An interprofessional team devised a comprehensive search strategy to identify these factors among working-age (18–64 years) PWIM. We queried Ovid MEDLINE, Web of Science, Scopus, and Embase via Ovid for articles published between January 1, 1990 and April 25, 2021. Twelve studies met our review criteria. We classified factors within one of four ecologic levels of influence: individual, social, environmental, and policy/program. Most studies disproportionately reported on personal level factors of influence, with less information on other levels of influence. This systematic review is an important first step for informing the design of evidence-based strategies to support healthy eating among PWIM. However, it also reveals a wide chasm in the needed information to adequately bridge structural determinants of this nutrition divide. More studies are needed that include rigorous measures of dietary intake and that aim to elicit how social, environmental, and policy-level factors contribute to dietary disparities among PWIM.

1. Introduction

Physical disabilities affect over one billion people internationally (UN World Health Organization (WHO), 2011), including one-quarter (26%) of all community-dwelling adults in the United States (US) (Okoro et al., 2018). As a commonly unrecognized health disparity population (Krahn et al., 2015), people with disabilities (PWD) experience higher rates of obesity, diabetes, cardiovascular disease, and other preventable co-morbidities relative to individuals living without a disability (Froehlich-Grobe et al., 2013). Higher rates of modifiable risk

Abbreviations: PWIM, People with impaired mobility; PWD, People with disabilities; US, United States; CDC, Centers for Disease Control and Prevention.

* Corresponding author.
E-mail address: Marianna-wetherill@ouhsc.edu (M.S. Wetherill).
[1] Present affiliation: Northern New Mexico Family Medicine, Santa Fe, NM, United States of America
[2] Present affiliation: University of Tennessee Health Science Center, Memphis, TN, United States of America
[3] Present affiliation: Cone Health Program, Greensboro, NC, United States of America
[4] Present affiliation: Texas Medical Center Library, Houston, TX, United States of America.

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factors for chronic health conditions, such as poor nutrition, potentially play a strong role in these chronic disease disparities (Kimokoti and Millen, 2016). For example, PWD are significantly less likely than the general population to meet the recommended dietary intake goals for key macronutrients and micronutrients linked to cardiometabolic disease risk, such as saturated fat, dietary fiber, and potassium (An et al., 2015). Consumption patterns of fruits and vegetables, which are essential components of a healthy eating pattern, are also suboptimal (An and Chiu, 2015). The pathways by which physical disabilities influence dietary intake are unclear, yet are likely multifactorial and may involve many structural determinants beyond individual factors. Thus, elucidating determinants of nutritional intake in this population may reveal opportunities to advance health equity for PWD. Adapted from the definition of health equity (Whitehead, 1992), this paper conceptualizes nutrition equity as the absence of avoidable and unfair differences in nutritional intake and in the health outcomes perpetuated by these differences.

Individuals living with disabilities represent a diverse, heterogeneous population (Okoro et al., 2018; Krahn et al., 2015). Broadly, this group includes people living with cognitive, hearing, visual and mobility limitations, each of which likely entails its own barriers to and facilitators for healthy eating (Krahn et al., 2015). Impaired mobility is the most common form of functional disability in the US, affecting one out of every seven people (Stevens et al., 2016). When limited to working-age adults, impaired mobility remains the most common type of disability, affecting one out of every 16 in this age group (Okoro et al., 2018). Notably, people with impaired mobility (PWIM) experience higher rates of diabetes and cardiovascular disease compared to those without impaired mobility (Wilby, 2019). Dietary intake is an important modifiable risk factor for these conditions, which benefit from a diet rich in minimally processed, whole foods (National Research Council Committee on D, Health, 1989). Although data are limited on dietary intakes of PWIM, one study found that meeting dietary guidelines is associated with a 40% reduced hazard of all-cause death in this population (Loprinzi et al., 2018).

The separate acts of food procurement, food preparation, and food consumption may each influence nutritional intake and present multiple challenges to PWIM. For example, impaired mobility may severely limit one or more activities of daily living (ADLs), such as ambulation and eating food (Allami et al., 2017), as well as instrumental activities of daily living (IADLs), such as grocery shopping, meal preparation, and household (kitchen) cleaning (Huang et al., 2012). These limitations in ADLs and IADLs may negatively affect dietary intake by limiting frequency of shopping trips, restricting access to needed food items at stores, decreasing overall fresh food in the home, and reducing the ability to prepare or consume healthy food at home (Disability and Health Program, 2003). Chronic pain, limited physical strength, and fatigue after standing or moving for periods of time may also be barriers. Limited social support to procure food or prepare meals may result in an inadequate home food supply, despite having financial means to purchase food. Physical disabilities can also lead to under- and unemployment, thereby indirectly affecting one's ability to afford healthy food (Coleman-Jensen and Nord, 2013).

Occupational and physical therapists play an important role in improving the quality of life for PWIM, and these disciplines may provide useful insights into potential facilitators of healthy eating. For example, occupational therapists utilize and recommend strategies, techniques, and tools to promote patient autonomy in meal preparation and eating, which may help to optimize dietary intake and overall food security (Juckett and Robinson, 2019). For instance, adaptive cooking tools and equipment designed to reduce physical exertion and standing time may help to improve dietary variety through increasing meal choices in the kitchen. Furthermore, existing evidence suggests that physical therapists can also play an effective role in supporting patient lifestyle change (Frerichs et al., 2012), and thus nutrition education as part of a patient's rehabilitation care plan (*The Role of the Physical Therapist and the American Physical Therapy Association in Diet and Nutrition*, 2019) may also be an important facilitator of healthy eating.

Disability inclusion (i.e., designing programs and policies with individuals with disabilities in mind) is a top priority for public policy decision-making in the US, and the Centers for Disease Control and Prevention (CDC) endorses community- and clinic-based interventions that promote health equity for PWD (Stevens et al., 2016). Although the barriers to and facilitators of physical activity for PWD are fairly well documented (Martin Ginis et al., 2016; Wright et al., 2019), much less is known about determinants of healthy eating among PWD, despite its critical importance for this population's overall health. One scoping review exploring the effect of physical disability on food access and food security concluded that a socioecological model is needed to fully conceptualize how food insecurity manifests in this population (Schwartz et al., 2019). Another scoping review of nutritional interventions for PWD (King et al., 2014) concluded that more research is needed in this area. A commitment to disability inclusion and nutrition equity requires public health researchers, health program planners, and policy makers to identify and address factors that lead to avoidable and unfair differences in nutritional intake for PWD. Thus, the primary objective of this systematic review is to identify barriers and facilitators to healthy eating among working-age PWIM, who comprise the most common functional physical disability group in the US.

