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Measurements of Physical Literacy in Adults: A Scoping Review

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Measurements of Physical Literacy in Adults: A Scoping Review

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Key words: Physical literacy, adults, instruments, motivation, confidence, physical competence, knowledge and understanding.

Word count: 3506

Abstract

Physical literacy (PL) is a comprehensive concept covering motivation, confidence, physical competence, knowledge and understanding of individuals' physical activity throughout life. PL has three overlapping domains; an affective, a physical and a cognitive domain. So far, PL has not been measured in the adults and no complete measurement has been developed to date. **Objectives:** The aim of this scoping review was to review existing instruments measuring different elements of domains of PL. **Method:** In order to investigate existing assessment tools available and maybe suitable for measuring PL among adults, we reviewed Education Research Complete; Cochrane; Medline; ScienceDirect; Scopus and SPORTDiscus. The reporting followed the PRISMA-ScR Guidelines. Studies were coded using a thematic framework which was based on the three domains of PL. **Results:** In total, 67 articles were identified as studies describing instruments reflecting the three domains of PL. Following full text reading, 21 articles that met our inclusion criteria were included. Several instruments of relevance to PL are available for assessing motivation, confidence, and the physical domain. However, few instruments exist that measure elements of the cognitive domain. **Conclusion:** This review showed that a range of existing and validated instruments exists, covering two out of the three domains of PL, namely affective and physical domains. However, for the knowledge domain no valid measurement tools could be found. This scoping review has identified gaps in the research (namely the cognitive domain) and also a gap in the research as no measures that consider the inter-relatedness of the three domains (holistic nature of the concept).

Key words: Physical literacy, adults, instruments, motivation, confidence, physical competence, knowledge and understanding.

Word count: 3506

1 **Strengths and limitations**

- 2 • This scoping review has some limitations, as to the extent of information the
3 author team has been able to identify.
- 4 • We have aimed to cover the most relevant databases and MeSH terms as possible;
5 however; we cannot conclude that databases or relevant terms are missing due to
6 the smaller scale of a scoping review compared to e.g., a systematic review.
- 7 • We have, however, aimed to adhere to the PRISMA-ScR guidelines, to achieve as
8 much transparency as possible. Thus, all steps of PRISMA-ScR are followed in
9 this study.

11 **Introduction**

12 Physical literacy (PL) has become a key focus of physical activity promotion research
13 and practice in countries such as Australia, Canada, UK and USA [1], because it is an
14 important predictor of participation in lifelong physical activity [2-3]. PL is a comprehensive
15 concept integrating components such as knowledge and understanding, motivation, self-
16 efficacy and physical competencies in relation to physical activity [1]. Even though PL is a
17 relative new concept, first proposed in 1993, various definitions exists [4]. Common for all
18 such definitions are three domains: affective, physical and cognitive domain [5]. Some
19 definitions also include a behavioral domain [2] and others also incorporate a social domain
20 [6].

21 PL is expected to improve the all-around health and wellbeing of individuals by
22 enhancing their ability to be physically active [7-8]. This makes PL important from a
23 population health perspective. Addressing the components of PL (e.g., motivation,
24 knowledge, competence and confidence) in physical activity interventions, and thereby
25 targeting participants' prerequisites and personal resources for being active has the potential

1
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3 1 for impacting individuals' continued physical activity participation beyond the intervention
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5 2 period. However, when such interventions or programs are to be evaluated, a valid and reliable
6
7 3 measure for adults PL is necessary.
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10 4 While research on children and adolescents has examined the concept of PL
11
12 5 extensively in recent years, applications of this concept to adults' physical activity are scarce
13
14 6 [9]. A review by Edwards and colleagues [10] examined studies attempting to measure PL
15
16 7 and found limited empirical studies. Furthermore, they found that almost all the literature
17
18 8 focused on children and adolescent [10]. In an initial explorative literature search, we found
19
20 9 no systematic reviews nor measurements involving PL and adults (using the search string
21
22 10 physical literacy; review; adults); empirical research in this area was also limited (for an
23
24 11 exception, see Lane et al., 2020 and Shearer et al., 2021). Thus, today no instrument for
25
26 12 measuring PL among adults exists.
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30 13 Several instruments of PL exist which potentially in combination could be used as a
31
32 14 measurement tool for PL in adults. However, no studies have mapped these instruments,
33
34 15 reviewed, and understood them within a PL theoretical framework. Therefore, the aim of this
35
36 16 scoping review was to review the existing instruments for measuring the different elements
37
38 17 of the three overall domains of PL (i.e., affective, physical and cognitive).
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19 Method

20 Study design

21 21 Scoping reviews are suitable for mapping broad topics and gaps in research related to
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23 22 a defined topic, through systematic searches, selection criteria, and synthesizing knowledge
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25 23 [11-12]. We adhered to the Preferred Reporting Items for Systematic reviews and Meta-
26
27 24 Analyses extension for Scoping Reviews (PRISMA-ScR) [13], which were used as a
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30

1 framework for the reporting of the methodology and results. This checklist consists of 20
2 essential reporting items and two optional items [13].

