



Job Accommodations, Return to Work and Job Retention of People with Physical Disabilities: A Systematic Review

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Abstract

Purpose We aimed to identify job accommodations that help persons with physical disabilities maintain or return to work and explore the barriers and facilitators that influence the provision and reception of job accommodations. **Methods** We conducted a systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The review was registered in PROSPERO (CRD42019129645). The search strategy incorporated keywords describing physical disabilities, employer-approved job accommodations, and employment retention or return to work approaches. We searched MEDLINE, the Cochrane Library, Embase, CINAHL, PsycINFO, Web of Science, and ProQuest Theses and dissertations. Reviewers independently selected studies for inclusion. We used Hawker et al.'s method to assess study quality. **Results** We identified 2203 articles, of which 52 met inclusion criteria, developed a table of job accommodations commonly used by persons with physical disabilities, summarized the percentages of job accommodations used by persons with disabilities, synthesized evidence of the effectiveness of job accommodations, and identified the factors that influence job accommodation use. The most frequently reported accommodations were as follows: modification of job responsibilities, change of workplace policy, supportive personnel provision, flexible scheduling, and assistive technology. We summarized four types of facilitators and barriers that affect job accommodation use: employee-related factors, accommodation-related factors, job-related factors, and social workplace-related factors. **Conclusion** The absence of randomized controlled trials and prevalence of cross-sectional surveys provides inconclusive evidence regarding the effectiveness of specific job accommodations for people with particular functional limitations. Our system of categorizing job accommodations provides a guide to investigators seeking to evaluate the effectiveness of job accommodations using experimental methods.

Keywords Physical disabilities · Job accommodation · Vocational rehabilitation · Employment

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Introduction

Employment offers many advantages for both individuals and society. Work is especially beneficial for persons who have physical limitations by enhancing a sense of purpose, promoting economic self-sufficiency, and improving emotional well-being [1–4]. However, persons with physical disabilities often encounter difficulties in returning to work after disability onset. For example, Kraus [5] reported that only 34.4% of working-age persons with disabilities are employed compared to 75.4% of their non-disabled peers. Employees with physical disabilities may experience multiple barriers at work due to a fear of requesting accommodations, unsupportive employers or co-workers, inflexible work schedules, or difficulty managing a high volume of work [6]. Consequently, many individuals with physical

disabilities are unemployed or leave the labor force earlier than they desire [7]. Working-age persons with disabilities are an untapped workforce for many industries and in specific geographic areas [8, 9]. There is a clear need to facilitate employment and job retention for persons with physical disabilities.

Job accommodations are critical in supporting workers with disabilities and ensuring equal access to employment opportunities [10, 11]. The Americans with Disabilities Act (ADA, [12]) provides civil rights protection for persons with disabilities. The legislation mandates that employers provide reasonable accommodations to employees with disabilities, unless there is an undue hardship. Reasonable accommodations are provided on a case-by-case basis depending on the employee's job tasks and functional limitations [12, 13]; however, certain types of accommodations are provided more frequently. Common accommodations include flexible work schedules, modified work duties, the use of assistive technology (AT), and work environment changes [14–17]. Despite the legal requirements of the ADA, employees with disabilities report a low rate of job accommodations used in the workplace, with only 26% of older persons with disabilities (≥ 65 years) receiving accommodations from their employers [18]. One of the most significant barriers for employers in providing job accommodations is the lack of knowledge regarding accommodations themselves, which may help employees with varied functional limitations and unique needs fulfill specific job demands [15, 19, 20]. In addition, employers are often concerned about the cost and cost-effectiveness of job accommodation [21, 22]. In this systematic review, we identify common workplace accommodations and their associated functional limitations. We summarize the effectiveness and efficiency of accommodations in the peer-reviewed literature.

Previous reviews have synthesized different types of job accommodations for various disability populations and diagnoses [6, 15, 23–25]. For example, Sundar [25] investigated how the provision of job accommodations varied by type of disability. Dick et al. [23] explored the evidence for workplace management of persons with upper limb disorders, such as carpal tunnel syndrome and extensor tenosynovitis. Padkapayeva et al. [15] synthesized 117 articles that detailed the workplace accommodations and found that most studies did not examine the effectiveness of accommodations rigorously. Nevala et al. [6] reported that the key factors of employment for persons with disabilities were self-advocacy, supports from employers and the community (including training as needed and flexibility in the workplace). Vocational counseling may also contribute to a successful return to work. Dowler et al. [24] conducted a literature review to describe the use of personal assistance services in the workplace. Most reviews focused on identifying the facilitators and barriers to employment outcomes.

However, few have summarized the factors that influence the provision of job accommodations in the workplace. Finally, although previous reviews have examined the effectiveness of job accommodations, no review drew conclusions related to job accommodation efficiency due to the limited evidence and the variety of populations and accommodations studied [6, 15]. Thus, there is a need to examine evidence of the effectiveness of job accommodations comprehensively [15].

To address these limitations, we conducted a systematic review to summarize evidence regarding job accommodations for persons with physical disabilities. We focused on persons with physical disabilities, regardless of their concurrent psychological or cognitive limitations, such as those resulting from traumatic brain injuries. Our purpose was to identify the workplace accommodations that previous studies addressed and to summarize the use of these accommodations for employees with physical disabilities. We also sought to synthesize the evidence on the frequency and effectiveness of certain accommodations. Thus, the aims of this review were to:

- (1) Identify job accommodations and summarize the potential use of accommodations for persons with physical disabilities,
- (2) Review the effectiveness and efficiency of job accommodations in promoting employment outcomes of persons with physical disabilities,
- (3) Explore the barriers and facilitators that influence the reception and provision of workplace accommodations for employees with disabilities, and
- (4) Describe the rates at which job accommodations were provided.