2. Methods

2.1. Search strategy

We used the PRISMA guidelines for systematic reviews to inform our methods for this study (Page et al., 2021). A team representing the disciplines of dietetics, occupational therapy, physical therapy, public health, and library sciences selected the search terms. Since the CDC defines mobility disability as a condition involving serious difficulty walking or climbing stairs (Stevens et al., 2016) rather than using specific medical diagnoses, we developed our query to align with this definition. Example search terms used to capture studies of PWIM included mobility limitation, cane, walker, and wheelchair. The specific search terms used for the full query are provided in Supplementary File 1. A librarian (KP) with experience in systematic review methods conducted the database searches, which included MeSH headings, subheadings, and keywords that the review team compiled. The team queried Ovid MEDLINE, Web of Science, Scopus, and Embase via Ovid. We limited our search to studies that were published in peer-reviewed journals between January 1, 1990 and April 25, 2021, included humans living in the US or Canada, and that were available in English.

2.2. Selection criteria

We included studies for this review if they: 1) included adults primarily aged 18–64, 2) exclusively or primarily comprised individuals living with a mobility-related physical disability, 3) collected data using one or more measures of dietary intake, and 4) included one or more modifiable barrier and/or facilitator measures of dietary intake or eating behaviors. Food insecurity and food access measures were classified as determinants of intake rather than as measures of dietary intake for this review. We also included qualitative studies exploring healthy eating barriers and facilitators in this population. Studies were excluded if they: 1) involved children 17 years and younger or exclusively focused on older individuals aged 65 years and older; 2) exclusively or primarily comprised individuals living with disabilities that are associated with mental, cognitive, or sensory impairment; 3) represented institutionalized, hospitalized, or artificially-fed populations; 4) comprised exclusively of elite athletes (who are not representative of the general PWIM population); 5) presented study protocols without data; 6) were opinion-based articles; 7) involved multi-component health behavior intervention trials where dietary change was not the exclusive focus of the study and the effects of barriers and facilitators to a healthy diet could not be clearly delineated; or 8) were conducted outside of Canada or US.

2.3. Screening process

We used Rayyan software (Ouzzani et al., 2016) to remove duplicate articles and screen articles for potential selection based on the inclusion and exclusion criteria. At least two members of the research team (MSW, ARD, CML, NSP, MEJ) independently reviewed each study's title and abstract for potential eligibility. At least two members then independently reviewed the full-text copy of each selected article to confirm the study's eligibility for inclusion. Disagreements about a study's suitability for inclusion in the review were resolved through mutual consensus.

2.4. Data extraction and narrative synthesis

Extracted data included study title, authors, publication year, country, study characteristics (design, sampling methods, sample size), participant demographics (gender, age, race), mobility-related disabilities represented, primary nutrition outcomes, and variables used to measure barriers and facilitators. Consistent with a previous systematic review of barriers and facilitators to physical activity for PWD (Shields et al., 2012), we classified facilitators and barriers on one of four levels: individual, social, environmental, and policy or program. Within each level, we then classified facilitators and barriers into distinct themes and subthemes for descriptive reporting purposes. Due to the wide variety of barriers, facilitators, and dietary measures used we did not conduct any meta-analyses.

2.5. Quality assessment

Guided by the critical review guidelines developed by the McMaster University Occupational Therapy Evidence-Based Practice Research Group (Law et al., 1998; Letts et al., 2007), and the study rating criteria developed by Imms (Imms, 2008) and further used by Shields et al. (Shields et al., 2012), two members of the research team (MSW and ARD) independently evaluated the quality of each study. Quantitative study ratings were based on three criteria of rigor: 1) study's sampling approach, 2) use of validated and reliable measures, and 3) analytic approach. This review did not include an additional bias assessment of quantitative studies. We rated qualitative studies based on four criteria of trustworthiness: 1) credibility, 2) transferability, 3) dependability, and 4) confirmability.

3. Results

The initial search strategy produced 2378 duplicated studies that were combined with five articles from outside sources. Once duplicates were removed, 2275 articles remained for further screening (Fig. 1). Of these, 46 studies were selected on the basis of study title and abstract for further consideration via full-text review. After obtaining the full text,

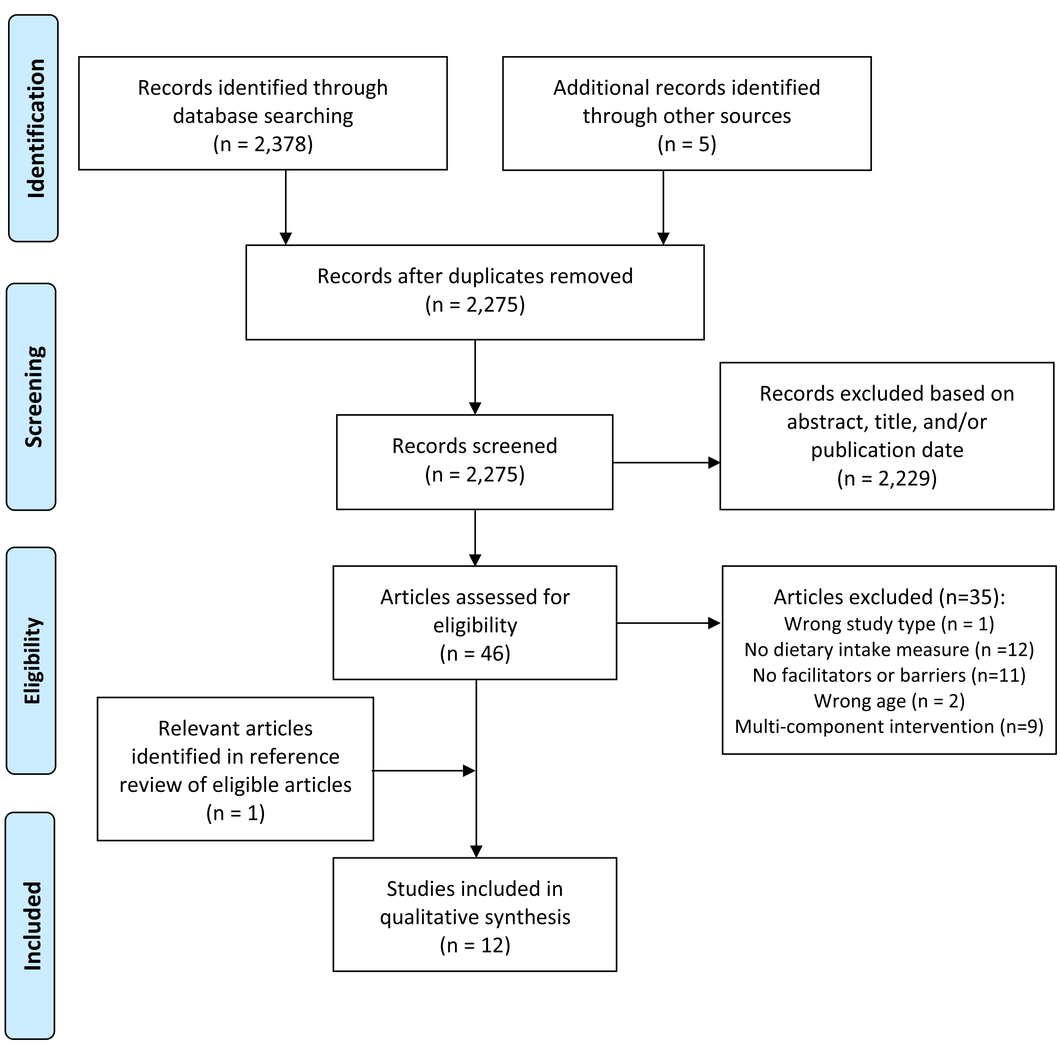

Fig. 1. PRISMA flow chart of study selection process for studies included in the systematic review.

