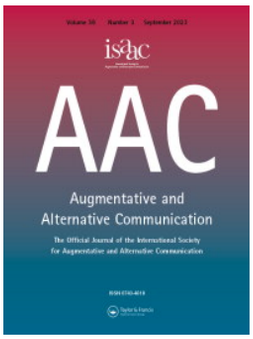

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RESEARCH ARTICLE

Barriers and facilitators to accommodations in the workplace for adults who use augmentative and alternative communication (AAC): a systematic review

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ABSTRACT

Workplace accommodations can reduce barriers to employment for people who use augmentative and alternative communication (AAC), however, the lack of accommodations continues to challenge participation in employment. This systematic review identified and analyzed barriers and facilitators to implementing workplace accommodations for adults (19 years and over) who use AAC. A systematic search of nine databases was conducted to identify relevant studies using the search terms "AAC" and "workplace accommodations" and variations of each term. Results were imported into Covidence. Seventeen studies met the inclusion criteria. Results were presented using the International Classification of Functioning, Disability, and Health (ICF) framework. The Oxford levels of evidence and Confidence in Evidence from Review of Qualitative Research (GRADE-CERQual) were used to assess the quality of the studies and confidence in findings, respectively. Environmental barriers related mainly to attitudes and technology, and personal barriers related to job qualifications, education, and work-related skills. A combination of facilitators such as personal strengths, access to technology, and supportive relationships contributed to successful implementation of accommodations. The findings of this review suggest that implementing workplace accommodations for adults who use AAC strategies is complex and further research is needed to advance practices and policies that support the implementation of workplace accommodations.

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Accommodation; augmentative and alternative communication; employment; systematic review

Employment is a significant life experience in adulthood and contributes to positive outcomes including subjective well-being, improved mental health, social status and financial independence (Jebb et al., 2020; Modini et al., 2016; van der Noordt et al., 2014). Given the significance and benefits of employment, the underrepresentation of people with disabilities in employment is a pressing issue. A study based on 27 countries by the Organization for Economic Co-operation and Development found that the average employment rate of working-age for people with a disability was 44% which is much lower in contrast to the employment rate of people without disabilities at 75% (World Health Organization & World Bank, 2011). Individuals with communication disabilities, however, face exceptionally lower employment rates, estimated as low as 14% (Blackstone, 1993 as cited in McNaughton & Bryen, 2002). Addressing the barriers to accessing employment can help to achieve equity in employment for people who use AAC.

Providing workplace accommodations is one approach that may help to address the discrepancy in employment rates between people with and without disabilities. The concept of reasonable accommodations in the workplace refers to adaptations and modifications to the work environment without undue burden to make employment equally accessible for people with disabilities (World Health Organization, 2011). For the purpose of this systematic review, workplace accommodation was operationally defined as any strategy, adjustment, or tool used at any stage of employment to allow a person who uses AAC to perform the duties of their job (Carleton University, n.d.; U.S. Department of Labor, n.d.). Accommodations may include adaptive technology, flexible work arrangements, task modifications, environmental modifications, and attendant services. While research focusing on the role of workplace accommodations for people who use AAC has been limited, research regarding people with disabilities more broadly in employment stresses the significance of accommodations. Anand and Sevak (2017) reported that over one third of people with a physical, sensory, and/or mental health related disability who were unemployed reported barriers that could be mitigated through accommodations. Implementing accommodations has been found to reduce social, physical, and attitudinal barriers to employment faced by people with disabilities (Lindsay et al., 2018; Padkapayeva et al., 2017; Solovieva & Walls, 2013). Employers have also reported multiple benefits to accommodations including retaining a qualified employee, improvement in

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productivity, and in coworker interactions (Solovieva et al., 2011). A systematic review by Nevala et al. (2015) reviewed the effectiveness of accommodations in employment for people with physical, sensory, mental, and cognitive disabilities. They found moderate evidence that certain accommodations, such as vocational counseling, flexible work schedules, and accessible transportation can help to maintain employment for employees with physical disabilities. The review also identified key factors that influence the work accommodation process which included employee self-advocacy and the support, attitudes, and knowledge of employers and colleagues. While this review focuses on the link between workplace accommodations and employment for people with disabilities, studies explicitly focused on employees with communication impairment were not included. Currently, there is no equivalent review for people who use AAC and therefore it is not well understood what factors impact workplace accommodations for people who use AAC. Additionally, individuals who use AAC may face distinct challenges in employment related to the significance of effective communication skills to employment success, access to and use of AAC in the workplace, limited job-related networks, and hiring processes dependent on interviews (Bryen et al., 2007; Carey et al., 2004). Previous case study reports have highlighted the implementation of accommodations in the workplace to support successful employment for adults who use AAC such as assistive technology (Murphy, 2005), on-the-job training (Odom & Upthegrove, 1997), and modified tasks (Lasker et al., 2005). The unique challenges that people who use AAC may face in employment could potentially be addressed with the appropriate accommodations however there is lack of research regarding the relationship between use of AAC and workplace accommodations and thus further research is greatly needed to inform accommodation processes. To further explore accommodation as a factor of employment for people who use AAC, it is imperative to study factors that influence the use of workplace accommodations (World Health Organization, 2001).

The research question defining this systematic review was: What are the barriers and facilitators to accommodating adults who use AAC in employment? For the purpose of this review, adults are 19 years and older as defined by the World Health Organization (2013). The specific objectives of this review were to (a) evaluate studies that included employment experiences of adults who use AAC, (b) identify and summarize the barriers and facilitators to provision and use of workplace accommodations for employees who use AAC, and (c) discuss the strengths and limitations of the current research evidence and identify implications for future practice and research.

Method

The systematic review was guided by the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). It was conducted by developing a search strategy and inclusion and exclusion criteria based on the research question, screening for eligible studies, extracting data, assessing confidence in findings, and conducting a framework analysis following a five-step process: familiarization, theme identification, indexing, charting and summarizing, and mapping and interpretation (Iliffe et al., 2015).

Search strategy

The comprehensive search strategy was developed by four reviewers and a health sciences librarian at the university. Nine electronic databases – Cumulated Index to Nursing and Allied Health Literature, Excerpta Medica Database, Engineering Village, Global Health, Health and Psychosocial Instruments (HAPI), Medical Literature Analysis and Retrieval System Online, Psychological Information Database, REHABDATA, and Web of Science – were searched using the academic search tool Omni, with the last search run on February 8th, 2021. The following search terms related to AAC, and workplace accommodations were identified:

1. AAC-related terms: ("AAC*.mp." OR "aided communication*.mp." OR "Alternative and Augmentative Communication*.mp." OR "assistive communication device*.mp." OR "augmentative and alternative communication*.mp." OR "communication aids for disabled*.mp." OR "communication aid*.mp." OR "complex communication need*.mp." "sign language*.mp." OR "speech generating device*.mp." OR "speech disab*.mp." OR "communication disab*.mp." OR "non-verbal communication*.mp." OR "multi modal communication*.mp." OR "voice output*.mp." OR "picture exchange*.mp.")
2. Workplace accommodations-related terms: ("employment*.mp." OR "job accommodat*.mp." OR "job*.mp." OR "workplace*.mp." OR "work accommodat*.mp." OR "vocation*.mp." OR "Rehabilitation, Vocational" OR "career*.mp." OR "internship*.mp.").

Complete search strategy available in Table S1, supplementary material.

Screening criteria of studies

Studies had to meet the following criteria: (a) original research published in peer-reviewed journals; (b) published in English up to February 2021; (c) explored the barriers and facilitators of workplace accommodations for adults who use AAC; (d) included the perspectives and experiences of employees who use AAC, employers, employment specialists, job developers, or job coaches; (e) employee participants were individuals who use AAC aged 19 years and older with accommodations in employment; and (f) focused on employment experiences which referred to seeking employment, being employed, or returning to work in paid employment, internships, or mandatory work programs. Studies were excluded, if they were: (a) about alternative or unpaid work placements (e.g., volunteer or sheltered workshop, training); (b) not fully accessible (e.g., only abstract was available);

(c) literature reviews, commentaries, conference abstracts, or presentations of preliminary results only; or (d) employee did not require the use of AAC.