Methods

The research team for this systematic review included two scholars who have research experience in employment issues for people with disabilities, one librarian, three certified rehabilitation counselors, a research coordinator, a research assistant, two medical students, and two undergraduates in the health professions. The review was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA), a reporting guideline for prospectively registered systematic reviews in health and social care [26]. The review was registered in PROSPERO International Prospective Register of Systematic Reviews (CRD42019129645). This review examined the current literature regarding how employees with disabilities and employers report using specific types of job accommodations in the workplace. and the goal of this review was to summarize the outcomes of those accommodations in terms of efficiency, job retention, and cost. Finally, we identified

the factors that affected why and how employers provided accommodations.

Information Sources and Search

The review team consulted with a research librarian to develop a search strategy. The search strategy incorporated keywords and controlled vocabulary terms (MeSH) describing physical disabilities including cognitive disabilities related to brain injury, employer-approved job accommodations, and employment retention or return to work approaches. The Population, Intervention, Comparison and Outcome (PICO) statement [27] was used to facilitate the literature search and to develop the inclusion criteria of the paper review. The selected databases include MEDLINE (Ovid), Cochrane Library (Wiley), Embase (Elsevier), CINAHL with Full Text (Ebsco), PsycINFO (Ebsco), Web of Science (Thomson Reuters), and ProQuest thesis and dissertations databases. Searches in each database spanned the date from inception to April 17, 2020 and were limited to English-language studies. Search strategies are listed in Online Appendix 2.

Research Selection Process

The review team used Covidence [27], an online review management tool, to facilitate the screening process. Figure 1 shows the procedure for the review process and data extraction. First, pairs of researchers independently reviewed titles and abstracts before reaching consensus about whether or not to include each article. The research team resolved conflicts about article inclusion during weekly meetings. The process was repeated to assess the selected articles' full texts. Articles were excluded if they focused on physical disabilities in the workplace and mentioned specific types of job accommodations, and excluded articles if they were secondary sources (e.g., literature reviews), abstracts, introductions, single case studies, legal analyses, focused on developmental or behavioral disabilities, or reported attitudinal research. Further, we found that previous literature reviews and other secondary sources often included original research that we already included in our systematic review. To reduce duplication of original research summarized in this systematic review, articles of literature reviews and secondary sources were excluded.

We used Hawker et al.'s method [28] to facilitate data extraction and quality assessment. The critical appraisal tool was used to evaluate the methodological rigor of quantitative and qualitative studies. The scoring criteria included nine categories: *abstract and title*, *introduction and aims*, *method and data*, *sampling*, *data analysis*, *ethics and bias*, *findings/results*, *transferability/generalizability*, and *implications and usefulness*. The appraisal tool offered a grade for each of

the nine categories on a scale from 1 to 4: (1) very poor, (2) poor, (3) fair, and (4) good. The categorical grades were then tallied to assess the article's overall quality, a perfect score being 36 out of 36. We set 2.5 as the cut-off point for each category and accepted articles with quality that are higher than poor to eliminate poor quality reports. All studies rated below 22.5 in the total score of the nine categories did not meet our criteria for a rigorous scientific study.

Data Extraction and Analysis

We extracted and summarized the following data: (1) *basic research characteristics* (such as study design, research purposes, and disability type of the target population); (2) *job accommodations*; (3) *outcomes* of providing or receiving job accommodations (such as effectiveness, efficiency and cost); (4) *factors* that determined accommodation provision; and (5) rates of job accommodations used in the workplace. We also synthesized the rates of job accommodations provided as reported by the studies included in this review. We entered the extracted data into an Excel spreadsheet, imported the data into NVivo [29], then conducted a content analysis to identify the type of accommodations mentioned, barriers and facilitators of providing or receiving accommodations, accommodation use rate, and the effectiveness and efficiency of job accommodations. Pairs of team members conducted and reviewed the data extraction and content analysis. Finally, three of the authors who are certified rehabilitation counselors and have extensive experience working with people with disabilities and functional limitations, developed a list of potential job accommodations for persons with disabilities. All authors reviewed the list and reached consensus on the content (see Table 1).

Theory to Organize the Factors that Influence Job Accommodation Use

To organize the facilitators and barriers that influence the reception and provision of workplace accommodations, we modified the Person-Environment-Occupation (PEO) model [30] to three categories: *employee-related factors* (Person), *workplace-related factors* (Environment), and *job-related factors* (Occupation). We added another category, *accommodation-related factors*, to characterize how interactions among these four categories shape the experience of returning to work for people with physical disabilities.

Results

The initial database searches yielded 1354 unique studies. We excluded 995 articles after screening articles' titles and abstracts using the criteria outlined in the reviewer's

