

1 **TITLE**

2 A scoping review of disability assessment in prospective and cross-sectional studies that included
3 device-based measurement of physical activity

4

5 **ABSTRACT**

6 **Background**

7 Evidence on the prevalence, determinants, and health outcomes of physical activity in disabled
8 people is limited. It is possible that the limited availability of high-quality scientific evidence is due to
9 the extent and nature of disability assessment in physical activity research. This scoping review
10 explores how disability has been measured in epidemiological studies that included accelerometer-
11 based measurement of physical activity.

12 **Methods**

13 Data sources: MEDLINE (Ovid), Embase, PsychINFO, Health Management Information Consortium,
14 Web of Science, SPORTDiscus, and CINAHL.

15 Eligibility criteria: Prospective and cross-sectional studies that included an accelerometer
16 measurement of physical activity. Survey instruments used in these studies were obtained, and
17 questions relating to the International Classification of Functioning, Disability and Health (ICF)
18 domains of: 1) health conditions; 2) body functions and structures, and 3) activities and
19 participation, were extracted for analysis.

20 **Results**

21 Eighty-four studies met the inclusion criteria, from which complete information on the three
22 domains was obtained for 68. Seventy-five percent of studies (n=51) captured whether a person had
23 at least one health condition, 63% (n=43) had questions related to body functions and structures,
24 and 75% (n=51) included questions related to activities and participation.

1 **Conclusion**

2 Whilst most studies asked something about one of the three domains, there was substantial
3 diversity in the focus and style of questions. This diversity indicates a lack of consensus on how these
4 concepts should be assessed, with implications for the comparability of evidence across studies and
5 subsequent understanding of the relationships between disability, physical activity, and health.

6

7

8

9

10 **BACKGROUND**

11 Emerging evidence indicates that physical activity is beneficially associated with many physical and
12 mental health outcomes in disabled people. This includes improved mood, psychological well-being
13 and overall quality of life, and reduced self-reported depression, stress and pain.^{1,2} Physical activity
14 also has a role in the prevention and management of chronic disease in this population, including
15 coronary heart disease, type 2 diabetes, stroke and some types of cancer.^{3,4}

16

17 Whilst evidence exists on the benefits of physical activity for disabled people, the volume of research
18 is small relative to that for the non-disabled population. Less than 5% (n=1235) of articles published
19 in the five highest ranked medical journals between 1999 and 2019 focused on disabled people, and
20 less than 7% (n=77) of these addressed physical activity and/or health.⁵ Thus, while the available
21 evidence has started to provide insights, relatively little is known about how active disabled people
22 are, and the types of actions needed to address barriers and support disabled people to be
23 physically active⁶. There is, therefore, a need for further high-quality research on physical activity in
24 disabled people, especially given some preliminary data suggest disabled people are twice as likely
25 to be physically inactive compared to the non-disabled population.⁷

26

1 The World Health Organization (WHO) 2020 physical activity and sedentary behaviour guidelines⁸
2 were the first global guidelines to address people living with chronic conditions and impairments.
3 The Guideline Development Group reviewed the evidence on the association between physical
4 activity and health outcomes in four chronic conditions (cancer, hypertension, type 2 diabetes and
5 HIV) and eight types of impairment or disability (multiple sclerosis, spinal cord injury, intellectual
6 disability, Parkinson's disease, stroke, major clinical depression, schizophrenia, and attention deficit
7 hyperactivity disorder (ADHD)); however, due to the small volume of evidence identified, they also
8 considered the applicability of the general population guidelines to disabled people.⁹ They found no
9 evidence to suggest the general population guidelines would not be applicable, and thus
10 extrapolated the general population guidelines to all disabled people. The guidelines note, however,
11 that disabled people might need to consult a health professional to determine the appropriate type
12 and amount of physical activity.⁸

13

14 It is possible that the limited availability of high-quality scientific evidence in the field of disability
15 and physical activity is due to limited funding for research in this population and/or the complexity
16 of measuring disability in this context. For example, physical activity research has typically adopted a
17 medical model, classifying people by their diagnosed health condition, rather than considering the
18 nature of their impairment(s). This approach could be problematic, especially where there is wide
19 variation in the severity of symptoms and/or the nature of impairment experienced by people with
20 the same diagnosed condition. There is a need to better understand how disability is currently
21 assessed in physical activity research and whether improvements in this area might facilitate the
22 development of a more robust evidence base.