six studies (Nosek et al., 2004; Tomey et al., 2005; Nosek et al., 2006; Knight et al., 2011; Plow et al., 2012; Plow et al., 2017) from the search results and all five articles (Stuifbergen and Becker, 1994; Hall et al., 2003; Odette et al., 2003; Manns and Chad, 2001; Plow and Finlayson, 2012; Bailey et al., 2018) from outside sources were retained for inclusion in the final sample. We additionally screened reference lists of these included articles, which resulted in one additional article (Hall et al., 2003). The remaining studies selected for full-text screening were not included in the final review due to no dietary intake measure (n = 12), wrong study type (n = 1), no facilitators or barriers (n = 11), wrong age (n = 2), or being a multi-component intervention study (n = 9).

Of the 12 studies selected for final inclusion, six were quantitative (Tomey et al., 2005; Nosek et al., 2006; Knight et al., 2011; Plow et al., 2012; Stuifbergen and Becker, 1994; Hall et al., 2003), five were qualitative (Nosek et al., 2004; Odette et al., 2003; Manns and Chad, 2001; Plow and Finlayson, 2012; Bailey et al., 2018), and one was mixed-methods (Plow et al., 2017). All quantitative studies were cross-sectional in their design, with one of these limited to descriptive statistics only (Hall et al., 2003) and the remaining statistically testing specific associations between facilitators or barriers and dietary intake (Tomey et al., 2005; Nosek et al., 2006; Plow et al., 2012; Stuifbergen and Becker, 1994). Multiple physical disabilities were represented across studies, with nearly half of study samples including individuals with multiple disabilities (Nosek et al., 2004; Nosek et al., 2006; Stuifbergen and Becker, 1994; Hall et al., 2003; Odette et al., 2003), and the remaining focusing on specific disabling disease states or disabilities including stroke (Plow et al., 2017), spinal cord injuries (Tomey et al., 2005; Knight et al., 2011; Manns and Chad, 2001; Bailey et al., 2018) and multiple sclerosis (Plow et al., 2012; Plow and Finlayson, 2012). Gender-specific studies more commonly focused on women (Nosek et al., 2004; Nosek et al., 2006; Hall et al., 2003; Odette et al., 2003) than men (Tomey et al., 2005). Participants were primarily white (66.7% - 98.5%) in the majority of studies, with the exception of one study involving men with spinal cord injuries (Tomey et al., 2005). Three studies did not provide race or ethnicity information (Hall et al., 2003; Manns and Chad, 2001; Bailey et al., 2018). Results of extracted data and quality assessment for each study are summarized in Table 1. The scientific rigor of most quantitative studies varied widely, with some being limited to a two-star rating due to minimal testing of associations between independent (i.e., potential facilitator or barrier) and dependent (i.e., dietary intake) variables of interest. In contrast, most qualitative studies had strong designs including rich descriptions of the lived experience, although most of these studies focused more broadly on healthy living, rather than exclusively on healthy eating.

3.1. Measures of healthy eating

With only one exception (Hall et al., 2003), all quantitative studies provided clear details on dietary measures used. Eating behavioral measures included Health Promoting Lifestyle Profile (Stuifbergen and Becker, 1994) and a nutritional behaviors scale developed by Nosek et al. (2006) (Nosek et al., 2006; Plow et al., 2012). Other measures of dietary intake were less-frequent, included 24-h food recall (Knight et al., 2011) and food frequency questionnaires (Tomey et al., 2005). In contrast, all but one qualitative study defined healthy eating as a discrete behavior in the interview guide or used it as one of several examples of health promotion behaviors. The remaining study evaluated facilitators and barriers to ongoing adherence to an anti-inflammatory elimination diet following the end of the intervention period (Bailey et al., 2018). The only mixed-methods study included in this review used the nutritional behaviors scale developed by Nosek et al. (2006) in its questionnaire, which was complemented by open-ended questions during focus groups and individual interviews about facilitators and barriers to nutrition and other health behaviors (Plow et al., 2017).

3.2. Barriers to healthy eating

All studies described one or more barriers to healthy eating, which are summarized in Table 2.

3.2.1. Personal

In one well-designed, quantitative study of women with physical disabilities by Nosek et al. (2006), two barriers remained predictive of the nutritional behaviors scale in the final adjusted model: greater need for assistance with ADLs and longer time spent in "productive" activities (i.e., work, school, parenting, housekeeping, home maintenance, recreation, self-improvement) (Nosek et al., 2006). Of these two barrier variables, need for assistance with ADLs overwhelmingly contributed the most explanatory power in the final adjusted model. In another well-designed mixed methods study of stroke survivors, reduced ADLs and reduced hand function were moderately correlated with eating habits in bivariate analyses (Plow et al., 2017). These quantitative associations were also identified in focus groups and interviews as contributors to reduced autonomy over food choice. For example, reduced hand function was described as one reason for eating unhealthy fried finger foods to avoid the embarrassment and difficulties associated with eating healthier foods that require a fork, such as a salad (Plow et al., 2017). Three other studies also reinforced this theme, including reduced hand function (Manns and Chad, 2001; Plow and Finlayson, 2012), which can limit diet to those foods and utensils that one can manipulate (Nosek et al., 2004). Limitations in ADLs and IADLs influenced food choices in additional ways, particularly when one depends upon others for food shopping or preparation (Hall et al., 2003), and also when disability affects chewing or swallowing abilities (Nosek et al., 2004; Hall et al., 2003).

Many other direct and indirect barriers to healthy eating were described among the reviewed studies, although associations for these barriers were not tested in adjusted statistical models, became non-significant after statistical adjustment, or were qualitatively described. Example physical limitation barriers included low energy (Hall et al., 2003; Odette et al., 2003), fatigue (Nosek et al., 2004; Plow et al., 2017; Plow and Finlayson, 2012) or weakness (Nosek et al., 2004), chronic pain (Plow et al., 2017), limited mobility (Plow et al., 2017; Plow and Finlayson, 2012), and difficulty standing while cooking (Plow and Finlayson, 2012) that hindered grocery shopping and/or meal preparation. Plow et al. (2012) elicited how fatigue combined with limited mobility increase susceptibility to choosing meals from unhealthy, convenience food environments (Plow and Finlayson, 2012). Psychological barriers included those related to motivation, such as lack of desire or will power (Hall et al., 2003), including after the initial dietary intervention period ends (Bailey et al., 2018), as well as negative emotions, including stress (Nosek et al., 2004), and negative mindsets, including perceived hopelessness or helplessness in achieving good health (internalized devaluation) (Nosek et al., 2004). Knowledge barriers were described far less in studies, and included limited meal planning and preparation knowledge (Bailey et al., 2018) and difficulty understanding how to follow a healthy diet (Plow and Finlayson, 2012).