Study selection

Search results were imported into the online systematic review management software Covidence (Covidence Systematic Review Software, 2021) and duplicates automatically removed. Initial eligibility screening was based on the titles and abstracts. Three pairs of reviewers independently reviewed between 670 and 680 title and abstracts and a fourth author acted as a third reviewer to resolve 59 conflicts by making a final decision. Cohen's Kappa was calculated for each pair of reviewers resulting in a mean of 0.51 or a moderate agreement among reviewers for title and abstract review. Subsequently, full-text studies were reviewed by three pairs of authors indicating "include" or "exclude" with each author independently reviewing between 26 and 42 articles. Fourteen conflicts were resolved by a third reviewer, one of the authors not involved in the initial text review, who independently made final decisions in nine instances. The remaining five conflicts were resolved through a discussion among four authors to reach a consensus. A mean agreement score of 0.46 was calculated using Cohen's Kappa, indicating moderate agreement among reviewers for the full text review. The moderate scores at both the title and abstract screening and full text review may have been reflective of the varied backgrounds and experiences of the authors, graduate students in rehabilitation science and engineering, with regards to research and AAC. Lastly, the authors manually reviewed the references of included studies to reveal additional sources.

Data extraction

The authors used a two-step data extraction process. First, two independent reviewers completed the Critical Review Form for Qualitative Studies for each article (Letts et al., 2007). Next, the authors summarized key data items in a table by: (a) author and country, (b) aim or purpose of the study, (c) method (study design and data collection), (d) participants (stakeholder, number of participants, age, gender, diagnosis), (e) findings (barriers and facilitators to employment accommodations), and (f) limitations. Table 1 and Table 2 provide a summary.

Quality assessment and risk of bias

The quality assessment was carried out by four graduate students under supervision of professors in Rehabilitation Science and Engineering with extended practice and research experience in the field of AAC. To determine the quality of evidence the four coauthors assessed each study using the Oxford levels of evidence (OCEBM Levels of Evidence Working Group, 2011). The Oxford levels of evidence provided a numerical rating that allowed for an early and quick comparison and summary of studies.

Following data analysis and the identification of major themes and associated subthemes, two coauthors assessed the confidence of the thematic findings using Grading of Recommendations Assessment, Development and Evaluation Confidence in the Evidence from Review of Qualitative Research (GRADE-CERQual) (Lewin et al., 2018). Authors used the data extracted and critical appraisal of each study from the Critical Review Form for Qualitative Studies (Letts et al., 2007) to inform the GRADE-CERQual assessment. The GRADE-CERQual is a tool specific to evaluating qualitative evidence to support use of evidence in decision making, such as informing policies or guidelines (Lewin et al., 2018). First, the coauthors collaboratively summarized each theme and subtheme previously identified in discussion with the wider team. Next, the same coauthors independently evaluated 50% of the findings presented as subthemes and acted as a second reviewer of the other 50% of the findings using the GRADE-CERQual Interactive Summary of Qualitative Findings (iSoQ) online tool (GRADE-CERQual Project Group, 2022). The review findings were assessed based on the methodological limitations, coherence, adequacy of data, and relevance of the studies contributing to each finding (Lewin et al., 2018). The result of the assessment was a rating of the overall confidence for each finding. Based on consensus between the coauthors, and as per the CERQual tool, each theme was finalized as either "high", "moderate", "low", or "very low".

Analysis

For each article, two independent reviewers extracted data relevant to the research question. The analysis involved three levels of inductive coding completed by four authors. First, four coauthors completed the initial coding and coded data as barrier or facilitator. The coauthors amalgamated the identified barriers and facilitators into a single chart. Next, the coauthors reviewed all barriers and facilitators found in the data and collated similar factors. Through discussion, the authors created a second level of codes to reflect the major clusters. At this stage, it was evident that the barriers and facilitators identified in the data were contextual factors which were subsequently mapped onto the the International Classification of Functioning Disability and Health (ICF) (World Health Organization, 2001). The ICF definition of environmental factors was used to capture external influences on accommodation, whereas personal factors referred to characteristics or factors specific to the individual employee who uses AAC. The authors met and reviewed the results of coding and organized the codes into personal or environmental codes until group consensus was reached. Next, the environmental codes were grouped into five subcategories of environmental factors corresponding to the ICF and one additional subcategory not captured in ICF. In addition, the authors developed five subcategories for personal factors (Figure S1, Supplementary materials). Finally, the authors engaged in another review of subcategories to ensure all data was represented and categories were finalized. Last, coauthors summarized into a table the results of the coding

Table 1. Summary of the single participant studies.

Author/Country	Aim/Purpose of the article	Method		AAC
		Qualitative design and data collection	Participant	
Isakson et al., 2006/US	To present an employment success story and inspire ideas to support others who use AAC. To provide information to help families and service providers support individuals who use AAC.	Unspecified	$N = 1$ (m) Age: 29 Dx: CP Stakeholder: employee	Aided-high tech
Lasker et al., 2005/US	To investigate the return-to-work experience of a professor using AAC post-stroke and student attitudes toward two different teaching approaches integrating AAC.	Case study survey, observation, feedback from students	$N = 1$ (f) Age: 53 Dx: aphasia post stroke Stakeholder: professor	Aided-high tech
Murphy, 2005/US	To present factors that supported integration of assistive technology in the workplace to accommodate an employee with multiple disabilities including employee and employer attitudes and employee's previous experiences.	Case study unspecified	$N = 1$ (m) Age: 25 Dx: CP Stakeholder: employee	Aided-high tech
Odom & Upthegrove, 1997/US	To explore an individual's experiences with communication-related interventions between ages 7–28 years and to highlight facilitators to successful employment for a 28-year-old male participant who uses high tech AAC.	Case study unspecified	$N = 1$ (m) Age: 29 Dx: CP Stakeholder: employee	Aided-high tech

Note: N: number of participants; m: male; f: female; R: range; Dx: diagnosis; CP: cerebral palsy; US: United States.

process, which consisted of 22 categories in total. Tables 4 and 5 present more details on the findings.

Results

Identification of relevant studies

Figure 1 illustrates the search from the nine databases, which yielded 1310 potentially relevant articles of which 301 duplicates were removed in Covidence. Of the 1009 articles reviewed during the title and abstract screening, 954 were excluded, leaving 55 articles for full-text review, which resulted in 16 articles meeting the inclusion criteria. The manual search of references from the 16 papers resulted in full-text review of nine articles, one of which met the inclusion criteria. A total of 17 articles were included in this review. The rationale for the exclusion of articles is outlined in the PRISMA diagram (Figure 1). At title and abstract screening, papers were excluded if they did not pertain to AAC, employment, or were not a peer reviewed article. Papers were excluded after the full text review if they did not meet inclusion criteria and reasons for exclusion at this stage included that the article was not about paid employment experience, employee participants did not use AAC, participants did not meet age criteria, unsuitable source such as opinion paper, book, review paper, forum note, report, or full text was inaccessible.

Characteristics of studies

Tables 1 and 2 illustrate characteristics of the 17 studies. Three were case studies (Lasker et al., 2005; Murphy, 2005; Odom & Upthegrove, 1997), one was a multiple-case study (Richardson et al., 2019), six studies were exploratory (Bryen et al., 2006; 2007; Carey et al., 2004; Light et al., 1996; McNaughton et al., 2003; Rosengreen & Saladin, 2010), five were descriptive (McNaughton et al., 2001, 2002, 2006, 2014; Punch et al., 2007), one was phenomenological (Stokar & Orwat, 2018), and one did not describe study design (Isakson et al., 2006).