3 **Information Sources and Search Strategy**

4 A literature search was conducted using the following six electronic databases: 1)
5 Cochrane Library; 2) Education Research Complete; 3) Medline; 4) ScienceDirect; 5) Scopus;
6 and; 6) SPORTDiscus. These databases cover a broad range of different fields related to PL,
7 including the fields of public health, behavioral and social science, sport, exercise, as well as
8 health education. The final search was conducted on 1st August 2021. The search strategy
9 covered three elements: instrument or measuring; adult; and constructs relating to the three
10 domains of PL: affective, physical, and cognitive. For example, search terms combined to
11 identify measures relating to the affective domain were “*instrument or measuring AND adult*
12 *AND motivation*”. To provide a comprehensive coverage of possible instruments of the
13 cognitive domain of PL, a search on health literacy was also conducted. To ensure the search
14 results were comprehensive, the term ‘physical activity’ was added as a fourth element
15 [example of a search string: *(measurement or measuring) AND adult AND motivation AND*
16 *“physical activity”*]. The searches were limited to English language and peer-reviewed
17 articles in all six databases. Furthermore, the searches were limited to abstracts, title and
18 keywords. The systematic reviews by Edwards et al. [5; 10] were used to identify other articles
19 through a chain search based on the references in this review [14].

20 **Eligibility criteria and study records**

21 The eligibility criteria of inclusion were: 1) studies with age groups between 18-60
22 years; 2) meta-analyses, reviews or quantitative studies focusing on the measurement of at
23 least one of the three domains of PL; and 3) instrument that were self-reported.

24 Exclusion criteria were as follows: 1) articles not covering instruments of at least one
25 of the three domains concerning PL; 2) studies on children, adolescents (under 18 years), and

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2
3 1 older people (above 60 years); 3) conference abstracts, position papers, editorials, forewords,
4
5 2 letters or comments; 4) non-English language instruments; and 5) instruments that were not
6
7
8 3 self-assessed (e.g. motor competence or fitness test). Two researchers from the author team
9
10 4 used the above-mentioned criteria to review the abstract from each article independently. The
11
12 5 researchers (KR, PSM, HTM, PB & PE) discussed discrepancies until agreement was reached.
13
14 6 A collective list of instruments within each domain was then presented to the full author team
15
16 7 and experts within the field of each domain (GN, SS, NN and other experts SB and LE, please
17
18 8 see acknowledgements) who reviewed the list. For each domain, mutual agreement on which
19
20 9 instrument to be included was required between the full research team (i.e., all authors) and
21
22 10 the field experts. Figure 1 shows the flow chart of the process of study identification and
23
24 11 selection in the literature search.
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31 13 *Insert figure 1 here*
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35 15 **Data Items and Data Synthesis**

36
37 16 The data were summarized through thematic analysis [15] to highlight similarities and
38
39 17 differences across the instruments and domains. A two-step method was used in the analysis
40
41 18 process. First, the researchers became familiar with the instruments through a close reading
42
43 19 of the included full-text articles. Based on these readings, the instruments were classified into
44
45 20 one of three themes representing measures of the affective, physical, and cognitive domains
46
47 21 of PL. Secondly, subthemes were generated based on the type of instrument (e.g., elements
48
49 22 within each domain such as motivation and confidence of the affective domain). The results
50
51 23 for each theme/domain are shown in Tables 1-4, respectively. It was possible for one article
52
53 24 to be represented in multiple themes or subthemes if various instruments were described
54
55 25 herein. After identifying the different instruments, the following characteristics were
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1 extracted (see Tables 1-4): author (year); tool description, outcome, psychometric validation
2 method, strengths and limitations.