Fig. 1 Flowchart outlining the article selection process

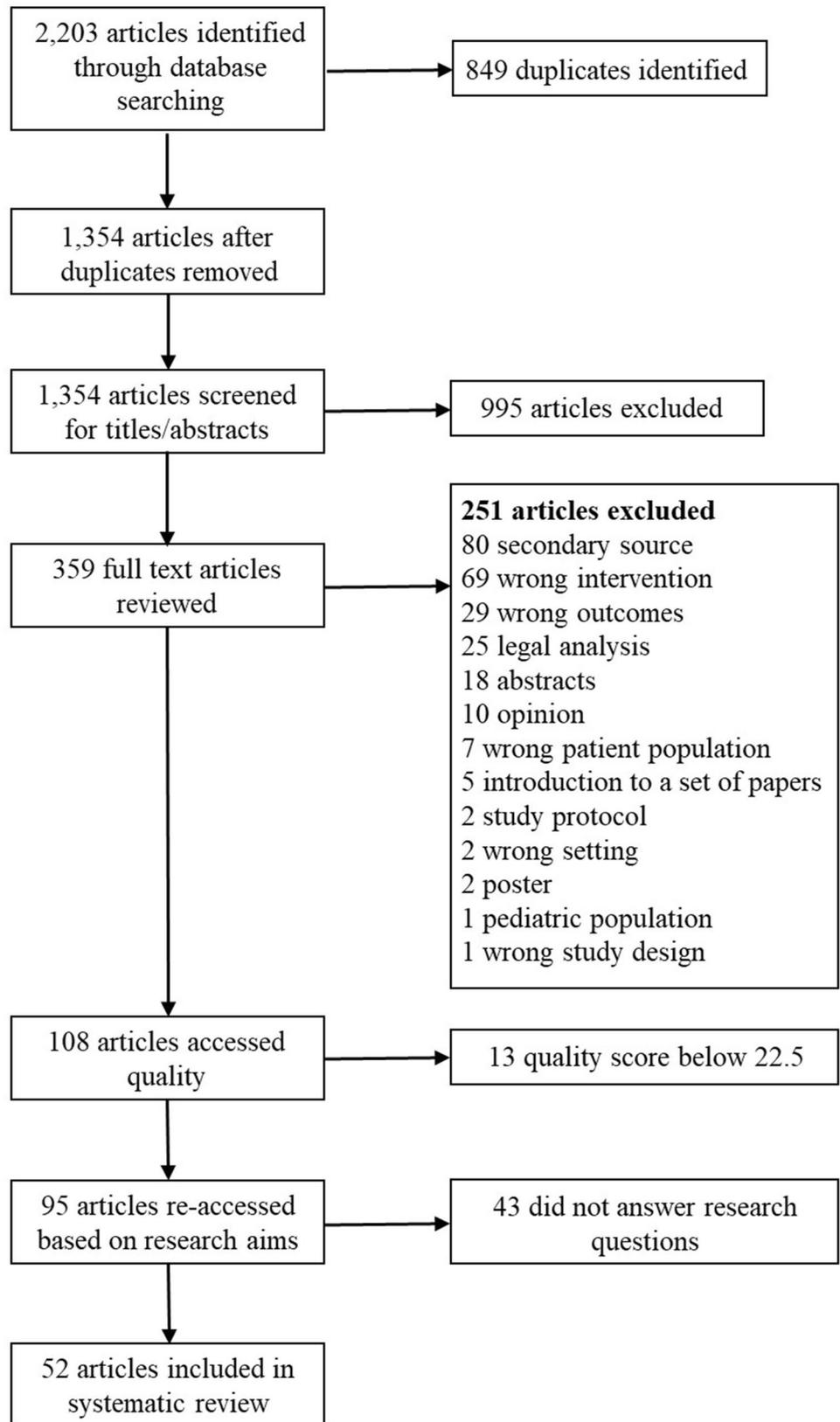


Table 1 Job accommodations frequencies/rates in reviewed articles and examples of job accommodation usage

Type of job accommodations	Freq	Rate/disability/article	Examples of job accommodation usage
Job accommodation not specified		42–73% (MS, cancer, [35–39]) 35–40% (RA, IA, OA, AS, SLE, Cardiovascular disease, [40–42])	
Modifying architecture/workplace environment to increase workplace access			
Architectural or workplace environmental modifications to increase workplace access- Not specified	28	17–66% (unspecified disability, [11, 43–46]) 8%, 79% (Lupus, [47, 48]) 10–47% (MS, [35, 49]) 12% (LBP, [50]) 6% (OA & IA, [41])	
Accessible transportation	9	10–19% (unspecified disability, [11, 44–46]) 2–5% (physical disability, [17, 51]) 2–8% Driver (MS, [35, 49])	Assistance commuting from home to workplace for employees with disabilities
Using modified furniture (desk, chair, etc.)	9	49% (OA & IA, [52]) 10–33% (unspecified disability, [16, 44, 45]) 20% (physical disability, [51])	Height adjustable desk for wheelchair users Dividers to reduce distractions for employee who is easily distracted at work, such as persons with PTSD
Parking	6	8%, 70% (Lupus, [47, 48]) 10% (unspecified disability, [45]) 4% (RA, OA, AS, [40]) 8% (MS, [36])	Accessible entrance for employees who use wheelchairs, canes, crutches or walkers Van Accessible parking for wheelchair users and Accessible parking spaces for others as appropriate (e.g. canes, crutches, or walkers)
Temperature control	3	12–15% (MS, [36, 49]) 4% (physical disability, [51])	Easy access for employees who easily become fatigued when walking long distances An employee with MS is sensitive to and intolerant of heat because it exacerbates his/her symptoms An employee who has problems with temperature regulation due to cervical and high thoracic spinal cord injuries An employee's skin is sensitive to temperature extremes due to his/her physical disabilities, such as burn injury
Adding ramps	2	13% (unspecified disability, [16])	An employee who has problems with temperature regulation due to cervical and high thoracic spinal cord injuries
Adding automatic doors	1	11% (unspecified disability, [16])	Employees who have difficulty opening doors, such as, (1) People who use wheelchairs, canes, crutches or walkers; (2) People who have upper body weakness; or (3) people who have bilateral amputations
Making washrooms accessible	1	10% (unspecified disability, [40])	A large washroom cubicle with grab bars for employees who use wheelchairs, canes, crutches or walkers that enable independent transfer to commode A large washroom cubicle for employees who require a personal assistance for toileting

Table 1 (continued)