23

24 According to the WHO International Classification of Functioning, Disability and Health (ICF),¹⁰
25 disability results from the dynamic interaction between an individual with a health condition and
26 contextual (Personal and Environmental) factors. The ICF considers how these factors combine to

1 negatively affect people in terms of 1) body functions and structures; 2) ability to execute
2 tasks/activities; and 3) involvement/participation in life situations (further detail is provided in the
3 methods). This scoping review used ICF to explore whether disability has been assessed within
4 epidemiological studies that included accelerometer-based measurement of physical activity in
5 adults, and if so, what information on disability was captured.

6

7 To note, we have chosen to consistently use the term 'disabled people' throughout the paper, as this
8 term is typically more accepted among the UK disability community¹¹ (where the authors are based),
9 however we acknowledge that other terminologies (such as 'people with disabilities') are preferred
10 among some individuals, groups and organisations.

11

12 **METHODS**

13 This review was conducted in accordance with the Joanna Briggs Institute (JBI) guidelines for scoping
14 reviews¹², and is reported following the Preferred Reporting Items for Systematic reviews and Meta-
15 Analyses extension for Scoping Reviews (PRISMA-ScR) framework.¹³ A protocol was developed *a*
16 *priori*, as described below, and was later made available on the Open Science Framework (DOI:
17 <https://doi.org/10.17605/OSF.IO/C2JHV>).

18

19 **Eligibility criteria**

20 Our search strategy focused on publications, but the unit of analysis for the review was 'study',
21 findings from which may have been reported across multiple publications. Studies were considered
22 for inclusion if they met the following criteria: 1) observational studies that were either prospective
23 or cross-sectional and representative of a national or regional population; 2) report data on adults
24 (over the age of 18 years) alone, or separately from any data on children or adolescents; and 3)
25 include accelerometer measurement of physical activity. We restricted the review to studies that
26 included accelerometer measurement of physical activity to keep the number of potentially eligible

1 studies to a manageable size. There was no sample size requirement. Studies only reporting data on
2 children and adolescents, or studies only reporting data on cohorts of participants recruited due to
3 the presence of a clinical condition were excluded. We were interested in understanding the
4 assessment of disability within population-based observational studies, and hence the exclusion of
5 studies focused on specific clinical sub-groups. Searches were limited to articles published in English-
6 language peer-reviewed scientific journals. Searches were not limited by publication date.

7

8 **Information sources**

9 Literature searches were completed in March 2020 (updated in November 2021) using the following
10 databases: MEDLINE (Ovid); Embase; PsychINFO; Health Management Information Consortium; Web
11 of Science - Core collection; SPORTDiscus through EBSCOhost; and CINAHL (Cumulative Index to
12 Nursing & Allied Health Literature) through EBSCOhost. A base search strategy was developed in
13 MEDLINE (Ovid) and syntaxes altered accordingly for subsequent database searches. See
14 Supplementary File 1 for the full search strategy for Medline. Supplementary searches were
15 completed through bibliographic screening, forward and backward citation searches of articles, and
16 correspondence with experts in the field to identify other studies that potentially met the inclusion
17 criteria. The search strategy included title, abstract and subject word searches for Medical
18 Subheading (MeSH) terms relating to physical behaviour, physical activity, sedentary behaviour,
19 device-based measurement of movement (accelerometer, accelerometry, motion sensor, device),
20 and terms denoting cross-sectional and prospective observational studies.

21

22 **Selection of sources of evidence**

23 Following the removal of duplicates, titles and abstracts of all articles returned by the searches were
24 independently screened by two reviewers to assess whether the study described by the article was
25 eligible for inclusion. Disagreement between reviewers was resolved in consultation with a third
26 arbiter. Full-text versions of articles included at initial screening were then assessed by one reviewer,

1 who consulted with the third arbiter from the initial screen stage on any uncertainties. For the
2 studies identified, we attempted to obtain all questionnaires, used to collect any form of data,
3 across the lifetime of the study up to November 2021 using the protocol detailed below.