Time constraints were identified in multiple studies (Nosek et al., 2006; Plow et al., 2017; Hall et al., 2003; Manns and Chad, 2001; Plow and Finlayson, 2012). In the context of daily routine, one qualitative study elicited how much of the day is pre-determined and must be well-planned in order to accomplish daily tasks (Manns and Chad, 2001), implying greater difficulty in taking on a new healthy behavior change. A similar theme was described by Plow et al. (2017) where the additional time required to complete ordinary daily tasks can make it more difficult to prioritize and integrate new health behaviors. However, this study also identified stroke as a tipping point for radical dietary behavior change, either for better or for worse (Plow et al., 2017).

Finally, the associations between other health behaviors and diet were infrequently explored. Smoking was identified as a potential barrier to healthy eating in only one study of men with paraplegia (Tomey

Table 1
Summary of included studies.

Author (year)	Country	Quality assessment	Study design		Study measures		Participant details			
			Study design	Sample size	Dietary	Barriers/facilitators	Average age (SD)	Race/ Ethnicity	Sex	Disabilities represented
Quantitative										
Stuifbergen and Becker (1994)	US	Sample*** Measures*** Analysis***	Cross-sectional survey, statewide convenience sample (Texas), correlational including hierarchical multiple regression	117	Health promoting lifestyle profile (HPLP) nutrition subscale	17-item general self-efficacy subscale of the self-efficacy scale; 28-item self-rated abilities for health practices scale (measures specific self-efficacy subscales to perform health-promoting practices in the domains of nutrition, physical activity/exercise, psychological well-being, and responsible health practices); 4-item health self-rating scale; 18-item barriers to health promoting activities for disabled persons scale	44.1 years (SD not reported)	88% white	Males (n = 63); Females (n = 54)	Neuromuscular impairments (58%), neurocognitive disabilities (10%), chronic conditions (15%), hearing impaired (8%), visually impaired (5%); mechanical assistance required for day-to-day activities (46%)
Hall et al. (2003)	Canada	Sample*** Measures* Analysis*	Cross-sectional survey, community-based convenience sample, descriptive only	1096	Not specified other than "nutrition preventive health practices"	Researcher-developed list of 16 barriers to improving eating habits and 12 facilitators for improving eating habits	48.9 years (14.4)	Not reported	Women only	Disabilities not specified: Majority required personal assistance for ADLs (n = 684) and used assistive devices (n = 878)
Tomey et al. (2005)	US	Sample*** Measures*** Analysis**	Cross-sectional survey, medical records recruitment sample (Chicago, IL), correlational	95	Block food frequency questionnaire modified to reflect past 7 days; healthy eating index-f calculated to assess dietary quality	Nutrition knowledge questionnaire developed by Parmenter and Wardle; 20-item Center for Epidemiological Studies Depression (CES—D) scale; living alone	38.3 years (10.3)	39% white; 41.1% black; 19.9% Latino; 2.1% Asian	Men only	Paraplegia with T1–4 (14.0%), T5–12 (70.9%), or L1 or below (15.1%) spinal cord injury
Nosek et al. (2006)	US	Sample*** Measures*** Analysis***	Cross-sectional survey, national convenience sample, correlational including regression	386	Researcher-developed, unidimensional nutritional behavior scale (0–10 points) based on frequency of 5 types of eating behaviors: Making good food choices, eating ≥5 servings of fruits and vegetables a day, limiting fat intake, reading labels, and eating regularly	Impairment block: Disability type, duration, and pain; Functioning block: Need for assistance, mobility, physical functioning, and physical role limitations; Psychological block: 5-item mental health, 4-item vitality, and 3-item role functioning-emotional subscales of the SF-36; author-developed nutrition self-efficacy scale (eat well-balanced diet, follow diet recommended by doctor, select foods for weight maintenance, select appropriate vitamins/ supplements, label reading); physical activity self-efficacy scale; social block: Occupation and social integration	47.1 years (10.1)	80.8% white	Women only	Joint and connective tissue disease (40.7%); neuromuscular disease/post-polio (19.7%); spinal cord injury/spina bifida (15.5%); multiple sclerosis (11.4%); stoke, traumatic brain injury (6.5%); cerebral palsy (6.2%) Physical functioning subscale score described as well below US norms for women (M = 23.4, SD = 24.2 vs. M = 81.5, SD = 24.6).

(continued on next page)

Table 1 (*continued*)

Author (year)	Country	Quality assessment	Study design		Study measures		Participant details			
			Study design	Sample size	Dietary	Barriers/facilitators	Average age (SD)	Race/ Ethnicity	Sex	Disabilities represented
						subscales of the CHART short form, 2-item social functioning subscale SF-36, and the 20-item MOS social support survey; Environmental block: Help with ADLs (yes/ no) and adequacy of needed help				
Knight et al. (2011)	Canada	Sample** Measures*** Analysis***	Cross-sectional survey recruited from the study of health and activity in people with SCI (SHAPESCI); correlational including logistic regression	75	24-h food recall analyzed using EATracker to estimate adherence to 4 food groups (vegetables and fruit; grains, milk and alternatives, meat and alternatives)	Physical activity Recall assessment for persons with SCI (PARA-SCI) – Only leisure-time physical activity reported	42.4 years (11.8)	94.7% white	Men primarily (n = 61)	Paraplegia (n = 37); tetraplegia (n = 38) All had to use a wheelchair at home
Plow et al. (2012)	North America	Sample*** Measures*** Analysis***	Cross sectional online survey, sampled from patient registry, correlational including logistic regression	292	Nosek et al. (2006) scale based on frequency of 5 types of eating behaviors: making good food choices, eating ≥5 servings of fruits and vegetables a day, limiting fat intake, reading labels, and eating regularly	Impairments: 12-item Symptoms of Multiple Sclerosis Scale; Number of co-morbidities; BMI, and type of MS; Activity limitations: Self-Reported Functional Measure (SRFM) (perceived abilities for daily activities), Perceived Deficits Questionnaire (PDQ) (cognitive impairments), and the MS Walking Scale (mobility tasks); Nutritional self-efficacy scale by Nosek et al. (2006); Life Orientation Test-Revised (optimistic or pessimistic disposition); Cognitive Symptom Management questionnaire (cognitive/emotional management)	Not reported for overall sample; M = 51.6 (10.4) for group with lower nutritional behavioral score M = 54.0 (9.3) for group with higher nutritional score	98.5% white	Males (n = 64); Females (n = 252)	Multiple sclerosis (MS) only; 59.7% used mobility aid
Qualitative										
Manns and Chad (2001)	Canada	Credibility*** transferability*** dependability*** confirmability***	Semi-structured interviews; purposive sampling from Canadian paraplegic association database	15	*No question pertaining to diet specifically as the study focused on quality-of-life broadly*	Series of questions pertaining to how SCI has affected quality of life	22–63 years (SD not reported)	Not reported	Females (n = 6); males (n = 9)	Quadriplegia (n = 7); paraplegia (n = 8)
Odette et al. (2003)	Canada	Credibility*** transferability*** dependability** confirmability***	Focus groups;	45	Discussion guide defined nutrition as a wellness activity	Discussion guide centered on the participants' experiences of prevention from engaging in desired wellness activities, including nutrition	43 years (SD not reported)	Canadian (n = 34); south Asian (n = 8); African descent (n = 2)	Women only	Of the 45 women, 51 physical disabilities were reported, such as rheumatoid and osteoarthritis, cerebral palsy, multiple sclerosis, stroke, polio, musculoskeletal problems; 11 hearing disabilities,