Modifying architecture/workplace environment to increase workplace access

Relocating work station	1	36% (cancer, [38])	An employee needs to sit closer to the break room, restroom, office equipment, or employee parking lot due to his/her mobility limitations Employees who are easily distracted at work due to conditions such as PTSD, TBI or CVA may need his/her workstation moved to minimize distractions Employees who are easily distracted at work due to conditions such as PTSD, TBI or CVA may need a door on his/her cubicle to minimize distractions An employee has migraines and finds that light exacerbates symptoms
Providing cubicle doors, shields or shades	1		
Modifying job responsibilities			
Modifying job responsibilities- not specified	5	15%, 88% (Lupus, [47, 48])	
Reassigning jobs	9	6%, 48% (Lupus, [47, 48]) 36% (OA, [53]) 24% (LBP, [50]) 5% (physical disability, [17]) 4% (MS, [49]) 0% (RA, OA, AS, [40])	An employee has physical disabilities and is unable to complete the essential functions that are physical in nature An employee has cognitive limitations, which prevent him/her from completing work assignments in a timely and accurate manner An employee is distracted by loud noises in the work environment An employee is medically restricted from working at heights An employee is unable to complete the physical tasks required by the job position, such as lifting or moving large or heavy objects to a required location An employee is unable to complete the cognitive tasks required by the job position, such as maintaining concentration An employee is unable to drive and make customer deliveries that is required by the job position An employee may encounter risks when conducting certain job tasks due to his/her medical conditions; for example, a person takes medication that causes him to bruise easily, so manual job tasks put him at risk An employee's pain increases in the afternoon, so lifting or carrying tasks are limited to mornings An employee easily becomes fatigued and is unable to work for full-time
Modifying job duties or shifting responsibilities to others	21	70% (RA, [33]) 17–31% (unspecified, [11, 44, 46]) 7–11% (MS, [35, 36]) 31% (physical disability, [51])	
Controlling work pace or work order	4	31%, 80% (Lupus, [47, 48]) 22% (physical disability, [51]) 8% (MS, [54])	

Table 1 (continued)

Modifying job responsibilities				
Job-sharing	1			An employee has fatigue or pain and is unable to work full time An employee is unable to drive and make customer deliveries that are required by the job description An employee is unable to complete the physical tasks required by the job description due to his/her physical disabilities An employee has cognitive limitations that prevent him/her from completing work assignments in a timely and accurate manner An employee is unable stand for extended periods due to his/her physical disabilities, such as (1) pain or weakness in legs, and (2) knee amputation An employee needs to take breaks from sitting for extended periods, such as (1) persons with back pain, and (2) persons with arthritis and (3) MS
Changing sitting or standing work position per needs or preferences	2			
Modifying workplace policies				
Modifying workplace policies—not specified		3		
Allowing employees to work from home or work from a remote location (partially or fully)	18	78% (Lupus, [47, 48]) 39% (OA & IA, [55]) 21% (physical disability, [51]) 6–15% (MS, [38, 54])		An employee has difficulty in traveling back and forth to work due to his/her mobility limitations An employee easily gets fatigued by commute due to his/her disabilities An employee with mobility impairments lives or works at an inaccessible location An employee is medically restricted from driving and is unable to find alternative work transportation options An employee is receiving ongoing therapy An employee has regular doctor appointments An employee receives in-home medical services
Flexible leave	8	16–44%, 80–90% (Lupus, [47, 48]) 19–72% (OA & IA, [41, 53, 55]) 42% (unspecified disability, [56])		
Modifying workplace policies—other Including: being flexible in HR policies, extended health benefits, and providing disability payment	6	82% (unspecified disability, [43]) 53–64% (OA & IA, [41, 53, 55])		
Providing supportive personnel				
Providing job support—not specified	9			
Arranging for co-workers to assist as needed	12	30%, 88% (Lupus, [47, 48]) 32–47% (unspecified disability, [11, 44, 46]) 24–56% (OA & IA, [41, 52]) 12–22% (physical disability, [17, 51])		An employee is unable to complete the physical tasks required by the job description due to his/her physical disabilities, such as lifting or moving large or heavy objects An employee is unable to drive and make customer deliveries that is required by the job description

Table 1 (continued)

Providing supportive personnel			
Using paid personal assistants	12	5–12% (unspecified disability, [11, 16, 45, 46]) 2–7% (MS, [35, 37])	An employee needs assistance with lifting or reaching work-related items due to his/her physical disabilities, such as upper body weakness An employee needs help to access the restroom due to his/her physical or cognitive limitations, such as spinal cord injury or brain injury An employee needs help to eat or drink at work due to his/her physical or cognitive limitations An employee needs help to travel for business purposes due to his/her physical or cognitive limitations An employee with diminished cognition needs help understanding his/her job tasks or requires assistance for ongoing reminders An employee needs assistance in learning or relearning to complete job tasks due to memory loss An employee needs assistance in initiating and completing tasks due to his/her cognitive limitations An employee needs assistance with maintaining social and life skills in the workplace An employee needs advice on workplace accommodations An employee has severe hearing loss and is expected to attend regular meetings An employee has vision loss or has difficulty in reading and needs to review or understand hardcopy materials An employee needs a support animal due to his/her physical disabilities An employee needs a support animal to monitor glucose due to diabetes An employee is visually impaired and needs a support animal
Using job coaches	8	8–41% (unspecified disability, [11, 16, 46])	
Using qualified readers or interpreters	7	2% (unspecified disability, [16]) 0.3–1% reader (MS, [35])	
Using support animals	2	2% (unspecified disability, [16])	
Flexible scheduling			
Flexible scheduling- not specified	15	17–53% (MS, [35–37]) 44–50% (unspecified disability, [1, 44, 46]) 31% (OA & IA, [41])	

Table 1 (continued)