4

5 **Protocol**

6 To obtain questionnaires, or a data dictionary of study questions and response options, the following
7 steps were taken:

8 1. Online search; for example, through the Google search engine, to identify a study website

9 2. Exploration of study documents/papers; for example, study protocol or published research
10 papers

11 3. Contact via:

12 i. 'Contact us' form on the study website

13 ii. Any contact details/ email address on study website, for study lead, principal
14 investigator (PI) or data collection team

15 iii. Emailing the PI or corresponding author on a research paper

16 In Step 3, contact attempts were made over a four-week period. If no response was received within
17 two weeks of the first contact, a follow up contact attempt was made. If no response was received
18 within a further two weeks, the study was excluded.

19

20 **Data charting process**

21 A data charting template was developed to extract information on how each study captured the

22 following three dimensions of ICF: 1) health conditions; 2) body functions and structures; and 3)

23 activities and participation. During initial development, a trial data extraction was undertaken on ten

24 studies by two authors independently and then compared to ensure all relevant data would be

25 extracted and consistently recorded. Following agreement, data extraction for all studies was

26 undertaken, led by the lead author, who engaged the last author on any aspects of uncertainty. Final

1 decisions were reached through discussion between these two authors. See Supplementary File 2 for
2 a complete list of the information extracted on each study. In summary:

3

4 (1) Health condition

5 Health condition is the umbrella term used by the ICF for disease, disorder, injury, or trauma. We
6 categorised each health condition that was assessed in each study according to the International
7 Statistical Classification of Disease and Related Health Problems (ICD-10)¹⁴ to provide a standard
8 classification system across studies. We present results based on 14 chapters from the ICD-10; 1)
9 Endocrine nutritional and metabolic diseases; 2) Diseases of the circulatory system; 3) Diseases of
10 the respiratory system; 4) Neoplasms; 5) Diseases of the musculoskeletal system and connective
11 tissue; 6) Diseases of the nervous system; 7) Mental and behavioural disorders; 8) Diseases of the
12 eye and adnexa; 9) Diseases of the digestive system; 10) Diseases of the genitourinary system; 11)
13 Certain infectious and parasitic diseases; 12) Diseases of the ear and mastoid process; 13) Diseases
14 of the skin and subcutaneous tissue; 14) Diseases of the blood and blood-forming organs and certain
15 disorders involving the immune mechanism.

16

17 (2) Body functions and structures

18 In the ICF, *body functions* refer to the “physiological functions of the body systems (including
19 psychological functions)”, and *body structures* are the “anatomical parts of the body such as organs,
20 limbs and their components”.^{10(p10)} Within the ICF, body functions and structures are one component
21 but classified under two sections. For this review, the two sections have been combined under the
22 following chapters 1) Mental and nervous system; 2) Sensory and pain; 3) Cardiovascular,
23 haematological, immunological, and respiratory; 4) Voice and speech; 5) Neuromusculoskeletal and
24 movement-related; 6) Digestive, metabolic and endocrine; 7) Genitourinary and reproductive; and 8)
25 Skin and related structures.

26

1 (3) Activities and participation

2 The ICF utilises a combined system for categorising a person's ability to execute tasks/activities and
3 involvement/participation in life situations (referred to as 'activities and participation' from here).

4 Within the ICF categorisation system for activities and participation, there are nine chapters: 1)
5 Learning and applying knowledge; 2) General tasks and demands; 3) Communication; 4) Mobility; 5)
6 Self-care, 6) Domestic life; 7) Interpersonal interactions and relationships; 8) Major life areas; and 9)
7 Community, social and civic life.

8

9 **Synthesis of results**

10 The unit of analysis was study. We included all question-sets that each study used across its lifetime.
11 Data were synthesised narratively, focussing on the frequency and characteristics of measurement
12 in the three domains of 1) health condition, 2) body functions and structures, and 3) activities and
13 participation. A study only had to capture the data once, at any point in its history, for a frequency
14 count to be recorded. Where percentages are reported, these are based on the total number of
15 included studies. As we were only gathering questionnaire items, ethical approval was not required.

16

17 **RESULTS**

18 As depicted in Figure 1, 84 studies were eligible for inclusion in the review. Following the protocol
19 to obtain study questionnaires, 16 studies were excluded, either due to no reply or because we were
20 unable to obtain sufficient information on the questionnaire items used. Therefore, 68 studies were
21 included in the synthesis. Thirty-seven (54%) took place within Europe. The remaining studies were
22 predominately located within North America (n=16, 24%), although studies were also included from
23 South America (n=5, 7%), Australia and Oceania (n=5, 7%), Asia (n=4, 6%), and Africa (n=1, 1%).