(*continued on next page*)

Table 1 (*continued*)

Author (year)	Country	Quality assessment	Study design: Study design	Study design: Sample size	Study measures: Dietary	Study measures: Barriers/facilitators	Participant details: Average age (SD)	Participant details: Race/Ethnicity	Participant details: Sex	Participant details: Disabilities represented
										and 7 visual disabilities
Nosek et al. (2004)	US	Credibility*** transferability*** dependability*** confirmability***	Interviews and focus group; purposive sampling from Houston/Harris County, TX area from disability-related service organizations	18	Interview schedule included questions about diet (specific question not given)	"What do you do to maintain physical and emotional wellness?"	41.4 years - focus group; 46.0 years - individual interviews (SD not reported)	White (n = 12); Black (n = 4); Latino (n = 1); American Indian (n = 2)	Women only	Joint and connective tissue disorder (n = 3); neuromuscular disorder (n = 6); spinal cord injury (n = 6), post-polio syndrome (n = 2); cerebral palsy (n = 1); severe limitations related to disability (n = 12)
Plow et al. (2012)	US	Credibility** transferability*** dependability*** confirmability***	Participants from previous study living in the Chicago, IL area	8	Interview schedule emphasized multiple aspects of diet, including dietary/nutritional habits; nutritional intake, meal/food choices, healthy eating	Example open-ended questions included, "in general, what do you think influences your meal/food choice?" "what barriers do you experience in trying to eat healthy?" "discuss how confident you are in making healthy food choices."	47 years (SD not reported); range 29–58 years	White (n = 4); Hispanic or Latino (n = 2); Black (n = 2)	Women (n = 6) Men (n = 2)	Individuals with MS who all used a mobility aide (i.e., cane, walker, or wheelchair)
Bailey et al. (2018)	Canada	Credibility** transferability*** dependability*** confirmability***	Interviews and focus group	6	Interview schedule contextualized to following an anti-inflammatory diet	16-item interview guide covered perceived benefits, facilitators, and barriers	Range 23–68 years	Not reported	Men (n = 3) Women (n = 3)	Spinal cord injury only (one-year post 3-month anti-inflammatory diet intervention study)
Mixed methods										
Plow et al. (2017)	US	Sample** Measures** Analysis** Credibility*** transferability*** dependability*** confirmability***	Mixed methods including standardized survey and semi-structured qualitative focus groups with subsequent one-to-one phone interviews with participants	25	Nosek et al. (2006) scale based on frequency of 5 types of eating behaviors: making good food choices, eating ≥5 servings of fruits and vegetables a day, limiting fat intake, reading labels, and eating regularly	Survey: 16-item stroke impact scale to measure physical function (ADL, mobility, and hand function limitations) Focus groups: Motivators for and barriers to engaging in nutrition; perceived interrelationships between physical activity, nutrition, and sleep Interviews: Attitudes, knowledge, confidence, outcome expectations, problem-solving strategies, and perceived barriers and facilitators to nutrition, physical activity, and sleep	64.1 years (SD not reported)	20% racial minority	Males (n = 13); females (n = 12)	Stroke survivors; cane use (n = 12); walker use (n = 10); wheelchair use (n = 7)

Quality assessment: *no evidence; ** some evidence or unclear reporting, ***evidence of study meeting criterion.

et al., 2005). In another study, poor sleep was not significantly associated with diet, but qualitatively was described as a contributor to poor eating due to its effects on other barriers, such as chronic pain and fatigue (Plow et al., 2017). The association between higher BMI and poor dietary intake was mixed across two studies, with a significant relationship among those with MS (Plow et al., 2012), but not stroke history (Plow et al., 2017). One study among those with a spinal cord injury found the highest level of leisure-time PA to be associated with not meeting daily eating guidelines for the meat and alternatives food group, but not for any other food groups in multiple regression analysis (Knight et al., 2011).

3.3. Social

Only one study tested statistical associations between social barriers and dietary intake. Specifically, those who reported an inability to engage in social activities due to poor health were significantly less likely to achieve healthy eating behaviors in the bivariate analysis;

however, this association became non-significant in the final adjusted model (Nosek et al., 2006). In three other qualitative studies, the limited knowledge (Odette et al., 2003) and unhealthy food preferences (Nosek et al., 2004) of personal aids or family members reduced nutritional autonomy (Plow and Finlayson, 2012), especially for those individuals who required assistance in grocery shopping or meal preparation.

3.4. Environmental

Four of the five dimensions of the food environment (Caspi et al., 2012) were collectively described in one quantitative (Hall et al., 2003) and three qualitative studies (Odette et al., 2003; Plow and Finlayson, 2012; Bailey et al., 2018). Neither quantitative study tested the statistical associations between these dimensions and dietary intake. These dimensions included unaffordability of healthy foods in stores (Hall et al., 2003), inaccessibility of stores (Hall et al., 2003), poor accommodation inside stores for shoppers with physical disabilities (Odette et al., 2003), such as difficulty maneuvering stores with a scooter or walker (Plow and Finlayson, 2012), and availability of high calorie or unhealthy foods at social gatherings (Bailey et al., 2018). Transportation barriers were described as a major contributor to poor access, including travel to and from grocery stores, and particularly the additional burden of carrying groceries home (Odette et al., 2003; Plow and Finlayson, 2012). The remaining dimension of the food environment, acceptability, which includes quality and selection of local foods, was not described in any of the studies.

3.5. Policy/Program

The current structure of benefits programs was identified as a barrier in three studies, including disability benefits providing inadequate income (Hall et al., 2003) to be able to afford a healthy diet, particularly fresh fruits and vegetables (Odette et al., 2003). Inadequacy of in-home care services, i.e., having to choose between assistance with grocery shopping or meal preparation, were described as a barrier in multiple studies (Hall et al., 2003; Odette et al., 2003), and in one study, this service gap resulted in missed meals (Nosek et al., 2004). For those accessing charitable food programs, the amount of food provided may not be adequate to fill gaps in food supply (Hall et al., 2003). In addition to disability benefits programs, barriers within the healthcare system included lack of provider empathy and proper training for dietary counseling in the context of disabilities (Nosek et al., 2004), infrequent referrals to dietitians or virtually absent conversations from providers about healthy eating (Plow et al., 2017; Plow and Finlayson, 2012), and lack of coverage for preventive health services (Nosek et al., 2004). Health information access was further limited by existing programs not offering tailored support for women with disabilities, particularly those from minority or low-income backgrounds (Nosek et al., 2004), or who required information in alternative formats (Hall et al., 2003).