Participants

Participant characteristics ranged among studies. Four studies had one participant, and in 13 studies the number of participants ranged from 5 to 54. The 17 studies included 282 participants in total, consisting of employees who use AAC ($n = 208$), seeking employment ($n = 17$), employers ($n = 41$), coworkers ($n = 6$), and one study (Lasker et al., 2005) included speech language pathology students ($n = 10$) and a professor who uses AAC ($n = 1$). Richardson et al. (2019) did not specify the number of family members and employer participants; therefore, only employee participants ($n = 7$) are represented in the total. The ages of participants who use AAC ranged from 19 to 59 years. Participants were from the United States ($n = 238$) and Australia ($n = 54$). Out of all, 119 had diagnoses of cerebral palsy, 84 hearing loss, 11 autism spectrum disorder (ASD), five amyotrophic lateral sclerosis (ALS), four developmental disability, one traumatic brain injury, and one aphasia.

Researchers used a variety of methods to interact with the participants in their studies. In five studies, researchers conducted surveys by mail, instant messaging, or in-person (Bryen et al., 2006; 2007; Carey et al., 2004; Light et al., 1996; Punch et al., 2007). In four studies, researchers facilitated online focus groups (McNaughton et al., 2001, 2002, 2006, 2014). Rosengreen and Saladin (2010) used in-person interviews and in five studies a combination of data collection methods were used (Lasker et al., 2005; McNaughton et al., 2003; Richardson et al., 2019; Stokar & Orwat, 2018) including observations, questionnaires, documentation review, and interviews. In three studies, method was not specified (Isakson et al., 2006; Murphy, 2005; Odom & Upthegrove, 1997).

The studies included represented a range of topics related to employment. In five studies, researchers explored the

Table 2. Summary of studies with multiple participants.

		Method		AAC
Author/Country	Aim/Purpose of the article	Qualitative design and data collection	Participant	
Bryen et al., 2006/US	To explore social networks for individuals who use AAC and the role communication technologies play in job-related social networking.	Exploratory survey: via telephone, interview, mail, instant messaging	*N* = 38 (24 m, 14f) Age: R = 19–59; M = 32.5 Dx: CP (*n* = 37), ASD (*n* = 1) Stakeholder: employee, seeking	Aided-high-tech
Bryen et al., 2007/ US	To determine barriers, strategies, and approaches to obtaining employment for adults who use AAC from perspective of employers, with and without experience with employees with AAC.	Exploratory survey: via telephone, in-person, mail, instant messaging.	*N* = 27 Age: not provided Dx: not applicable Stakeholder: employers	n/a
Carey et al., 2004/ US	To explore the development and use of social networks to obtain employment for individuals who use AAC.	Exploratory survey: via telephone, in-person, mail, instant messaging.	*N* = 38 (24 m, 14f) Age: R = 19–59; M = 34.5 Dx: CP (*n* = 37), ASD (*n* = 1) Stakeholder: employees	Aided-high tech
Light et al., 1996/US	To investigate experiences in community-based jobs including types of jobs, job satisfaction, strategies for securing and maintaining employment, and workplace barriers.	Descriptive survey: via regular mail.	*N* = 25 (18 m, 7f) Age: R = 23–56; M = 35 Dx: CP (*n* = 19), DD (*n* = 4), TBI (*n* = 1), ASD (*n* = 1) Stakeholder: employees	Aided-high tech (27), low tech (13); unaided (27)
McNaughton et al., 2001/US	To understand facilitators of employment for individuals with ALS who use AAC	Descriptive focus group: online	*N* = 5 (2 m, 3f) Age: R = 50–57; M = unknown Dx: ALS Stakeholder: employees	Aided-high tech (5), light tech (1); unaided (1)
McNaughton et al., 2002/US	To gather detailed information of experiences of individuals with cerebral palsy who use AAC and were successfully employed full time.	Descriptive focus group: online	*N* = 8 (m) Age: R = 30–57; M = 39.6 Dx: CP Stakeholder: employees	Aided, high tech
McNaughton et al., 2003/US	To report the experiences of employers and coworkers who worked with individuals who use AAC and explore perspectives on impact, challenges, and supports of employment.	Descriptive Questionnaires and interviews: email, mail, telephone	*N* = 14 (7f, 7 m) Age: R = 20s–50s; M = unknown Dx: not applicable Stakeholder: employers, coworkers	n/a
McNaughton et al., 2006/US	To report information about the self-employment experiences of people with CP who use AAC including employment activities, impact, supports, barriers, and recommendations.	Descriptive focus group: online	*N* = 7 (m) Age: R = 22–49; M = 36.7 Dx: CP Stakeholder: employee	Aided-high tech (6); light-tech (1)
McNaughton et al., 2014/US	To understand the impact of telework, both positive and negative, and to better understand supports and challenges of telework for people who use AAC.	Descriptive focus group: online	*N* = 9 (6 m, 3f) Age: R = 23–58; M = 33.4 Dx: CP (*n* = 8), ASD (*n* = 1) Stakeholders: telework employees	Aided–high tech (8); low tech (1)
Punch et al., 2007/Australia	To investigate the workplace experiences of university graduates who are deaf or hard of hearing to gain insight into their career directions, experiences, use of accommodations.	Descriptive survey: via regular mail	*N* = 54 (m/f unspecified) Age: unspecified Dx: Deaf, hard of hearing Stakeholders: university graduates	Unaided
Richardson et al., 2019/US	To better understand employment experiences of individuals with ASD who use AAC, including type of employment, supports, challenges, and benefits.	Multi-case Questionnaire and interview: in-person, telephone	N = 7 (m) Age: 20-26; M = 22.8 Dx: ASD (employees only) Stakeholders: employees, employers, family	Aided – high tech (6); light tech (1); Unaided (6)
Rosengreen & Saladin, 2010/US	To determine expectations and behaviors for deaf workers and hearing employers in the workplace.	Exploratory interviews: in-person	*N* = 24 (9 m, 15f) Age: R = 19–53; M = 32 Dx: prelingual deafness (employees) Stakeholders: employees, employers	Unaided

(*continued*)

Table 2. Continued.

Author/Country	Aim/Purpose of the article	Method		AAC
		Qualitative design and data collection	Participant	
Stokar & Orwat, 2018/US	To investigate social integration and accommodations in the workplace of Deaf restaurant employees through their own and their managers' experiences	Phenomenology; Observation and in-person interviews	$N = 12$ (7 m, 5f) Age: R = 23–48; M = 37 Dx: Deaf Stakeholder: managers, employees	Unaided

Note: *N*: total number of participants; n: subtotal of participants; M: mean; m: male; f: female; R: range; Dx: diagnosis; ASD: autism spectrum disorder; CP: cerebral palsy; DD: developmental disability; TBI: traumatic brain injury, US: United States.

employment experience of people who use AAC based on diagnosis (McNaughton et al., 2001, 2002; Punch et al., 2007; Richardson et al., 2019; Rosengreen & Saladin, 2010), two studies explored the role of social and job-related networks (Bryen et al., 2006; Carey et al., 2004), three single case studies described pre-employment and employment experiences (Isakson et al., 2006; Lasker et al., 2005; Odom & Upthegrove, 1997), one single-case study explored the role of assistive technology in employment (Murphy, 2005), three studies investigated type of employment (Light et al., 1996; McNaughton et al., 2006, 2014), and four studies explored the perspectives of employers, managers, or coworkers (Bryen et al., 2007; McNaughton et al., 2003; Richardson et al., 2019; Stokar & Orwat, 2018).

Quality of studies

All 17 studies used a qualitative methodological approach. The Oxford levels of evidence range from 1 to 5, with level 1 indicating most rigorous evidence. On this scale, qualitative evidence rates low and thus all articles were at level 5, indicating evidence at the level of expert opinion (OCEBM Levels of Evidence Working Group, 2011).