Flexible scheduling	
Modifying work hours	<p>17 20%, 79% (Lupus, [47, 48]) 31–68% (OA & IA, [41, 53, 55]) 6–40% (physical disability, [17, 51]) 29% (LBP, [51]) 8–17% (MS, [36, 49, 54]) 49% (cancer, [38])</p> <p>An employee is receiving ongoing therapy An employee has regular doctor appointments An employee receives in-home medical services An employee is unable to work night shift due to medical condition An employee has difficulty in traveling back and forth to work due to physical disabilities An employee easily becomes fatigued by commute due to physical disabilities An employee has general weakness and requires frequent breaks An employee takes medications that causes grogginess needs a later more flexible schedule</p>
Modifying break schedule	<p>15 17%, 77% (Lupus, [47, 48]) 70% (RA, [33]) 16–17% (OA & IA, [41, 52]) 7–10% (physical disability, [17, 51]) 4–9% (MS, [36, 54])</p> <p>An employee suffers low back pain and needs to take breaks from sitting for extended periods An employee has been advised by his/her doctor to stand several times per hour to stretch and minimize stiffness and pain due to arthritis and MD An employee needs extended time to access the restroom due his/her physical disabilities An employee has insulin-dependent diabetes and needs additional breaks to test blood sugar, administer insulin and eat throughout the day Same as modified or flexible work hours</p>
Modifying work schedule	<p>16 15–53% (OA & IA, [41, 55]) 12–22% (MS, [35, 49]) 42% (cancer, [38])</p>
Providing additional training time or training refreshers	<p>7 14%, 86% (Lupus, [47, 48]) 13–21% (OA & IA, [41, 53]) 13% (LBP, [50]) 3–6% (physical disability, [17, 51])</p> <p>An employee has difficulty in reading and needs extra time to review or understand materials An employee has diminished cognition and has difficulty in taking tests in allotted periods</p>
Adjusting arrival or departure times	<p>3 34%, 81% (Lupus, [47, 48]) 17% (OA&IA, [52]) 6% (physical disability, [17])</p> <p>An employee needs to leave early or late to receive ongoing therapy, attend doctor appointments, or receive in-home medical services An employee needs to arrive late in order to access specialized transportation due to his/her physical disability</p>
Providing assistive technologies	
Assistive technologies- not specified	<p>20 18–42% (MS, [37, 49])</p>
Computer equipment—keyboards and computer mice	<p>8 5–13% (unspecified disability, [16, 45])</p> <p>An employee needs assistance with typing due to impairment, such as hemiparesis, quadriplegia, or upper extremity amputation(s)</p>
Computer equipment- monitors	<p>6 5–12% (unspecified disability, [16, 45])</p> <p>An employee has a visual deficit An employee has light sensitivity</p>

Table 1 (continued)

Providing assistive technologies	
Computer equipment -Trackballs	2
Software or Applications for Memory, Concentration, Organization, etc.	8
Speech Recognition Software	7
Verbal & Written instructions or checklists	4
Lifting and carrying aids, such as overhead cranes, carts or reachers	2
Environmental sound machines, tinnitus maskers, white noise or noise canceling headsets	1
Cognitive-assisted applications, such as electronic organizers, calendars, wall calendars, professional organizers	1
Recorded directives, messages	1
Assistive technology—other Including: talking clock, telephone headset, electronic formatted documents, Braille formatted materials, Wrist splints, CCTVs, amplified telephone, hearing aids, TTY/pager text communicator	22

MS multiple sclerosis, *RA* rheumatoid arthritis, *IA* inflammatory arthritis, *OA* osteoarthritis, *AS* ankylosing spondylitis, *SLE* systemic lupus erythematosus, *LBP* low back pain, *TBI* traumatic brain injury, *CVA* cerebrovascular accident, *MD* muscular dystrophy, *PTSD* post-traumatic stress disorder, *DD* developmental disability

An employee needs assistance with typing due to impairment, such as hemiparesis, quadriplegia, a bilateral or upper extremity amputation(s)

Employees with cognitive impairments, such as TBI, MS, Parkinson's disease and DD, need assistance with staying on task and completing tasks

An employee needs cues for job tasks

An employee needs reminders for tasks and schedules

An employee requires a guide to complete tasks

An employee needs assistance with typing due to upper limb impairments, such as hemiparesis, quadriplegia, a bilateral or upper extremity amputation(s)

An employee has difficulty in memory or staying on tasks and needs cues or reminders to complete the tasks, such as stroke, brain injury, MS, or Parkinson's disease

An employee has difficulty in lifting or carrying goods due to physical disabilities, such as MS, SCI, Parkinson's disease and medical lifting restrictions

An employee is distracted by work environment

Employees with cognitive impairments, such as TBI, MS, Parkinson's disease and DD, need assistance with staying on task and completing tasks

An employee needs cues for job tasks

An employee needs reminders for tasks and schedules

Employees with cognitive impairments, such as TBI, MS, Parkinson's disease and DD, need assistance with staying on task and completing tasks

An employee needs cues for job tasks

An employee needs reminders for tasks and schedules

A pushcart for an employee with mobility issues who needs to be able to move materials from place to place

An employee with hemiparesis needs a telephone headset to answer her phone

PICO statement, which left 359 articles for the full-text review. After reviewing the texts in their entirety, we excluded an additional 307 articles for not meeting the inclusion criteria ($n=251$), being of very poor or poor quality ($n=13$), or unrelated to the research aims ($n=43$). Fifty-two articles remained for data synthesis. Figure 1 shows the flowchart outlining the article selection process. Online Appendix 1 summarizes the 52 selected articles.

Job Accommodations Categories for Persons with Physical Disabilities

We organized the job accommodations into six broad categories: (1) modifying architecture/workplace environment to increase workplace access, (2) modifying job responsibilities, (3) modifying workplace policies, (4) providing supportive personnel, (5) flexible scheduling, and (6) providing assistive technologies. Categories from previous studies were referenced while drafting the initial framework for this review's results (15); however, the final categories were developed after synthesizing data from a broader selection of study designs than earlier literature. These categories reflect the job accommodations in previous studies, such as Padkapayeva et al. [15]. We revised the categorizations based on the data extracted from the included studies. For example, the new category titled "modifying workplace policies" describes how companies provide employment support at the organizational level. Table 1 summarizes the reported rates of job accommodations used in the workplace.