3.6. Facilitators to healthy eating

Eleven of the 12 studies described one or more facilitators to healthy eating (Table 3).

3.6.1. Personal

Nosek et al. (2006) identified three predictive facilitators to healthy nutrition behaviors in women with physical disabilities in their final adjusted regression model: better mobility, higher nutrition self-efficacy, and higher vitality (energy-level) (Nosek et al., 2006). Of these, nutrition self-efficacy overwhelmingly contributed the most explanatory power in the model among all facilitators. In another study of men and women with various physical disabilities, those of female sex and higher self-rated nutrition ability had higher nutrition profile scores in the adjusted regression model (Stuifbergen and Becker, 1994). Among a mixed-sex sample of individuals with multiple sclerosis, nutritional self-efficacy, physical activity, and communication with physicians remained significant predictors of the nutritional behaviors scale after adjustment (Plow et al., 2012).

Many potential facilitators were identified in remaining studies, although associations were either not tested using adjusted statistical models or became non-significant after statistical adjustment. Modifiable factors included nutrition knowledge (Tomey et al., 2005), various types of health-related self-efficacy (Nosek et al., 2006; Stuifbergen and Becker, 1994), and perceived value of healthy eating for physical well-being and quality of life (Manns and Chad, 2001). Among the qualitative studies, personal autonomy over meal choice (Bailey et al., 2018) and experience of health benefits gained (Bailey et al., 2018) fostered adherence to healthy diets.

3.6.2. Social

Within the social level of influence, three qualitative and one quantitative studies described facilitators of healthy eating. The quantitative study described the desire for assistance with grocery shopping (Hall et al., 2003), with the other two qualitative studies eliciting the benefits of making explicit shopping lists for personal aids (Nosek et al., 2004) or family members (Plow and Finlayson, 2012). A related qualitative theme was ensuring sufficient support at mealtimes, including instructing attendants how to cook according to dietary needs and preferences (Nosek et al., 2004), with the quantitative study identifying the benefit of having someone to help with feeding (Hall et al., 2003). Finally, peer support in the forms of information sharing (Bailey et al., 2018) and motivation (Bailey et al., 2018), as well as family support (Plow and Finlayson, 2012; Bailey et al., 2018), was also described.

3.6.3. Environmental

Studies in the environmental facilitators domain were very limited. Only one study identified more accessible grocery stores (Hall et al., 2003) as a facilitator for healthy eating, but no further details were provided to identify the dimension of accessibility being referenced, nor was the association between improved access and dietary intake tested. Another study described intentional modifications made by individuals to their home food environments to promote healthy food choices (Plow et al., 2017), while a separate study elicited the benefits of re-organizing or remodeling a kitchen to better accommodate walker use during meal preparation (Plow and Finlayson, 2012).

3.6.4. Policy/Program

Only one descriptive study listed two explicit recommended changes for disability benefits. These recommended changes included improving the level of income benefits available through disability pensions to cover food costs (Hall et al., 2003), as well as increasing the total amount of time provided by in-home care attendants to ensure adequate grocery shopping and cooking time (Hall et al., 2003). This same study also described several services to improve eating habits. These services included home delivered food programs (Hall et al., 2003), food box programs that provide food in single servings (Hall et al., 2003), and food banks providing fresh fruits and vegetables (Hall et al., 2003). Another qualitative study provided an example within the food programs theme of farm-to-consumer purchasing programs as a source of lower-cost produce (Odette et al., 2003). Additionally, accessible and cheap cooking classes, local community center classes, and making nutrition education available in alternate formats were identified as potential strategies for improving nutrition education programs (Hall et al., 2003). Finally, one mixed-methods study qualitatively described the role of provider counseling as influential for healthy eating change, especially when presented as a possible alternative to medications for patients recovering from stroke (Plow et al., 2017).

Table 2
Summary of barriers to healthy eating among people with impaired mobility across reviewed studies.

Personal	Social	Environment	Policy/Prog
Physical limitations ■Energy: Too tired to cook (Hall et al., 2003); Fatigue and weakness (Nosek et al., 2004); limited physical energy to purchase and cook nutritious meals (Odette et al., 2003); fatigue (Plow et al., 2017; Plow and Finlayson, 2012) ■Mobility and weakness: ADL limitations (Plow et al., 2017); hand function (Plow et al., 2017; Manns and Chad, 2001; Plow and Finlayson, 2012); being limited by foods and utensils that can be manipulated (Odette et al., 2003); too hard to go shopping (Hall et al., 2003; Plow and Finlayson, 2012); difficulty standing while cooking (Plow and Finlayson, 2012) ■Chronic pain (Plow et al., 2017) ■Difficulty chewing and swallowing: Fruits and vegetables (Hall et al., 2003); weakened muscles that make it difficult to chew (Nosek et al., 2004) ■Dependence: Assistance with ADLs (Nosek et al., 2006); not enough assistance while shopping (Hall et al., 2003) *Time constraints* ■Too busy (Hall et al., 2003) ■Time spent in "productive" activities (i.e., work, school, parenting, housekeeping, home maintenance, recreation, self-improvement) (Nosek et al., 2006; Plow and Finlayson, 2012) *Daily routine* ■Days are pre-determined (Manns and Chad, 2001) *Financial* ■Overall food budget: Lower income (Tomey et al., 2005) ■Healthy food costs: Organic foods/health foods too expensive (Hall et al., 2003); nutritious foods too expensive (Hall et al., 2003); healthy food cost (Odette et al., 2003); intervention diet too expensive (Bailey et al., 2018) ■Prepared food costs: Expense of eating out for those with limited options for preparing meals at home (Nosek et al., 2004) *Psychological* ■Motivation: Lack of desire or will power (Hall et al., 2003), including after intervention period ends (Bailey et al., 2018) ■Hopelessness: Perceived hopelessness or helplessness in achieving good health (internalized devaluation) (Nosek et al., 2004) ■Negative emotions: Stress (Nosek et al., 2004) ■Food cravings (Plow and Finlayson, 2012) *Limited Knowledge & Goal-Setting* ■Limited meal planning and preparation (Bailey et al., 2018) ■Difficulty understanding how to follow a healthy diet (Plow and Finlayson, 2012) *Health risks & behaviors* ■Smoking status (Tomey et al., 2005) ■Higher BMI (Plow et al., 2012) ■Higher leisure time physical activity (adherence to meat intake goals only) (Knight et al., 2011) *Demographics* ■Lower education (Tomey et al., 2005) ■Male sex (Plow et al., 2012) ■Living alone (Tomey et al., 2005)	*Social influence* ■Other's unhealthy eating habits: Friends and family encourage one to "cheat" (Bailey et al., 2018) *Personal aids & family caregivers* ■Knowledge: Personal assistants not being able to identify requested vegetables during shopping trips (Odette et al., 2003) ■Food preferences: Little control over food choices (reduced nutritional autonomy (Plow and Finlayson, 2012)) due to family member or attendant food preferences (Nosek et al., 2004) *Ability to socialize* ■Health interference with social activities: Lower social functioning score (Nosek et al., 2006)	*Food environment* ■Affordability: Local food stores too expensive (Hall et al., 2003) ■Accessibility: Limited transportation to grocery stores (Odette et al., 2003; Plow and Finlayson, 2012); local food stores not physically accessible (Hall et al., 2003); physical access after shopping, including carrying grocery bags home (Odette et al., 2003) ■Accommodation: Physical access within stores, including elevated store shelving (Odette et al., 2003); difficulty maneuvering store with a scooter or walker (Plow and Finlayson, 2012) ■Availability: Unhealthy food at social gatherings (Bailey et al., 2018)	*Benefits programs* ■Income: Government disability pension is not enough (Hall et al., 2003) "system" benefits not being adequate for a proper diet, including fresh fruits and vegetables (Odette et al., 2003) ■In-home care: Homemaker service programs only providing time for grocery shopping or meal preparation, but not both (Odette et al., 2003); not enough attendant time to shop/ prepare food (Hall et al., 2003); attendant does not have enough time to help with feeding (Hall et al., 2003); inadequate assistance resulting in missed meals (Nosek et al., 2004) *Food banks* ■Food bank does not provide adequate source for food (Hall et al., 2003) *Health system* ■Provider training: Doctor not asking about diet (Plow et al., 2017; Plow and Finlayson, 2012); ridicule about weight gain without advice on weight management (Nosek et al., 2004); healthcare systems and wellness programs that limit lack of information on the part of service providers about health in the context of disability and appropriate exercise and diet regimens within the limitations imposed by disability (Nosek et al., 2004) ■Service coverage: Lack of coverage for preventive health services (Nosek et al., 2004) *Information accessibility* ■No tailoring: Lack of outreach and public health education that is tailored to the situation of women with disabilities, particularly those from minority and low-income backgrounds (Nosek et al., 2004); nutritional info not available in alternate formats (Hall et al., 2003)