On the basis of critical appraisal using the Critical Review Form for Qualitative Studies, no studies were excluded and the appraisal data was included in CERQUal assessment. The overall CERQual statement indicated that results could be regarded with a low to moderate degree of confidence. Generally, themes were evaluated as having minor or moderate concerns due to partial relevance of the contributing studies, limited richness of the data contributing to the theme and methodological limitations related to sampling and lacking details in method. Table 3 presents a summary of the quality assessment using the GRADE-CERQual.

Personal barriers and facilitators

This review identified the following personal factors: education, skills and knowledge, previous and current experience, character, and psychosocial factors. Findings are presented below and a summary is provided in Table 4.

Education, skills, knowledge, and experience

Barriers. Collectively, four articles reported barriers related to education (Bryen et al., 2007; McNaughton et al., 2003), skills and knowledge (Bryen et al., 2007; McNaughton et al., 2003, Richardson et al., 2019; Rosengreen & Saladin, 2010), and experience (McNaughton et al., 2003). In a study by Richardson et al. (2019), family members and employers reported that participation in employment activities was negatively influenced by employee challenges with social skills, emotional regulation, and skill acquisition. Understanding job-related instructions was another barrier to participation in work duties as found in two studies (Richardson et al., 2019; Rosengreen & Saladin, 2010).

Facilitators. All 17 articles mentioned at least one of the factors of education, skills and knowledge, and experience as a facilitator to obtaining work and workplace accommodations. Education appropriate for the job was a facilitator found in three studies (McNaughton et al., 2002, 2003, 2006). Four studies illustrated how the previous work experiences informed subsequent accommodations needed to perform job-specific skills (Isakson et al., 2006; Lasker et al., 2005; Murphy, 2005; Odom & Upthegrove, 1997) and one study illustrated that participation in networking opportunities can support access to employment (Carey et al., 2004). Several authors reported skills that supported use of accommodations in the workplace including self-advocacy (Isakson et al., 2006; McNaughton et al., 2014; Punch et al., 2007; Stokar & Orwat, 2018), job-specific skills (Bryen et al., 2006; Isakson et al., 2006; McNaughton et al., 2003; Odom & Upthegrove, 1997; Richardson et al., 2019), inter-personal skills (Light et al., 1996), ability to work as a team (Rosengreen & Saladin, 2010) and ability to make informed decisions regarding accommodations (McNaughton et al., 2001). Punch et al. (2007) found self-advocacy skills and assertiveness beneficial to discussing accommodations with supervisors. Competency with technology, including the ability to navigate, integrate, and troubleshoot issues was another skill set that positively impacted use of accommodations in five studies (Bryen et al., 2006; 2007; Isakson et al., 2006; McNaughton et al., 2003, 2006).

Personal qualities and characteristics

Barriers. Personal characteristics that prevented the use of accommodations were discussed in two articles. McNaughton et al. (2003) reported a lack of self-awareness of skills, and Odom and Upthegrove (1997) mentioned negative perception of employment possibilities as potential barriers to employment.

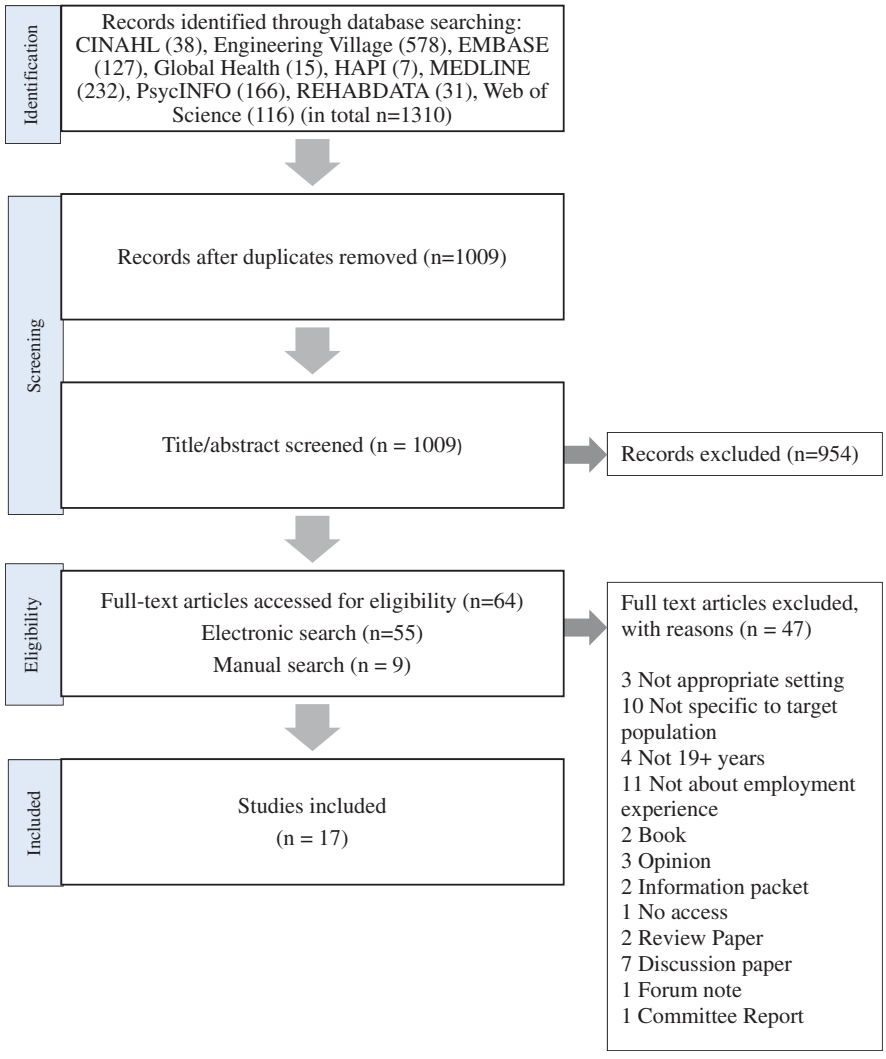

Figure 1. PRISMA flow chart of the reviewing process.

Facilitators. Eleven articles described personal qualities and characteristics of employees who required AAC that contributed to their workplace experience. Five studies highlighted that employees' positive attitudes supported participation in employment, including their use of accommodations (Isakson et al., 2006; Lasker et al., 2005; Light et al., 1996; McNaughton et al., 2001, 2006). Several authors found other factors that positively influenced participation in work included confidence (Isakson et al., 2006), self-awareness (Isakson et al., 2006), self-esteem (McNaughton et al., 2002), persistence (McNaughton et al., 2002), taking initiative (Carey et al., 2004, McNaughton et al., 2006) and flexibility (Rosengreen & Saladin, 2010). In a case study by Lasker et al. (2005), a professor with aphasia demonstrated openness to accommodation strategies and a willingness to participate in training that supported her adoption of a multi-modal communication strategy for teaching. Strong work ethic was a factor mentioned in three studies (Bryen et al., 2006; Light et al., 1996; McNaughton et al., 2014). Where accommodations were provided, quality work and ability to work with others supported maintaining employment for participants in two studies (Isakson et al., 2006; Murphy, 2005).

Psychosocial factors

Barriers. Psychosocial factors, referring to psychological and social influences on an individual, were found to be relevant to employment accommodations in four articles. Reluctance to make requests and address concerns can create barriers to using accommodations (McNaughton et al., 2001; Punch et al., 2007). The perception of the employer's expectation to resolve issues independently (McNaughton et al., 2002), feelings of failure (Rosengreen & Saladin, 2010) and difficulty accepting limitations associated with their health condition (McNaughton et al., 2001) contributed to such reluctance.

Facilitators. Two articles included psychosocial factors as facilitators. In a case study by Lasker et al. (2005), the participant's acceptance of needs and openness about their disability supported their participation in the accommodation process. Employee acceptance of alternative strategies facilitated the adoption of accommodations for employees by using text messages for communication instead of an interpreter (Stokar & Orwat, 2018).

Table 3. GRADE-CERQual assessment of confidence in the evidence.