3 **Patient and Public Involvement**

4 No patient involved.

6 **Results**

7 Our search in the six databases resulted in a total of 3,889 articles. Additionally, 14
8 articles were identified via snowballing technique, hand-searching and reviewing reference
9 lists of relevant papers. After the title and abstracts of the articles were screened and duplicates
10 were removed, 67 articles remained. After reading the full texts, 21 articles identifying
11 instruments were included in this review (see Figure 1).

12 **Summary of measurements**

13 The papers and instruments identified and included in the scoping review are shown
14 in Tables 1-4. Table 1-2 describe the included instruments within the affective domain of PL.
15 Ten instruments were measures of motivation and five measured confidence. For the physical
16 domain, four instruments of physical competence and capacity were included (Table 3). For
17 the cognitive domain, two measures of knowledge were included (Table 4). Table 4 provides
18 an overview of all included instruments and their strengths and limitations in the domains of
19 PL based on theory-driven knowledge about PL and its domains.

20 An abundance of instruments in the affective domain was evident (15 out of 21 papers,
21 71%). The physical domain is represented with four self-reported instruments (19%), which
22 is a low number compared to the large number of test instruments and assessment tests related
23 to this domain (e.g. tests delivered by professional health personal). For the cognitive domain,
24 only two relevant instruments were identified (9%) and these have not been validated, nor do

1 they measure knowledge about physical activity, but rather knowledge about diseases affected
 2 by lack of physical activity or official government guidelines for physical activity.

3 The ordering in all tables is by year and is not indicative of any preferred order.

4 Synthesis of results

Affective domain: Motivation					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
The Exercise Motivations Inventory (EMI-2) and the Exercise Motives and Gains Inventory (EMGI). Markland and Hardy (1993).	Target group is the whole population. The EMI-2 comprises 14 subscales and 56 items.	Motivation to exercise based on Deci and Ryan's (1985) self-determination theory.	The factorial validity and invariance of the factor structure across gender were rigorously tested using confirmatory factor analytic procedures (Markland & Ingledew, 1997).	Strong validation results. Assess what people want to gain from PA compared to other measurement. Translated to numerous languages.	EMI-2 is not theory driven.
Motivation for Physical Activity Measure (MPAM-R). Ryan, Frederick, Lepes, Rubio, & Sheldon (1997).	Target group is the general population. The measurement consists of 30 items shared among five motivation subscales: interest/enjoyment motivation; competence motivation; appearance motivation; fitness motivation; and social motivation.	The tool assesses participants' motivation for sport and exercise activities.	Studies support that the MPAM-R is both valid and reliable measurement (Ryan et al., 1997).	The measurement has been shown to predict various behavioral outcomes (e.g., attendance, persistence, or maintained participation, and to predict mental health and well-being). Acceptable reliability and validity results. Easy to administrate.	Problems with cross-cultural adaptations.
Kerner & Grossmans intention to exercise scale: Four scales that measure the exercise behavior of individuals. Kerner & Grossman (2001).	Target group is the general population. The measurement consists of four subscales with 40 items in total: fitness attitude scale (19 items); expectations of others scale (7 items); perceived behavioral control scale (3 items); and intention to exercise scale (11 items).	The measurement predicts participation in physical activity and measures the different independent variables from the theory of planned behavior model (Ajzen, 1995).	Studies support that the four scales have content validity and reliability. (Kerner & Grossman, 2001).	Preliminary content validity and good scale reliability. Using theory (Theory of planned behavior).	Small scale pilot study. Problems with cross-cultural adaptations.
Behavioral regulation in exercise questionnaire-2 (BREQ-2). Markland & Tobin (2004).	Target group is the general population. The measurement consists of 19 items and five subscales: amotivation; three types of extrinsic motivation (external regulation; introjected regulation; identified regulation); and intrinsic motivation.	BREQ-2 assesses the level of self-determined motivation for the exercise activity in question.	Studies have supported the factorial and construct validity of BREQ-2. Furthermore, BREQ-2 has been shown to be a reliable instrument to determine the regulation levels of the amotivation-intrinsic motivation continuum (Markland & Tobin, 2004).	Adds the dimension of amotivation to BREQ. Strong validity.	Amotivation assessment in BREQ-2 has been criticized (Liu et al., 2020).