Table 3
Summary of facilitators to healthy eating among people with impaired mobility across reviewed studies.

Personal	Social	Environment	Policy/Prog
Physical ability ▪Energy: Vitality (energy-level) (Nosek et al., 2006) ▪Mobility: Better mobility (Nosek et al., 2006) ▪Autonomy: Over meal choice (Bailey et al., 2018) *Knowledge* ▪Nutrition knowledge (Tomey et al., 2005) *Psychological* ▪Self-efficacy: Nutrition (Nosek et al., 2006; Plow et al., 2012; Stuifbergen and Becker, 1994), psychological well-being (Stuifbergen and Becker, 1994), responsible health practices (Stuifbergen and Becker, 1994), exercise (Nosek et al., 2006; Stuifbergen and Becker, 1994), general self-efficacy (Stuifbergen and Becker, 1994) ▪Perceiving the value of healthy eating: Positive effects on mental and physical health benefits gained (Bailey et al., 2018), physical well-being and quality of life (Manns and Chad, 2001) ▪Less optimistic predisposition (Plow et al., 2012) ▪Emotional self-management (Plow et al., 2012) ▪Adherence strategies: Use of cheat days/meals when following strict diet (Krahn et al., 2015) *Health behaviors* ▪Higher physical activity (Plow et al., 2012) ▪Communication with physician (Plow et al., 2012) *Adaptive cooking tools* ▪Use of two forks instead of tongs to accommodate hand weakness (Plow and Finlayson, 2012) *Demographics* ▪Female (Plow et al., 2012; Stuifbergen and Becker, 1994)	*Personal aids & family caregivers* ▪Having someone assist with shopping (Hall et al., 2003) ▪Instructed guidance: Making shopping lists (Nosek et al., 2004; Knight et al., 2011; Plow and Finlayson, 2012) and instructing attendants on how to cook according to dietary needs and preferences (Nosek et al., 2004) ▪Feeding assistance: Having someone help with feeding (Hall et al., 2003) *Social support* ▪Peer support: Information sharing (Bailey et al., 2018) and Motivation (Bailey et al., 2018) ▪Family support of household members (Bailey et al., 2018)	*Food environment* ▪More accessible grocery stores (Hall et al., 2003) (dimension of accessibility not specified) ▪Availability: Intentionally placing fruits and vegetables in the kitchen and removing junk foods (Plow et al., 2017). ▪Accommodation: Remodeling kitchen to accommodate use of walker during meal preparation (Plow and Finlayson, 2012)	*Benefits programs* ▪Income increase disability pension to cover food costs (Hall et al., 2003) ▪In-home care: More attendant time allowed for shopping/cooking (Hall et al., 2003) *Food programs* ▪Home delivered: Programs that deliver food to home (Hall et al., 2003); "good food box" program containing fresh fruits and vegetables purchased by neighbors for sharing at lower cost from local farmers (Odette et al., 2003) ▪Single-serving: Food box programs with single servings (Hall et al., 2003) *Food banks* ▪Food banks that provide fresh fruits and vegetables (Hall et al., 2003) *Nutrition education* ▪Nutrition classes: Accessible and cheap cooking classes (Hall et al., 2003); local community center offers nutrition education (Hall et al., 2003) ▪Tailoring: Nutritional education available in alternate formats (Hall et al., 2003) *Health system* ▪Provider nutrition counseling (Plow et al., 2017)

4. Discussion

This systematic review is an important first step for informing the design of evidence-based strategies for building nutrition equity among PWIM. However, its findings reveal a wide chasm in the needed information to adequately bridge structural determinants of this nutrition divide. We sought to qualitatively synthesize barriers and facilitators for healthy eating among PWIM across four ecologic levels of influence: personal, social, food environment, and policy/program. Although we did find examples in each of these domains, the summary tables clearly reveal a tendency of studies to emphasize individual-level variables, which implies the burden of change should rest on the person. These findings underscore a major bias within neoliberal societies where affected individuals are defined by their personal impairments with little to no emphasis on structural disadvantages faced in their daily lives. This runs counterintuitive to a nutrition equity perspective, which requires researchers to study factors outside the individual that shape how society provides advantages or disadvantages to members of a community. Nonetheless, these published studies can still provide some insights into how disadvantages experienced by PWIM may be addressed through single- or multi-level interventions.

Several of the barriers identified in this study are not limited to PWIM, such as the role of limited income or limited knowledge as determinants of dietary intake. However, several barriers reveal inherent challenges to healthy eating recommendations among PWIM, particularly those that emphasize unprocessed foods, which generally require more preparation time, skill, and physical stamina compared to processed, convenience food items. This implies that in order for PWIM to benefit from a diet rich in fruits, vegetables, and other unprocessed foods, nutrition education and other food programs need to consider IADL limitations and adapt nutrition guidance to include healthy foods that are not only affordable, but easy and safe to prepare. Neither the most recent US Dietary Guidelines for Americans, 2020–2025 (*U.S. Department of Agriculture and U.S. Department of Health and Human Services*, 2020), nor its accompanying online meal planning resource, My Plate.gov (*MyPlate: Search Results for Disabilities*, 2021), provide any acknowledgment of the unique needs of PWD or illustrate how existing guidelines can be adaptively applied. In stark contrast, the Physical Activity Guidelines for Americans, Second Edition, provides a full chapter on exercise guidelines for PWD and other conditions that require guideline modification (U.S. Department of Health and Human Services, 2018).