Theme	Finding	CERQual assessment	Explanation	Contributing studies
Environmental factors: barriers	Challenges with technology related to access, inaccessible design, unreliability, ineffectiveness, cost, learning demands, and inadequate technical support	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	13 Studies 1–3; 5–11; 12; 14; 15
	Physical environment is not fully accessible	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, minor concerns regarding adequacy, and minor concerns regarding relevance	5 Studies – 6; 7; 9; 14; 16;
	Additional time needed for alternative communication strategies is not provided in fast-paced environment	Low confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, moderate concerns regarding adequacy, and minor concerns regarding relevance	1 Study – 17
	Challenges to accessing necessary support and building relationships at work	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	8 studies – 2; 3; 6; 8-10; 14; 17
	Negative attitudes in workplace and society related to lack of awareness of AAC and workplace accommodations	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	9 Studies – 4; 6; 8; 9; 10; 14 – 17
	Services, systems, and policies related to workplace accommodations are limited, inaccessible, or complex	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	10 Studies – 3; 6–10; 12; 14–16
Environmental factors: facilitators	Access to effective assistive and communication technologies as well as technical support	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	13 Studies – 1–6; 8–13; 15
	Environment is safe and free from physical barriers	Low confidence	Minor concerns regarding methodological limitations, minor concerns regarding coherence, moderate concerns regarding adequacy, and minor concerns regarding relevance	2 Studies – 11; 17;
	Additional time is provided as needed on the job to develop appropriate accommodations	Moderate confidence	Minor concerns regarding methodological limitations, minor concerns regarding coherence, moderate concerns regarding adequacy, and minor concerns regarding relevance	3 Studies – 5; 13; 15;
	Employee who uses AAC has relationship with and support from colleagues, family, external agencies, personal care attendants, and specialists	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	15 Studies – 2–9; 11–17
	Workplace policies, government policies, funding, and services in the community that address accommodation needs of employee who uses AAC	Moderate confidence	Minor concerns regarding methodological limitations, minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	8 Studies – 2; 5–7; 11–13; 17
	Employers and colleagues have positive attitude and are supportive of employee who uses AAC	Moderate confidence	Minor concerns regarding methodological limitations, Minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	8 Studies – 4; 9; 11–15; 17

(*continued*)

Table 3. Continued.

Theme	Finding	CERQual assessment	Explanation	Contributing studies
Personal factors: barriers	Inadequate education for the job.	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, Moderate concerns regarding adequacy, and Minor concerns regarding relevance	2 Studies – 2; 9
	Lacking previous work experience.	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, Moderate concerns regarding adequacy, and Minor concerns regarding relevance	1 Study – 9
	Poor perception of employment or one's own skills.	Low confidence	Moderate concerns regarding methodological limitations, moderate concerns regarding coherence, moderate concerns regarding adequacy, and minor concerns regarding relevance	2 Studies – 9; 13
	Lacking qualifications and necessary job-related skills and knowledge.	Low confidence	Minor concerns regarding methodological limitations, minor concerns regarding coherence, moderate concerns regarding adequacy, and moderate concerns regarding relevance	4 Studies: 2; 9; 15; 16
	Feelings or thoughts that challenge the acceptance of accommodations	Low confidence	Minor concerns regarding methodological limitations, Moderate concerns regarding coherence, Moderate concerns regarding adequacy, and Moderate concerns regarding relevance	4 studies: 7; 8; 14; 16;
Personal factors: facilitators	Adequate education for the job	Moderate confidence	Minor concerns regarding methodological limitations, no/very minor concerns regarding coherence, moderate concerns regarding adequacy, and minor concerns regarding relevance	3 Studies: 8 –10
	Previous experiences related to the job including work, volunteer, and networking	Low confidence	Moderate concerns regarding methodological limitations, minor concerns regarding coherence, moderate concerns regarding adequacy, and moderate concerns regarding relevance	5 Studies: 3–5; 12; 13
	Positive attitude toward work and self are personal strengths of the employee who uses AAC	Moderate confidence	Minor concerns regarding methodological limitations, minor concerns regarding coherence, minor concerns regarding adequacy, and minor concerns regarding relevance	11 Studies:1; 3–8; 10–12; 16
	Possessing transferrable, self-advocacy and job-related skills to succeed in employment	Moderate confidence	Minor concerns regarding methodological limitations, minor concerns regarding coherence, no/very minor concerns regarding adequacy, and minor concerns regarding relevance	13 Studies: 1; 2; 4; 6; 7; 9–11; 13–17
	Acceptance of communication abilities and employment accommodations	Low confidence	Minor concerns regarding methodological limitations, Moderate concerns regarding coherence, Moderate concerns regarding adequacy, and No/Very minor concerns regarding relevance	2 Studies: 5; 17

Note: 1: Bryen et al., 2006; 2: Bryen et al., 2007; 3: Carey et al., 2004; 4: Isakson et al., 2006; 5: Lasker et al., 2005; 6: Light et al., 1996; 7: McNaughton et al., 2001; 8: McNaughton et al. 2002; 9: McNaughton et al. 2003; 10: McNaughton et al. 2006; 11: McNaughton et al. 2014; 12: Murphy, 2005; 13: Odom & Upthegrove 1997; 14: Punch et al. 2007; 15: Richardson et al. 2019; 16: Rosengreen & Saladin, 2010; 17: Stokar & Orwat 2018

Environmental barriers and facilitators

Barriers and facilitators to workplace accommodations for individuals who use AAC extended across all ICF environmental categories, which include products and technology; natural environment and human-made changes to the environment; support and relationships; attitudes; and services, systems, and policies (World Health Organization, 2001). In addition, one more category, the temporal nature of accessibility, was found in this review. Findings are further discussed, and a summary is provided in Table 5.

Products and technology

Products and technology refers to "any product, instrument, equipment or technology adapted or specially designed for

Table 4. Summary of findings based on ICF (personal categories).

Personal categories	Barriers	Facilitators
Education	Lacking or inadequate education	Adequate education for the job
Previous and current experience	Lacking previous experience	Has previous work experience
		Has previous job-related volunteer experience
		Participation in networking opportunities
Character	Perception that employment is not possible	Positive attitude
	Lack of self-awareness or realistic view of skills	Motivated
		Takes initiative
		Persistence
		Confidence
		Self-awareness
		Positive self-esteem
		Flexibility
		Openness to learning
		Strong work ethic
		Good relationships with others
		Commitment
Skills and knowledge	Understanding directions	Possesses job-related skills
	Difficulties expressing emotions (could be related to ASD or AAC)	Self-advocacy skills – ability to communicate needs to employer
	Ability to acquire new job skills	Competency with technology
	Lack of qualifications for the job	Ability to address minor technical issues independently
	Poor literacy skills	Time management skills on the job
		Ability to make informed decisions regarding employment and AT
		Ability to educate colleagues about conditions and supports
		Quality job performance
		Good interpersonal skills
		Skills working as part of a team
		Awareness of anti-discrimination legislation
Psychosocial	Reluctance to request help, address concerns, or use accommodation	Acceptance of communication abilities
	Difficulty adjusting to diagnosis/conditions	Acceptance of accommodations offered by employer
	Feelings of failure	

improving the functioning of a disabled person" (World Health Organization, 2007). Sixteen articles mentioned barriers and facilitators related to products and technology.

Barriers. Thirteen articles included factors related to technology that created barriers to use of workplace accommodations. Lack of accessibility of mainstream workplace technology, such as the phone was noted in several studies (Bryen et al., 2006; 2007; Light et al., 1996; McNaughton et al., 2003, 2014; Punch et al., 2007; Richardson et al., 2019). Technical issues were found to obstruct the use of assistive technology in the workplace, including breakdown (Bryen et al., 2007; Light et al.,1996; Murphy, 2005), malfunctioning (Richardson et al., 2019), discharged battery (Richardson et al., 2019), multitasking difficulties (McNaughton et al., 2002), lack of technical support (Light et al., 1996; McNaughton et al., 2002), limited accessibility features (Bryen et al., 2006) and inadequate repair services (McNaughton et al., 2002). Factors that negatively impacted use of AAC systems in the workplace were lack of access to job-related vocabulary (Light et al., 1996), learning demands of the AAC device (McNaughton et al., 2001), AAC systems that are ineffective or do not meet job demands (Carey et al., 2004; Lasker et al., 2005; McNaughton et al., 2006), and time required to program the AAC device for work (Murphy, 2005; Richardson et al., 2019). The cost associated with AAC devices and assistive technologies was another barrier mentioned in the study by Punch et al. (2007). High cost and limited funding made computer based AAC technologies particularly inaccessible (Light et al., 1996; McNaughton et al., 2001).