24 Supplementary File 3 provides study name and corresponding study number, as well as location and
25 source.

26

1 Of the 68 included studies, 8 (12%) did not collect any information related to health conditions, body
2 functions and structures, or activities and participation. Fifty-one (75%) had questions related to
3 health conditions, 43 (63%) had questions related to body functions and structures, and 51 (75%)
4 included questions related to activities and participation.

5

6 **Health conditions**

7 Table 1 presents the number and percentage of studies that asked whether participants currently or
8 previously had one or more specific condition, disease or other health related disorder, grouped
9 according to 14 chapters from the ICD-10.¹⁴ Fifty-one (75%) studies included at least one question
10 where participants reported whether they had previously or currently had a specific condition,
11 disease or other health disorder which fell into one or more ICD-10 chapter. One study had an open-
12 ended question where participants were asked to report what conditions they currently had, with no
13 specific conditions or diseases named. Most frequently, studies ascertained information about
14 conditions from the 'Endocrine, nutritional, and metabolic diseases' chapter of ICD-10 (n=48, 71%),
15 most commonly diabetes. This was closely followed by diseases of the circulatory system (n=47,
16 69%) such as high blood pressure or a heart attack, and diseases of the respiratory system (n=43,
17 63%) such as asthma and chronic obstructive pulmonary disease (COPD). In most instances, an open-
18 text question followed, where participants could report any other health conditions or diseases that
19 were not explicitly mentioned within the study's questionnaire(s).

20

Table 1: Frequency of studies that assessed health conditions, based on ICD-10 classification.

ICD-10 chapter	N	%	Study Reference No.
Endocrine, nutritional, and metabolic diseases	48	70.6	1-3,5,7-18,20,22,24-28,30-34,36-38,40,41,43,45,46,48-58,60
Diseases of the circulatory system	47	69.1	1-3,7-18,20,22,24-28,30-34,37,38,40,41,43-46,48-58,60
Diseases of the respiratory system	43	63.2	1,2,5,7-14,16,17,20,22,24-28,30,32-34,37,38,40,41,43-46, 48-55,57,58,60
Neoplasms	37	54.4	2,5,7-13,16,22,24,26-28, 30,32,34,36-38,40,41,44-46,48,49,51-58,60
Diseases of the musculoskeletal system and connective tissue	35	51.5	1,2,4,5,7,8,10-12,14,16,22,24,26,27,30,32-34, 37,38,40,41,43,45,49,51-58,60
Diseases of the nervous system	31	45.6	1,2,5,7,9-12,16,24,26,28,30,32-34,36-38,41,43,45,46,48,52,54-58,60
Mental and behavioural disorders	29	42.6	1,2,7,9,11,13,14,16,24,26-28,30,32-34,37-39,40,41,43,45,46,52-58,60
Diseases of the eye and adnexa	24	35.3	2,3,5,7,8,12,16,24,26,30,32,33,37,40,41,43,45,46,49,52,56-58,60
Diseases of the digestive system	22	32.4	1,5,7,9,10,12,16,22,28,33,34,38,40,41,43,48,52-54,57,58,60
Diseases of the genitourinary system	21	30.9	1,3,5,7,9,10,12,16,22,25,26,28,34,37,41,44,46,53,55,57,60
Certain infectious and parasitic diseases	15	22.1	2,5,9,10, 27,28,38,40,44,48,49,53,54,57,60
Diseases of the ear and mastoid process	11	16.2	5,8,26,30,32,40,41,45,46,57,60
Diseases of the skin and subcutaneous tissue	11	16.2	1,5,11,13,26,30,34,41,45,57,60

Diseases of the blood and blood-forming organs and certain

disorders involving the immune mechanism

5

7.4

8,25,34,44,60

1 **Body functions and structures**

2 As displayed in Table 2, of the 68 included studies, 43 (63%) included questions related to
 3 participants’ body functions and structures. Most questions related to a person’s body functions,
 4 rather than structures. There was considerable variation in the style of questions. Some studies
 5 included a validated measure, such as the Mini-Mental State Examination (n=6, 9%) to assess
 6 cognitive impairment.¹⁵ Others, such as the Northern Finland Birth Cohort (corresponding study
 7 number 41), asked participants to select a statement that best describes their health today with
 8 response options on a 5-point scale from “Can think clearly and logically; my memory works
 9 flawlessly” to “I am constantly delirious and have no sense of time and place”. ‘Mental and nervous
 10 system’ was the most common category assessed; in particular, questions most frequently related to
 11 a person’s memory and emotional functions. No studies asked questions on body functions and
 12 structures related to the chapter of skin and related structures.