Findings from this review also indicate the need for more studies on whether and how physical disability status may moderate the relationship between the built food environment and diet. For example, the fatigue associated with impaired mobility may increase the environmental influence of food swamps on dietary intake for PWIM. If this is so, then increasing availability of healthy, low-cost, ready-to-eat foods in these areas might be particularly beneficial for promoting equity for this population. Additionally, grocery stores, which are designed for able-bodied individuals, provide many obstacles to food procurement for people who shop seated or require a walker. The benefits of in-store shopping assistance, home-delivered groceries, and curbside pick-up programs for PWIM is unknown and should be explored. If beneficial, the costs of these programs should be offset through disability and food benefit programs.

This systematic review also supports the crucial role of personal aids and family members in determining the nutritional status of PWIM. Caregivers must have the knowledge to properly shop and prepare healthy foods for those PWIM who desire a healthier diet. However, we were unable to determine whether caregiver gender may moderate caregiver-patient food dynamics, which may be important, as limited research suggests that male spouse caregivers provide less support for positive health behaviors than female spouse caregivers (O'Brien, 1993).

One scoping review of nutrition interventions for PWD by King et al. (King et al., 2014) found that all interventions included only individual or small-group components that targeted education, skill-building, and self-efficacy to promote changes in dietary intake. The individual-level facilitators identified in this systematic review also support these areas as modifiable targets for healthy eating programs designed for PWIM. Although King et al. (King et al., 2014) concluded the outcomes of these interventions to be encouraging, the authors also underscored the need for community-based approaches in the participatory design of nutrition programs for PWD. This approach could help to further elicit and address social and environmental determinants of diet in future healthy eating programs for PWIM.

Our review has several strengths and limitations. Strengths include our use of an interprofessional review team and an expansive review process. Limitations include the possibility that our search strategy excluded studies that may provide further insights into our research question. We developed our search term query to align with the CDC definition of mobility disability as a condition involving serious difficulty walking, climbing stairs, or use of devices of ambulation. We did not include terms for all the types of medical diagnoses that may lead to mobility impairment, such as specific movement disorders and associated neurological disorders (e.g., Parkinson's disease and cerebral palsy), nor did we include chronic conditions where disease progression may result in physical disability (e.g., rheumatoid arthritis, osteoarthritis, and diabetes) as many individuals with these diagnoses may not yet meet criteria for mobility disability. Thus, we excluded studies involving barriers and facilitators to dietary intake pertaining to specific diagnoses when it was not clear that the majority of participants experienced mobility impairment or disability. We also acknowledge that some individuals with mobility disabilities depend on non-oral nutritional delivery systems, such as percutaneous endoscopic gastrostomy, and thus their life experiences are not represented in this study on barriers to oral feeding. PWIM may reside in assisted living or nursing facilities, which may present unique barriers to healthy food access and eating. These decisions may have resulted in a smaller pool of eligible studies.

Additionally, we limited our review to studies that focused on barriers and facilitators to dietary intake as opposed to predictors of food access and food security. Other important work explored aspects of the built environment on food access among individuals with physical disabilities (Huang et al., 2012), but questions remain on how this limited food access may contribute to dietary intake disparities. This is an important question since food insecurity disproportionately impacts PWD, including PWIM (Heflin et al., 2019). Food insecurity is recognized as an important predictor of dietary intake in adults and children (Hanson and Connor, 2014), but food insecurity has also been conceptualized as a core measure of nutritional status (Campbell, 1991). However, food insecurity's influence on eating behaviors varies based on the degree of food insecurity and the population being studied. Therefore, we did not include food insecurity as a surrogate measure of dietary intake. Many of the themes identified in our literature review, including limited income and unaffordability of healthy foods, support food insecurity as a potential barrier to dietary intake. The risk of food insecurity among PWD will also likely depend upon limitations in food-related ADL and IADLs (Juckett and Robinson, 2019). Finally, our review only included studies of working-age PWIM in the US and Canada, and thus more research is needed on older-age PWIM and those living outside these countries. Inclusion of countries with socially democratic policies might have provided greater insights into structural determinants of healthy eating, for example.

4.1. Implications for research and practice

It is clear that PWIM and other PWD likely experience disparities in healthy food access due to community and household-level food insecurity; however, more information is needed regarding how these factors influence dietary intake. Only one quantitative study in this review, which was limited to women, attempted to elucidate multi-level mechanisms linking individual and social determinants. This study fell short of including broader aspects of the built environment and policy-related barriers (Nosek et al., 2006). In contrast, several of the qualitative studies illuminated the importance of these issues. Future studies should include a balanced representation of community factors and other structural determinants of nutrition, rather than emphasizing personal and interpersonal components. We encourage researchers and health program planners to explore and consider these intersections, a recommendation that is consistent with the National Institute on Minority Health and Health Disparities (NIMHD) conceptual framework for reducing disparities in minority groups (NIMHD, 2017). Future nutrition intervention trials can benefit from the addition of disability status in its evaluation design using an equity in reporting framework, such as PROGRESS-Plus (O'Neill et al., 2014).

Personal aids and other caregivers of PWIM, who appear to play an important role in food access and meal preparation, may also be ideal recipients of nutrition interventions. Since these paraprofessionals often lack formal health training, further exploration of how to foster healthy shopping and meal preparation skills within this workforce to foster client nutritional autonomy (i.e., the "what, when, where, and with whom" of eating (Gerber, 2020)) is warranted. General health and wellness training programs for personal assistants have been well-received by both consumers and trainees (Schopp et al., 2007), and thus, could integrate an adaptive nutrition component.

Finally, our review also indicates that some healthcare providers, including physicians and dietitians, may benefit from additional training in nutrition assessment and nutrition prescriptions for PWIM, especially since physician counseling can help to initiate behavior change in adult populations (Pritchard et al., 1999). Surprisingly, we did not find any studies documenting the role of occupational therapy or impact of adaptive cooking tools on dietary intake or quality. Furthermore, despite the American Physical Therapy Association's position on the role of physical therapists in nutrition screening, education, and dietitian referral (*The Role of the Physical Therapist and the American Physical Therapy Association in Diet and Nutrition*, 2019), we did not find any studies describing how these processes may facilitate improved eating among PWIM. Both physical and occupational therapy care settings may provide a unique environment for the delivery of ongoing nutrition education and behavior change support throughout a patient's plan of care. More studies should be conducted to determine the success of these intervention plans in conjunction with rehabilitation. Interprofessional models are needed that integrate disciplines of dietetics, occupational therapy, and physical therapy with health promotion to support inclusive nutrition programs that consider the needs of PWIM. This combined expertise can also be used to advise food retailers, food banks, teaching kitchens, and other food programs about how their services can be more accommodating for PWIM.

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The authors have no conflicts of interest to disclose.

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Appendix A. Supplementary data

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