Facilitators. Thirteen articles highlighted facilitators related to technology. Access to and use of assistive technology was an important facilitator as indicated by several studies (Bryen et al., 2007; Lasker et al., 2005; Light et al., 1996; McNaughton et al., 2003, 2006; Odom & Upthegrove, 1997; Richardson et al., 2019). Three studies highlighted the important role of technical support in employment from various sources, including an attendant, family member, manufacturers' technical assistance hotlines, and engineers (Light et al., 1996; Murphy, 2005; Richardson et al., 2019). Features and functions of AAC systems also contributed to their use in employment. Compatibility and integration between specialized AAC technologies and generic technologies, such as cell phones and computers, supported using both types of technology as highlighted in three studies (Bryen et al., 2006; Isakson et al., 2006; Murphy, 2005). Effectiveness of high-tech AAC systems was key to use in employment in four studies (Carey et al., 2004; McNaughton et al., 2003, 2006, 2014), and

Table 5. Summary of findings based on ICF (environmental categories).

Environmental categories	Barriers	Facilitators
Products and technology	Lack of accessibility features of traditional workplace technology (ex. telephone) Technical issues with AAC and other AT: malfunctions, losing charge and breakdown AAC that does not accommodate skills of employee Lack of access to technology Inadequate support to resolve technological issues with AAC Time demands to set up AAC device to support work-related tasks Limited compatibility and integration of AAC device technology in workplace Ineffective AAC devices Challenges of multitasking with technology Cost of assistive technology Learning demands associated with AAC system	Access to assistive technology and communication technologies Tech support to troubleshoot issues Compatibility/integration of specialized and generic technology in the workplace An effective AAC system that meets needs of individual Features that support employment (ex. voice output feature)
Natural environment and human-made changes to environment	Physical inaccessibility of workspaces, washroom, and staff rooms Noisy environment	Safe physical environments Work from home – eliminate physical and transportation barriers
Temporal nature of accessibility	Time required for alternative communication strategies in fast paced environment	Provision of time on the job to problem-solve, develop accommodations, allow employee to adjust to workplace
Support and relationships	Challenges related to interactions and relationships building with colleagues Limited human resources Limited social networks Lack of support to learn AAC device Inadequate transition supports	Support from: employers, managers, coworkers, family, external agencies/service providers, job developers, communication assistants, personal care attendants, ASL interpreters Positive relationship with employer, supervisor, and coworkers Social and job-related networks
Attitudes	Negative attitudes and stigma – societal and in workplace Underestimating skills of people who use AAC in the workplace Employer fear of increased financial costs Managers' lack of awareness of and experience with accommodations Lack of knowledge of ADA Expectation for employee with AAC to use less than optimal accommodations	Supportive attitude of employer and coworkers Employer who understands needs of employee who uses AAC Manager attitude – willingness to learn from experience/perspective of employee and accommodate accordingly Employer's and coworker's willingness and commitment to people with disabilities
Services, systems and policies	Lack of reliable and accessible transportation options Inadequate transition services Limited availability of interpreter services Limited supportive policies and funding Difficulty finding personal care support education to employment Limited job and upward mobility Difficult and lengthy process to obtain accommodations Workplace practices – inconsistent work hours Challenges in acquiring necessary supports such as communication assistants, personal care attendant, ASL interpreters, i.e., cost, availability, hiring process Poor availability of information and services	Scheduled opportunities to speak to manager (performance evaluations) Company policies and practices that support accommodation – flexible scheduling, place and train model, employee autonomy, telecommuting Access to reliable transportation Government policies, information and services – Americans with Disabilities Act Informed and supportive service providers Supports to obtain necessary equipment Transition supports – "Person Centered Planning" to identify accommodations needed Funding to support use of aide, transportation, job coaches, accommodations

one study noted the significance of voice output capability to participation in employment (McNaughton et al., 2002).

Natural environment and human-made changes to environment

Barriers. Five articles reported barriers related to the workplace environment. Reduced access to and within the physical work environment interfered with adoption of workplace accommodations in four articles (Light et al., 1996; McNaughton et al., 2001, 2003; Rosengreen & Saladin, 2010). Noisy or crowded work environments made communication with AAC systems difficult (McNaughton et al., 2003; Punch et al., 2007). In the study by Light et al. (1996), one-third of the participants reported experiencing barriers to physical access at work due to a lack of wheelchair ramps as well as inaccessible washrooms, work areas, and staff rooms.

Facilitators. Two articles described positive environmental aspects that support use of accommodations. McNaughton et al. (2014) reported that working from home eliminated transportation needs and provided a physically accessible workspace, and, thus, reduced barriers for employees who use AAC. Physically safe environments also positively impacted use of accommodations in the workplace (Stokar & Orwat, 2018).

Temporal nature of accessibility

The temporal nature of accessibility refers to use or provision of time as it relates to accommodations in the workplace.

Barriers. A factor unique to people who use AAC is extra time required to communicate when using AAC (Beukelman & Mirenda, 2013). One article by Stokar and Orwat (2018) found that the additional time needed for alternative communication strategies was a barrier in a fast-paced workplace.

Facilitators. Appropriate time allowance was an environmental factor that could help to accommodate employees in three articles. Employers' provision of time allowed employees to adjust to accommodations with ongoing problem-solving and training, supported the development, modification, and implementation of accommodations (Lasker et al., 2005; Odom & Upthegrove, 1997; Richardson et al., 2019).

Support and relationships

Support and relationships concern the contributions of people, including family, employers, coworkers, and service providers, that impact accommodations.

Barriers. Barriers related to support and relationships were cited in eight articles and largely related to the lack of positive supports and relationships. People who use AAC were found to have limited social networks, and, therefore, less likely to be aware of job opportunities or be familiar with employers (Carey et al., 2004). Employers in a study by Bryen et al. (2007) noted the lack of human resources can negatively impact accommodating an employee who uses AAC. A lack of support to use AAC effects use of accommodations in the workplace (McNaughton et al., 2006). Furthermore, challenges related to interacting and relationship building with colleagues can contribute to a lack of supportive relationships in the workplace (Light et al., 1996; McNaughton et al., 2003; Punch et al., 2007; Stokar & Orwat, 2018). McNaughton et al. (2002) highlighted the critical need for personal care attendants in employment for adults who use AAC with physical limitations, noting that difficulties finding support creates barriers.

Facilitators. Supports from both within and external to the workplace were identified as important to the development and implementation of accommodations in several articles. Inclusion in social and job-related networks enhanced awareness of opportunities and employment supports as described in four studies (Carey et al., 2004; McNaughton et al., 2001, 2014; Murphy, 2005). Murphy (2005) reported that access to funding and personnel, like care attendants, was supported through social networks connections. Family was the main external support that positively influenced the implementation of accommodations as found in seven articles (Isakson et al., 2006; Lasker et al., 2005; McNaughton et al., 2001; 2002; Murphy, 2005; Odom & Upthegrove, 1997; Richardson et al., 2019). In three studies, implementation of accommodation was associated with a combination of support from the family and professionals, such as occupational therapists, speech-language pathologists, and educators (Isakson et al., 2006; Murphy, 2005; Odom & Upthegrove, 1997). As found by Light et al. (1996) and McNaughton et al. (2003), workplace accommodation also included accommodations for activities of daily living. Within the workplace, positive relationships with and support from colleagues, managers and/or employers and supportive communication partners enhanced participation in employment (Bryen et al., 2007; Carey et al., 2004; McNaughton et al., 2003; Murphy, 2005; Punch et al., 2007; Richardson et al., 2019; Rosengreen & Saladin, 2010; Stokar & Orwat, 2018). Richardson et al. (2019) reported that informal support from coworkers helped accommodate the needs of an employee who uses AAC. Collaborative problem solving around accommodations with supportive employers and engaged coworkers were facilitators described in six articles (Carey et al., 2004; Isakson et al., 2006, McNaughton et al., 2002; Murphy, 2005; Punch et al., 2007; Stokar & Orwat, 2018).