Modifying Architecture or Workplace Environment to Increase Workplace Access

Thirty-one articles mentioned modifying architecture or work environments as job accommodations, a category that includes modifying furniture, adding ramps, cubicle doors, shields and automatic doors, temperature control, and providing transportation support and accessible parking. Of the studies reporting modified architecture or workplace environment accommodations, the overall frequency rate ranged from less than 10% to more than 50%. *Using modified furniture* (49%) was the most commonly used accommodation and *hiring a driver* (2–8%) as the least frequent accommodation. Employees with certain types of disability may need specific environmental modifications. For example, employees with multiple sclerosis (MS) will likely need temperature control and air conditioning, as extreme body temperatures can exacerbate MS symptoms. Similarly, some people with mobility disabilities may need to work at an accessible workstation and workplace.

Modifying Workplace Policies

Twenty-five articles identified modifying workplace policy as an approach to reducing employment barriers. The most frequently used strategy was *allowing employees to work from home or work from a remote location (partially or fully)*, with reported frequency rates ranging from 6 to more than 50%. Flexible leave, flexible human resources policies, extended health benefits, and providing disability payments were other ways to help employees maintain their jobs, decrease barriers for returning to work, and perform essential functions of their jobs.

Providing Supportive Personnel

Twenty-two articles identified the provision of supportive personnel, which includes *arranging for co-workers to assist as needed* and *using paid personal assistants, job coaches, readers, interpreters or support animals*. Using existing workplace resources, such as *arranging for co-workers to assist as needed*, was the most common strategy adopted by employers, with reported frequency rate ranging from 12 to more than 50%. With a comparatively low percentage, a few employers provided job coaches, qualified readers, interpreters, or paid personal assistance services.

Modifying Job Responsibilities

Thirty-four articles described modifying employees' job responsibilities, including reassigning jobs, modifying job duties, controlling work pace or work order, and job sharing as strategies to restructure the job position or responsibilities. Although job restructuring is a form of accommodation, employers are not required to reassign the essential job functions to fulfill an employee's needs. Unsurprisingly, the modification of job responsibilities was not provided commonly by employers; most studies reported rates of modifying job responsibilities less than 40%. Some employers helped employees transfer to a new job position if the employee was no longer able to perform the essential functions of a position with or without accommodations.

Flexible Scheduling

Flexible scheduling is a broad accommodation that includes *modifying work hours, break schedule and work schedule, providing additional training time or training refreshers, and adjusting arrival and departure times*. Of the thirty-six articles that mentioned flexible scheduling accommodations, the reported frequency rate ranged from 20 to 80% across diagnoses. Flexible scheduling can be arranged formally or informally, depending on employers' ability to modify work hours and responsibilities. Because flexible scheduling is

common in some organizations, persons with disabilities may not perceive flexible scheduling as a job accommodation, despite using this strategy to mitigate symptoms and manage medical services.

Providing Assistive Technologies

Providing assistive technologies and devices was a type of job accommodations reported as being frequently provided by employers ($n = 30$). Assistive technologies included a wide range of equipment that people with disabilities use to mitigate workplace barriers and maximize their productivity. Examples of high- and low-tech devices and tools include keyboards, computer mice, monitors, software, cognitive-assisted applications, verbal or written instructions, checklists, lifting and carrying aids, environmental sound machines, recorded directives, electronic organizers, and smartphones. Assistive technologies vary based on employees' needs, task requirements, and workplace availability. Of the studies that mention assistive technology, approximately 20% to 50% of employees received assistive technology as an employer-provided accommodation.

Factors that Influence the Use or Adoption of Job Accommodations

This review also presents a summary of the facilitators and barriers that influence the likelihood of whether people with disabilities use or adopt certain job accommodations. The articles identified primarily focused on how employee characteristics and workplace features affect job accommodation use. Relatively few studies addressed the relationships between job characteristics, accommodation types, and use of job accommodations. The modified PEO model fit well in the context of using job accommodations. We categorized the factors that two or more studies cited and organized them into four broad categories: (1) employee-related factors, (2) social workplace-related factors, (3) job-related factors, and (4) accommodation-related factors, as shown in Fig. 2. Previous studies primarily focused on how employee characteristics and workplace features affect job accommodation use; however, few described the relationship between job characteristics, accommodation types, and the use of job accommodations.

Employee-Related Factors

Many studies included in this review examined the associations between individual factors and job accommodations. they often noted three main facilitators and barriers to the receipt of job accommodations: *psychosocial factors*, *disability and functional limitations*, and *demographic characteristics*. The most salient factor was employee awareness

of job accommodations and the willingness to advocate for themselves. Specifically, receipt of job accommodations is more likely when employees understand their limitations, know what job accommodations they need, have higher self-efficacy and confidence, are able to self-disclose and advocate for job accommodations, communicate well with their employers, have access to supportive resources, and perceive less stress when asking for accommodations. Other individual factors that play a role in job accommodation reception were functional limitations, diagnosis and symptoms, health conditions, pain and fatigue, education, age, sex, marital status, job tenure, and financial status.

Social Workplace-Related Factors

Selected studies also addressed social workplace-related factors as an important environmental factor that affects the receipt of job accommodations. Sixteen articles mentioned employer attitudes influence the provision of job accommodations. Six articles reported that employers lack knowledge regarding specific job accommodations. Five studies addressed the importance of employers' and co-workers' engagement in providing accommodations, and three articles suggested providing education to employers and co-workers about job accommodations would promote their use. *Employers' fear of costs* and *occupational areas* were cited as barriers to providing job accommodations.

Job-Related and Accommodation-Related Factors

Although numerous studies mentioned individual and environmental factors, few addressed how job characteristics and accommodation types affect their use. The cost and financial burden of job accommodations was an important consideration for employers when deciding whether to provide them. Company policies and procedures varied -some companies required medical documentation before approving an accommodation. Some persons with disabilities may qualify for financial assistance with accommodations from state-funded rehabilitation programs. Employers were less likely to provide high cost accommodations, whereas they were more likely to provide flexible scheduling or how cost assistive devices. In terms of job characteristics, employees who have more control over their jobs tended to receive more accommodations. Full-time workers were more likely to receive accommodations than part-time workers were, as did office workers compared to blue-collar workers. Work demands also influence the type of job accommodations that employees receive. When the work includes specific tasks which employees were unable to accomplish due to his or her disability, the employers may consider providing job accommodations to help employees handle the tasks.