13

14 **Table 2:** Frequency of studies that asked about each chapter within body functions and structures on
 15 the ICF.

Body functions and structures chapter	N	%	Study Reference No.
			1-5,7,9,11,12,16,22-26,28,30,33-
Mental and nervous system	38	55.9	42,45,46,49,52,54-60
Sensory and pain			1-9,11,13,16,20,22-26,28,30,33-35,37-41,
	38	55.9	45,46,49,52-54,56,58-60
Cardiovascular, haematological, immunological, and respiratory systems	13	19.1	1,2,7,16,22,24,26,28,41,45,52,58,60
Neuromusculoskeletal and movement-related	10	14.7	1,7,9,16,34,35,42,54,58,60
Voices and speech	8	11.8	22,24,34,41,42,46,53,8,60
Digestive, metabolic, and endocrine systems	1	1.5	60

Genitourinary and reproductive	1	1.5	60
Skin and related structures	0	0	

1

2 **Activities and participation**

3 Table 3 shows the number and percentage of studies that asked questions about activities and
4 participation, as categorised by the ICF. Fifty-one (75%) studies included questions related to a
5 person's activities and participation, but there was considerable diversity in the number and type of
6 questions asked. Forty-five (66%) asked about two or more of the nine activity and participation
7 chapters, with 19 (28%) asking questions about five or more of the chapters. Questions related to
8 mobility were asked most frequently (n=48,71%), although the level of detail differed considerably.
9 For example, the ActiFE ULM study (corresponding study number 1), asked participants how difficult
10 it was for them to carry out daily activities on their own, whilst Maastricht Study (corresponding
11 study number 35) asked participants to report on their ability to undertake a variety of different
12 activities including getting around the house, getting in and out of bed, washing face and hands, and
13 doing light and heavy household activities. Mobility and Self-care were asked about by over half of
14 studies, with some including measures such as the EuroQol-5D¹⁶ (n=9, 13%), 36-item Short Form
15 Health Survey (SF-36)¹⁷ (n=9, 13%) or 12-item Short Form Health Survey (SF-12)¹⁸ (n=9, 13%). Least
16 frequently referred to was interpersonal interactions and relationships (n=3, 4%).

17

18 **Table 3:** Frequency of studies that asked about each chapter within activities and participation on
19 the ICF.

Activities and participation chapter	N	%	Study Reference No.
Mobility	48	70.6	1-9,12,13,16,19-30,33-35,37-43,45-49,52-60 1-7,11,12,16,20-22,24-26,28-30,33-
Self-care	38	55.9	35,37,38,40,42,43,46,47,49,52-58,60

Learning and applying knowledge	28	41.2	1,2,4,7-9,11,16,22,24,26,34,36-42,46,49,52,53,55-58,60 1,2,6,8,9,11,12,20,22,24,26,33,36-
Communication	28	41.2	39,41,42,46,47,49,52,53,55-58,60 1,4,7,11,12,16,22,24,26,28,30,33,35,37-40,42,46,47,52-
Domestic life	28	41.2	58,60
General tasks and demands	14	20.6	1,2,24,26,28,33,35,40,41,42,46,47,55,56
Community, social and civic life	14	20.6	1,4,19,23,24,26,34,37,39,40,42,45,46,59
Major life areas	10	14.7	19,24,26,32,47,53,55-57,60,
Interpersonal interactions and relationships	3	4.4	26,55,60

1

2 DISCUSSION

3 Findings from this scoping review indicate that most studies asked something about health
4 conditions, body functions and structures, and/or life activities and participation; however there was
5 substantial diversity in the number and type of questions asked. This has implications for the
6 comparability of evidence across studies and subsequent understanding of the relationships
7 between disability, physical activity, and health. Though some studies asked about more than one
8 body function or structure, or addressed several ICD-10 chapters, this may have been across several
9 different questionnaires, delivered at different phases of the study. In addition, some of the
10 assessments were limited to sub-groups of participants, rather than the whole sample.