Attitudes

Barriers. Attitudinal barriers were identified in relation to coworkers, employers, and/or society in nine articles. The most recognized barrier was a lack of understanding (McNaughton et al., 2002, 2006; Punch et al., 2007; Richardson et al., 2019), and employers who minimized expectations of people who use AAC (Isakson et al., 2006; Light et al., 1996; Stokar & Orwat, 2018). The employees who use AAC in the study by McNaughton et al. (2002) indicated that negative attitudes toward people with disabilities from society and employers were the most substantial barrier to successful employment activities. Poor awareness or understanding of needs prevented implementation of accommodations, as exemplified by Stokar and Orwat (2018) when restaurant managers initially struggled to provide necessary accommodations due to inexperience and a lack of knowledge of relevant legislations. Attitudes about complex communication needs contributed to the limited employment options, according to participants in the study by Rosengreen and Saladin (2010). This was echoed in the study by McNaughton et al. (2003) in which a participant explained that employers' concerns about increased financial costs associated with employing a person with severe disabilities may discourage inclusive hiring practices (McNaughton et al., 2003).

Facilitators. In eight articles, positive attitudes were found to benefit the implementation of accommodations. In the study by Isakson et al. (2006), the employer's good understanding of disability and possible accommodations supported accommodating an employee who uses AAC. Supportive attitudes of employers and coworkers were shown to have a positive impact on accommodating employees who use AAC (McNaughton et al., 2014; Murphy, 2005; Odom & Upthegrove, 1997; Punch et al., 2007; Richardson et al., 2019). Positive experiences were reported when employers and coworkers displayed a commitment to

implementing accommodations in the workplace (McNaughton et al., 2003; Stokar & Orwat, 2018).

Services, systems and policies

Under services, systems, and policies, findings included funding sources, services for people who use AAC, and employer and government policies.

Barriers. Ten articles identified barriers related to services, systems and policies. Inadequate transition services between education and employment can negatively impact access to and participation in employment (McNaughton et al., 2006). Lack of funding and policies supportive of people who use AAC in employment were issues identified in studies by McNaughton et al. (2001, 2002) and Richardson et al. (2019). Although, government policy on workplace accommodations (e.g., Americans with Disabilities Act (ADA)) can inform workplace practices, participants in a study by McNaughton et al. (2001) reported that such policies were not consistently enforced by employers. Four articles identified a lack of accessible transportation for people with physical disabilities as a barrier to accessing the work environment (Carey et al., 2004; Light et al., 1996; McNaughton et al., 2002, 2003). Challenges in acquiring the necessary supports for the workplace, such as communication assistants, personal care attendants, or American Sign Language (ASL) interpreters, due to cost, availability or hiring processes is another barrier to participating in employment and using workplace accommodations (Murphy, 2005; Rosengreen & Saladin, 2010). Light et al. (1996) and Punch et al. (2007) reported that the difficult and exceptionally lengthy processes to obtain appropriate and necessary accommodations was another barrier.

Facilitators. Services, systems, and policies related facilitators were found in eight articles. Government policies and legislation, such as the ADA, can provide information and services to support the implementation of workplace accommodations (Light et al., 1996; McNaughton et al., 2001). Access to reliable transportation was another facilitator found in three studies (Light et al., 1996; McNaughton et al., 2014; Odom & Upthegrove, 1997). Funding was identified as an important factor in determining access to accommodations. The provision of funding by employer or government supported the acquisition of assistive technology, job coaches, and on the job assistance (Lasker et al., 2005; Murphy, 2005). Workplace practices and policies were also found to influence accommodations. One study's findings indicated that performance review was a workplace practice supportive of accommodating employees as it provided an opportunity to discuss concerns (Stokar & Orwat, 2018). A flexible work schedule was a valuable and supportive workplace practice for employees who use AAC, according to studies by Bryen et al. (2007) and McNaughton et al. (2014). Bryen et al. (2007) also found practices that ensured success included diversity training for coworkers, accommodation policies, and wheelchair accessibility. Odom and Upthegrove (1997) reported that the place-and-train model allowed for on the job support for the employees who use AAC and fostered the development of accommodations and the employees' work-related skills.

Discussion

This systematic review focused on identifying the barriers and facilitators for implementing workplace accommodations for adults who use AAC. Workplace accommodations are important to mitigate barriers that have resulted in low employment rates. Only 17 studies met the criteria to be included in this review. The findings illustrate five personal and six environmental categories of barriers and facilitators. Multiple findings in this study regarding the factors that influence the use of accommodations including employer and coworker attitudes, employer knowledge, perception of costs, workplace policies, employee confidence, education, and self-advocacy skills align with the findings of a systematic review regarding workplace accommodations for employees with physical disabilities (Wong et al., 2021).

In this review, barriers and facilitators to employment were also included as the implementation of accommodations is contingent on employment. Additionally, links between barriers to employment and implementation of accommodations reflect broader environmental barriers faced by people who use AAC. For example, issues with technology related to access, user proficiency, function, operation, and cost create barriers to obtaining and maintaining employment (McNaughton & Bryen, 2002), which, as found in this study, also impact the use of accommodations in the workplace.

Participants who use AAC represent a range of ages, diagnoses, educational backgrounds from less than high school to a doctorate degree, AAC systems from unaided to aided high tech, and type of employment, for example data entry, education, pharmacy, writing, cleaning, and website development. Given that participants in this review represented a generally small but heterogeneous group and not all the variables were reported consistently across studies, it is difficult to identify patterns of barriers and facilitators based on such factors. There were some factors attributed to studies that focused on participants of a shared diagnosis. For example, limited ability to express emotions and understand instructions were barriers only identified in a study with participants who have ASD (Richardson et al., 2019). As discussed in a systematic review by Lindsay et al. (2021) regarding workplace accommodations for employees with ASD, there is need to recognize the uniqueness of workplace accommodations related to ASD compared to other types of disabilities. In a study with participants who have ALS, difficulty adjusting to the diagnosis was considered a barrier that was unique to participants diagnosed with ALS in adulthood (McNaughton et al., 2001). While these examples suggest there are differences to consider based on the background of participants, this study focused on identifying barriers and facilitators among the studies collectively. Factors that were repeatedly identified, however, such as attitudinal barriers and facilitators, provide us with important information about

influences on workplace accommodations that permeate such variables.

Most barriers and facilitators identified in this review are from the perspectives of people who use AAC, however four studies focused on or incorporated the perspectives of employers and/or coworkers (Bryen et al., 2007; McNaughton et al., 2003; Richardson et al., 2019; Stokar & Orwat, 2018). There was overlap in the identification of personal facilitators from both perspectives regarding adequate education, job-related skills, competency with technology, and self-advocacy skills. Environmental facilitators identified by both groups were related to access to effective technology, positive relationships in the workplace, supportive workplace policies, and professional and familial supports. Barriers identified by both employers and employees included issues with AAC and mainstream technology, challenges building relationships in the workplace, lack of adequate transportation, and physical inaccessibility in the workplace. The intersection of these perspectives on barriers and facilitators suggests some mutual understanding between employers and employee and may highlight significant or common factors impacting use and provision of workplace accommodations.