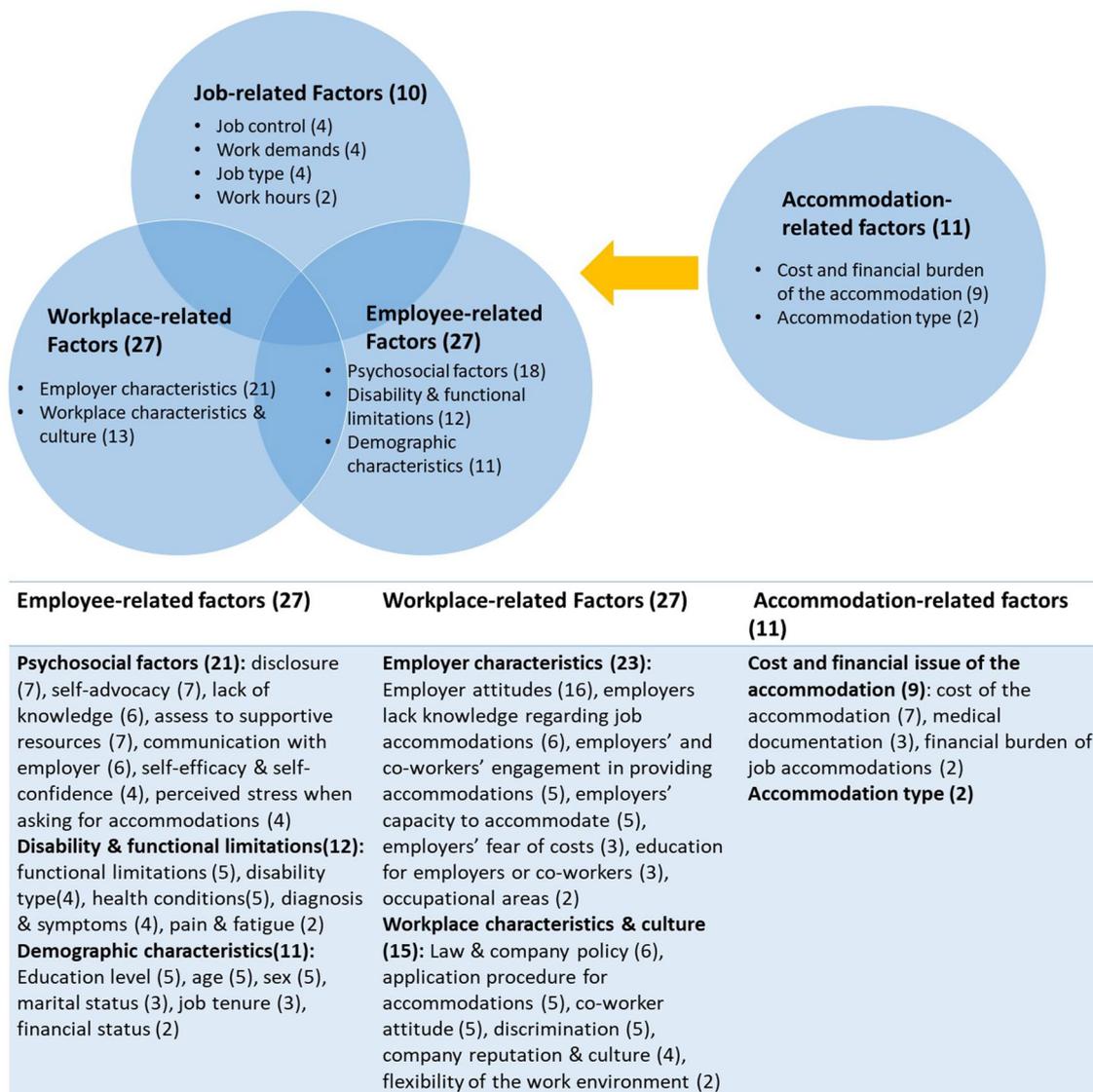


Fig. 2 Frequency of factors that influence the use or adoption of job accommodations. There is no sub-category identified for the *job-related factors*. Most articles focused on *social workplace-related fac-*

tors and employee-related factors. Few studies identified *job-related factors* and *accommodation-related factors*

Outcomes of Adopting Job Accommodations

The bulk of the previous literature only reported qualitative descriptions of job accommodations without reporting quantitative data to support the effectiveness of the accommodations made. Some studies described various benefits of job accommodations including biopsychosocial outcomes (such as *helping with physical functioning, preventing disability, decreasing symptoms, increasing self-esteem, and increasing social participation inside or outside of work*); cost, effectiveness, and efficiency (such as *acquiring and maintaining a job, reducing job disruption, increasing work productivity, improving ability to perform essential job functions, and*

increasing income); employers’ satisfaction and perceived benefits; and quality of employment (such as *work hours and decreased absence*) (Table 2).

Most studies reported *job acquisition* as their primary outcome. However, some reports suggested that job accommodations could also promote work productivity, increase work hours, help in maintaining employment, decrease absence due to illness, and improve physical and behavioral wellness. The evidence of job accommodation effectiveness is weak because of reliance on observational study designs. Despite a paucity of quasi-experimental and randomized control trials, most studies used cross-sectional surveys, longitudinal cohort studies, case-control studies, and qualitative designs. The lack

Table 2 Outcomes of adopting job accommodations

Outcomes	Frequency
Biopsychosocial outcomes	
Helping with physical functioning, preventing disability or decreasing symptoms	6
Increasing self-esteem	1
Increasing social participation inside or outside of work	1
Cost of job accommodations	6
Effectiveness and efficiency outcomes	
Acquiring a job, maintaining a job, reducing job disruption	14
Increasing work productivity, improving ability to perform essential job functions	9
Increasing income	1
Job outcomes from employer's perspective	
Employers' satisfaction and perceived benefits	4
Employer-perceived effectiveness or efficiency	3
Quality of employment	
Increasing work hours	4
Decreasing absence	2
Gaining positive work experience	1

of strong evidence precludes statements about the effectiveness of specific job accommodations for workers with specific disabilities.