11

12 Within this scoping review, questions about disability were included in most studies, with only 8 of
13 the 68 (12%) not asking any questions at all. In terms of the three domains of interest, assessment of
14 health conditions was most common, likely because it was an outcome of interest in many of the
15 included studies. Where studies only assessed health conditions (and not body functions and

1 structures, and/or activities and participation), they are limited to looking at the physical activity and
2 health relationship across health condition sub-groups. However, people with the same health
3 condition can experience different symptoms and impairments in body functions and face different
4 barriers to being physically active. Carr et al¹⁹ found the number and types of impairment
5 experienced was highly variable within and between people with different chronic health conditions.
6 They also found physical activity levels to vary among people with the same chronic condition,
7 depending on their type of impairment. Within this scoping review, 63% of studies included
8 questions related to participants' body functions and structures, and 75% included questions related
9 to a person's activities and participation. Though relatively high, the level of detail captured was
10 often limited, with some studies only asking questions relating to one chapter within each of these
11 two components of ICF. Including an assessment of disability in physical activity research which
12 accounts for functional and activity limitations, in addition to health conditions, would allow for an
13 improved understanding of the implications of a person's health condition upon their ability to
14 undertake physical activity²⁰.

15

16 The WHO advocates the use of the WHO Disability Assessment Schedule 2.0 (WHODAS 2.0), which is
17 a 36-item questionnaire that assesses disability in adults.²¹ It is applicable across cultures and
18 addresses the ICF's 'activities and participation' component of disability. We did not identify any
19 studies within this review that included the WHODAS 2.0, although many of the included studies
20 were conducted prior to the WHODAS 2.0 being published. Use of a consistent measure of disability
21 across studies would improve comparability of research findings and facilitate more possibilities for
22 pooled data analysis, which is essential to advancing health information systems.²²

23

24 There are several strengths and limitations of this scoping review. In terms of strengths, this is the
25 first review to explore the extent and nature of disability assessment in observational studies that
26 included device-based measurement of physical activity. The review was reported in accordance

1 with PRISMA-ScR guidelines. We conducted duplicate screening of titles and abstracts and no date
2 limits were imposed on database searches. We also didn't include any reference to disability within
3 our search strategy to enable the inclusion of studies that were drawn from the general population,
4 rather than solely focusing on studies that targeted people with specific health conditions or
5 impairments. In terms of limitations, the measurement and categorisation of health conditions, body
6 functions and structures, and activities and participation varied across studies, making it challenging
7 to classify studies in terms of their overall assessment of the different domains of interest. There
8 may therefore be some subjectivity in the typology presented. We also solely focused on research
9 published in English-language, and research which used an accelerometer-based measurement of
10 physical activity. Exploring research which has used other measures of physical activity, such as self-
11 report, may provide different findings and this is a potential avenue for future research. For this
12 scoping review we focused on questionnaire items and did not include tests of physical function that
13 studies may have undertaken, such as grip strength, sight, or hearing tests. These types of tests may
14 provide a more valid assessment of impairment than the self-report tools considered in this review.

15

16 **CONCLUSION**

17 This scoping review is the first to assess the extent and nature of disability assessment in research
18 studies of the adult population that included an accelerometer measurement of physical activity. It
19 highlights the need to consider how health conditions, body functions and structures, and activities
20 and participation are measured and categorised in future research. To strengthen the evidence base
21 on physical activity in disabled people and to improve comparability of evidence across studies, we
22 stress the need for a consistent approach to measuring disability in future physical activity related
23 research.

24

25 **ACKNOWLEDGEMENTS**

1 We would like to thank the Prospective Physical Activity, Sitting and Sleep Consortium (ProPASS)
2 project for their assistance and for sharing their database searches for this scoping review.