In this review, the personal barriers that were identified only by employers or coworkers were mainly concerned with the fit between the job and potential employee as they described lack of qualifications due to education or experience, as well as employee's unrealistic view of skills as potential barriers. Environmental barriers identified only by employers or coworkers were related to organizational factors, such as lack of human resources, potential costs, and manager's limited experience with accommodations. Employers and coworkers identified more barriers than facilitators, and thus, the large majority of facilitators discussed in this review were identified by participants who use AAC. One explanation may be that employers are more aware of the challenges; whereas employees who use AAC have increased awareness of solutions to support use of accommodations based on their personal experiences in employment.

The education, experience, and job-related skills of the employee who uses AAC was an important factor to obtaining employment. The importance of a good education in securing employment for people who use AAC is also indicated in a study by McNaughton and Bryen (2002). More recently, a study investigating workplace accommodations requests of people with disabilities based on educational background found that higher education correlated with increased likeliness to self-advocate and request accommodations, possibly due to knowledge and skills gained over the course of their education, giving weight to the need to further explore workplace accommodations and educational background (Dong et al., 2020).

Self-advocacy has also been identified as a key facilitator to employment and accommodations in the systematic review by Nevala et al. (2015) regarding workplace accommodations among people with disabilities. Employees are typically valued for their education, skills, and experience and, therefore, these factors are not unique to people who use AAC. It is important to consider, however, the interaction of personal and environmental factors that create different experiences for people who use AAC and how they impact implementation of workplace accommodations. For example, education is regarded as a personal factor; however, environmental factors such as lack of supportive policies, systems, and relationships can lead to inaccessible education for people who use AAC, which, in turn, impacts their transition to employment. This illustrates the importance of recognizing the interaction between the person and their environment as outlined in the ICF framework to better understand the experiences of people who use AAC.

In this review, key environmental barriers to the implementation of workplace accommodations included negative attitudes in the workplace and society, lack of accessible transportation, inaccessible work environments, and technology-related issues. The findings are consistent with previous research in workplace accommodations and people with disabilities, which also identified societal attitudes, unsupportive work environments, issues with assistive technology as barriers to integrating supports in the workplace (Nevala et al., 2015; Padkapayeva et al., 2017). In accordance with previous studies, attitudinal barriers were found in this study as significant and widespread, and included attitudes of employees and coworkers. Padkapayeva et al. (2017) described the **"**ignorance of colleagues and managers about a person's condition and needs**"** (p. 2142) as a barrier to workplace accommodations. Employers may overcome this through participating in diversity training, implementing flexible policies, and allowing time to adjust to accommodations.

The findings of this review suggest technology is an effective form of accommodation, particularly if accessible, effective, and compatible with other technologies. Despite the potential of assistive technology to meet a range of needs in the workplace, many technology-related barriers were identified in this review, including breakdowns, poor reliability, cost, and learning demands. This is in line with previous research findings concerning people with physical, sensory, cognitive, and mental disabilities that also identified barriers to assistive technology in the workplace, such as complexity of the technology, training demands, limited understanding of the technology, and cost (Nevala et al., 2015). The issue of poor reliability of AAC systems found in several articles in this review is supported by the work by Shepherd et al. (2009) who examined the several types of speech generating devices, and found that operational problems and breakdowns within the first year was a common issue across devices. Based on findings in this study and echoing recommendations by Shepherd et al. (2009), there is a need for improved design from AAC manufacturers as well as funding models that include coverage for cost of repairs of AAC devices to improve reliability.

Similar to previous work (Anand & Sevak, 2017; Nevala et al., 2015), the findings of the current review indicate that, in addition to effective technology, supports and work relationships of employees who use AAC positively affected their employment experiences. The findings highlighted that an interdisciplinary approach and a combination of supports, such as assistance in the workplace, transportation service,

supportive family and employers, and assistive technology, were particularly beneficial to the employee.

Implications for research and practice

Because this systematic review found low to moderate degree of confidence in findings, more research is needed, and caution needs to be used when applying the results to practice. The facilitators described in this review can be considered to inform recommendations for support networks and employers to make accommodations and the accommodation process more accessible. For example, employers could consider providing formal and informal opportunities for employees to discuss their needs openly with employers, which could be further evaluated as a strategy. This reflects the recommendation of Padkapayeva et al. (2017) that reviews should take place with employees who use assistive devices to ensure they have the appropriate technology and accommodations. Additionally, self-advocacy was identified as a facilitator by both employees and employers in this review and previous studies, and thus resources and training to build self-awareness and self-advocacy skills through education, vocational programs, and in the workplace could be beneficial to accessing accommodations.

The findings of this review could contribute to developing workplace policies to reduce barriers to accommodating employees who use AAC. For example, policies that allow for flexible scheduling and the option of working from home may not come at a great cost to the employer and have proven to be supportive to participation in employment for people who use AAC. Another recommendation would be for employers to allow for time to problem solve collaboratively with employees on the job to develop custom accommodations to optimize the performance of employees who use AAC. Creating a plan that identifies goals, timelines, resources, training, and monitoring use of accommodations may benefit the development and adoption of effective accommodations. Additionally, findings of our review suggest that employers could benefit from education opportunities regarding disability. This may include providing the opportunity for employees who use AAC to share information with the employer and their colleagues. Universal design was not identified in this review as a potential facilitator to implementing accommodations. This could result from the lack of universal accommodations, or a lack of research in the area. Padkapayeva et al. (2017) explored the use of universal design to accommodate diverse abilities, suggesting accommodations that benefit all workers.

Limitations and future directions

We recognize several limitations to this systematic review. There is a limited amount of research currently available regarding workplace accommodations for adults who use AAC, and, therefore, only 17 studies met the inclusion criteria. Additionally, due to the limited research in the area of AAC and employment, and the lack up to date and global statistics regarding the employment rate of people who use AAC, we have relied on articles from 10 to 20 years ago in providing background information. Included studies were limited to English due to the common language among authors given that we followed a systematic process of screening that involved two to three raters per article. This was a limitation to the number and diversity of articles included. Most were conducted in the United States and had small sample sizes that did not represent the diversity of the AAC community, which limits generalizability. Studies in other jurisdictions with different legislation, policies, services, supports, and societal attitudes may reveal different barriers and facilitators to implementing workplace accommodations for people who use AAC. Another limitation is the date range of the included articles, with many published over 15 years ago, which, therefore, may not reflect advancements in technology that impact use of employment accommodations today. The articles in this review focused on the employment experiences of adults who use AAC in which workplace accommodations played a role, however, provided limited explicitly information on the implementation of accommodations. As a result, data extraction included relevant information implicit in the studies guided by our shared interpretation of "workplace accommodation" as defined for this review.

Further research is needed to inform advancements in technology to improve accessibility and functionality for the employee who requires AAC. In addition, further exploration is required to determine practices and services to meet training and troubleshooting needs to minimize assistive technology discontinuance. Studies with larger and more culturally diverse samples are necessary to gain a greater understanding of the barriers and facilitators to accommodations experienced by employees who use AAC. Expanding the sample of studies both demographically and geographically can help employers understand the differences in barriers faced by individuals who have had successful, unsuccessful, and alternative employment experiences. Research and advocacy are needed to build awareness among employers of practices that effectively support the accommodation needs of employees who use AAC. More research regarding universal design and AAC is needed. Finally, given that personal and environmental factors impacting workplace accommodations also exist outside of the workplace, it is important to consider the journey to employment and expand research in the area of career preparation, training, and transition to adulthood.

Conclusion

This systematic review revealed limited research in the area of AAC and employment accommodations for adults who use AAC. The findings point to multiple personal and environmental barriers and facilitators to workplace accommodations and illustrate complexities surrounding access to and use of accommodations. Addressing environmental and personal factors requires an interdisciplinary approach that responds to the ongoing and changing needs of individuals

who use AAC related to skills development, access to employment opportunities and workplace accommodations. Further work related to barriers and facilitators through additional research and the advancement of practices and policies has the potential to improve employment outcomes and, hopefully, move toward the ultimate goal of employment equity for people who use AAC.

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