Cost of Job Accommodations

Five articles described the costs of job accommodations. For the most part, costs were low and were a one-time expense. For example, McNeal et al. [31] reported that more than half of job accommodations cost nothing, and 80% of job accommodations cost less than \$500. Stoddard reported the average cost per week for workplace accommodation was \$34.50, ranging from \$0 to \$250. Solovieva et al. [32] reported that 24% of job accommodations required only a one-time cost while 55% had a median one-time cost of \$500. More than half of employers (54%) reported no indirect costs for job accommodations, such as lost time due to extra training, decreased productivity, and supervisor time. Only 34% of employers identified indirect costs in providing job accommodations, which varied based on the type of accommodation. *Modifying architecture or workplace environment* and *providing supportive personnel* were the most likely types of accommodations to cost more than \$500. Solovieva and colleagues reported that the average cost of personal assistance services was \$7808 (median=\$1850) with the average estimated direct benefits as \$7017 (median=\$1600), for a net cost of \$693 (median=\$250).

Discussion

This systematic review provides novel information regarding the type, target, and effectiveness of job accommodations for people with physical disabilities. We modified the PEO model to develop a conceptual framework that distinguishes the influence of job-related, workplace-related and employee-related factors on employment outcomes, and the influence of specific job accommodations. Strengths of this review include the use of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), extensive collaboration with a medical librarian, rigorous procedures for data extraction, and use of a quality grading system.

This systematic review reports the frequency of job accommodations reported across 52 original reports, and the rate of use by specific disability categories alongside examples of job accommodations. Architectural and environmental modifications were among the most frequently provided accommodations, often for individuals with fine motor and mobility limitations. We found that employers frequently modified job responsibilities, workplace policies, provided supportive personnel, allowed flexible scheduling, and offered assistive technology. Aside from a handful of exceptions (e.g., persons with MS may need temperature control to prevent symptom exacerbation), we learned that

there were few differences in types of job accommodations by diagnosis or disability category. The findings align well with the experience of the research team's rehabilitation counselors in making individualized recommendations of job accommodations based on clients' personal functional needs as opposed to diagnosis or disability.

Compared to the job accommodation summaries reported in earlier reviews [15, 25], this systematic review adds new information regarding the rate of job accommodations used and in what situations employers provide accommodations. To ensure the results are applicable to real-world practice, the research team's three vocational rehabilitation counselor reviewed the analysis of primary sources, applied the PEO model, and developed a job accommodation map. Despite these strengths, it is challenging to map specific accommodation to specific functional limitations, as most reports did not describe the specific accommodation needs or requests of employees, or the accommodations that employers refused to provide.

Outcomes of job accommodations varied widely across the original reports. The most commonly reported outcomes were job acquisition, job retention, or improved performance. Other frequent outcomes were work productivity, reduced functional limitations, and hours worked. Articles infrequently reported satisfaction with employment and perceived effectiveness or efficiency of accommodations. Employment can increase a worker's social participation, both in the work environment and in the community. For example, job accommodations can improve life participation at home and increase leisure activity participation [33].

The limited number of studies using experimental designs severely limits the conclusions that we can draw on job accommodations' effectiveness and efficiency. In addition, most authors only reported the overall use of job accommodations and provided a qualitative description of outcomes; few studies measured work outcomes after providing job accommodations. Future studies should adopt stronger designs and assess specific work outcomes to evaluate the effectiveness of specific job accommodations. Consistent with previous reports [31, 34], this systematic review supports the conclusion that most job accommodation costs are low, dispelling one of employers' primary concerns. Considering the positive effects on employees who return to work and the benefits that accrue to employers, it is clear that providing job accommodations and developing policies that facilitate their use is cost-effective.

In this systematic review, we summarize the barriers and facilitators that influence the delivery and receipt of workplace accommodations for employees with physical disabilities and their employers. Employees' self-determination is a key factor in influencing whether they request and receive job accommodations, including awareness of

their own needs for accommodations, knowledge about job accommodations and resources, the extent of self-efficacy, readiness to disclose a need for accommodations to a supervisor or human resource staff, ability to advocate for their accommodation needs, and communication skills. Future studies should investigate how to improve self-determination to acquire and use job accommodations successfully.

Readers should note that while we selected reports with samples of persons with physical disabilities, we were not able to exclude subsamples with sensory, intellectual, or behavioral disabilities. Some studies included not only samples of people with physical disabilities but also people with other conditions, such as people with behavioral and cognitive impairments. Co-occurrence of physical and cognitive, behavioral, and sensory limitations is common. For example, people with traumatic brain injuries [57], Parkinson's disease and multiple sclerosis may also experience cognitive impairments. In addition, some reports included job accommodations for people with other disabilities. Because the use of job accommodations reflects a person's functional needs rather than diagnosis or disability category, we encourage investigators to specify the functional limitations of their samples in detail. A focus on function rather than diagnosis will improve our knowledge of accommodations in real-world practice.

This review provides a method to categorize job accommodations for persons with physical disabilities and examples of how and in what context employers provide specific job accommodations. This method provides a guide for investigators, practitioners, and employers. This review also provides a conceptual framework that describes the facilitators and barriers and relationships to job accommodations use. Persons with disabilities, vocational rehabilitation counselors, and employers may consider these factors when planning job accommodations. We hope that this framework provides investigators with a common language when evaluating outcomes of job accommodations.

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Compliance with Ethical Standards

Conflict of interest The authors have no conflict of interest to declare.

Ethical Approval All procedures performed in this project were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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