3

4 **CONFLICT OF INTEREST**

5 None declared

6

7 **FUNDING**

8 SC was supported by funding from the University of East Anglia Faculty of Medicine and Health

9 Studentship.

REFERENCES

1. Hicks AL, Martin KA, Ditor DS, et al. Long-term exercise training in persons with spinal cord injury: Effects on strength, arm ergometry performance and psychological well-being. *Spinal Cord*. 2003;41(1):34-43. doi:10.1038/sj.sc.3101389
2. Graham R, Kremer J, Wheeler G. Physical exercise and psychological well-being among people with chronic illness and disability: A grounded approach. *J Health Psychol*. 2008;13(4):447-458. doi:10.1177/1359105308088515
3. Carroll DD, Courtney-Long EA, Stevens AC, et al. Vital signs: disability and physical activity--United States, 2009-2012. *MMWR Morb Mortal Wkly Rep*. 2014;63(18):407-413. <http://www.ncbi.nlm.nih.gov/pubmed/24807240>.
4. Ballard-Barbash R, Friedenreich CM, Courneya KS, Siddiqi SM, McTiernan A, Alfano CM. Physical activity, biomarkers, and disease outcomes in cancer survivors: A systematic review. *J Natl Cancer Inst*. 2012;104(11):815-840. doi:10.1093/jnci/djs207
5. Martin Ginis KA, van der Ploeg HP, Foster C, et al. Participation of people living with disabilities in physical activity: a global perspective. *Lancet*. 2021;398(10298):443-455. doi:10.1016/S0140-6736(21)01164-8
6. Carty C, van der Ploeg HP, Biddle SJH, et al. The First Global Physical Activity and Sedentary Behavior Guidelines for People Living With Disability. *J Phys Act Heal*. 2021;18(1). doi:10.1123/jpah.2020-0629
7. Sport England. Disabled People. <https://www.sportengland.org/know-your-audience/demographic-knowledge/disabled-people>. Accessed November 5, 2020.
8. World Health Organization. *WHO Guidelines on Physical Activity and Sedentary Behaviour*. Geneva, Switzerland; 2020.
9. World Health Organization. *WHO Guidelines on Physical Activity and Sedentary Behaviour*:

- Web Annex. Evidence Profiles*. Geneva, Switzerland; 2020.
10. World Health Organization. *International Classification of Functioning, Disability and Health : ICF*. World Health Organization; 2001. <https://apps.who.int/iris/handle/10665/42407>.
 11. Smith B, Wightman L. Promoting physical activity to disabled people: messengers, messages, guidelines and communication formats. *Disabil Rehabil*. 2019. doi:10.1080/09638288.2019.1679896
 12. MDJ P, C G, P M, Z M, AC T, Khalil H. Chapter 11: Scoping Reviews (2020 version). In: E A, Z M, eds. *JBI Manual for Evidence Synthesis, JBI*. ; 2020.
 13. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Ann Intern Med*. 2018;169(7). doi:10.7326/M18-0850
 14. World Health Organization. ICD-10 Version:2019. <https://icd.who.int/browse10/2019/en>. Published 2019. Accessed June 7, 2021.
 15. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189-198. doi:10.1016/0022-3956(75)90026-6
 16. EuroQol Group. EuroQol - a new facility for the measurement of health-related quality of life. *Health Policy (New York)*. 1990;16(3):199-208. doi:10.1016/0168-8510(90)90421-9
 17. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (Sf-36): I. conceptual framework and item selection. *Med Care*. 1992;30(6):473-483. doi:10.1097/00005650-199206000-00002
 18. Ware JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: Construction of Scales and Preliminary Tests of Reliability and Validity. *Med Care*. 1996;34(3):220-233. doi:10.1097/00005650-199603000-00003

19. Carr S, Atkin AJ, Jones A, Milton K. The association of chronic conditions and disability with self-reported physical activity in adults. *Under Rev.*
20. Atkin AJ, Carr S, Friedenreich C, Biddle SJ, Milton K. Behavioural epidemiology of physical activity in people living with chronic conditions. *Br J Sports Med.* 2022:bjsports-2021-105171. doi:10.1136/bjsports-2021-105171
21. Üstün TB, Kostanjsek N, Chatterji S, Rehm J, eds. *Measuring Health and Disability: Manual for WHO Disability Assessment Schedule WHODAS 2.0.*; 2010.
22. Kostanjsek N, Rubinelli S, Escorpizo R, et al. Assessing the impact of health conditions using the ICF. *Disabil Rehabil.* 2011;33(15-16):1475-1482. doi:10.3109/09638288.2010.527032