1 2 3 4 5 6 7 8 9 10 11	The Behavioral Regulation in Exercise Questionnaire (BREQ-3). Wilson, Rodgers, Loitz, & Scime (2006).	Target group is the general population. BREQ-3 consists of 24 items and six subscales, adding integrated regulation to BREQ-2.	The tool assesses the 6 types of motivation in self-determination theory as well as amotivation.	The BREQ-3 has been found to be a valid and a reliable measurement instrument to measure behavior regulations, stemming from self-determination theory, in the exercise domain. (Rodgers et al., 2006).	BREQ-3 is a valid and reliable measurement of behavior regulation underlying SDT in the exercise domain. Used broadly among researchers.	It has been suggested that it is difficult to translate some of the items to different language and cultural contexts directly (Cid et al., 2018).
12 13 14 15 16 17 18 19 20 21 22 23	Sports motivation scale (SMS-6): Revised six-factor sports motivation scale. Mallett, Kawabata, Newcombe, Otero-Forero & Jackson (2007).	Target group are athletes' motivation toward sport participation. SMS-6 consists of 24 items and 6 subscales, stemming from self-determination theory (Deci & Ryan, 1985).	The SMS-6 is a measure of contextual motivation that is intended to identify the perceived reasons for participating in sport.	Items measuring self-determining forms of extrinsic motivation have been found to possess satisfactory levels of construct validity. Moreover, it has been found that integrated regulation significantly and positively correlated with various aspects of flow (e.g., autotelic experience, sense of control) (Mallett et al., 2007).	SMS-6 is preferable to the original SMS.	It measures motivation for sport, which many adults do not engage in at all.
24 25 26 27 28 29 30 31 32 33 34 35	The Behavioral Regulation in Sport Questionnaire (BRSQ). Lonsdale, Hodge and Rose (2008).	Target group are elite and nonelite athlete populations (competitive). Consists of 7 subscales and 36 items.	Measures intrinsic motivation, 4 types of extrinsic motivation, and amotivation (self-determination theory; Deci & Ryan, 1985).	BRSQ has shown good reliability and validity in elite and nonelite athlete populations. The test-retest reliability of the scores has been found acceptable. The factorial validity of the BRSQ scores has also been generally supported. The majority of the evidence also supports the nomological validity of the scores. (Lonsdale et al., 2008).	Strong reliability and validity.	Developed for competitive sports.
36 37 38 39 40 41 42 43 44 45 46 47 48 49	Basic Psychological Needs in Exercise Scale (BPNES). Vlachopoulos, Ntoumanis & Smith (2010).	Target group is the general population. The PNSE is an 18-item scale with three subscales.	Satisfaction/fulfilment of the three basic psychological needs during exercise	BPNES has shown satisfactory internal reliability coefficients, and evidence for the factor concurrent, discriminant, and nomological validity of the translated scale. Cross-cultural validity analyses supported configural invariance and partial metric, partial strong, and partial strict factorial invariance of the BPNES responses (Vlachopoulos et al., 2010).	Cross-cultural validated. Relatively short. Strong reliability and validity.	Possible gender measurement non-invariance.
50 51 52 53 54 55 56 57	Self-Motivation Inventory (SMI-10). André & Dishman (2012).	Target group are elderly participants. SMI-10 is a 10-item short version of the original SMS (40 items).	Measures participants' self-motivation for exercise adherence.	The SMI-10 shows acceptable internal consistency reliability, similar to the original SMI-40 score. (André & Dishman, 2012).	Predicts drop-out from exercise. Validated in English and French. The shortened version SMI-10 has acceptable internal consistency.	Mostly used among elders.
58 59 60	Sports motivation scale (SMS-II). Pelletier,	Target groups are sport participants. SMS-II consists of 18 items and six	The tool assesses the level of motivation towards sport, using the self-determination	Studies have found a good factor structure and adequate convergent validity.	Stronger measurement than SMS. Adds to BRSQ	Needs more research on test-retest reliability. The invariance

Rocchi, Vallerand, Deci and Ryan (2013).	subscales.	theory framework (Deci & Ryan, 1985).	Furthermore, the construct validity has been supported (Pelletier et al., 2013).	and SMS-6.	of the measurement with regards to different age groups is unknown.
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Table 1. Instrument overview: affective domain (motivation)

Affective domain: Confidence					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Self-efficacy scales for health-related exercise and dietary behaviors. Sallis, Pinski, Grossman, Patterson, & Nader (1988).	Target group is the general population. The measurement consists of two exercise self-efficacy subscales and five dietary self-efficacy subscales. 61 items.	Self-efficacy scales are assessed with respect to reported diet and exercise behaviors.	The self-efficacy scales for eating and exercise behaviors have been found to show preliminary evidence of being reliable and valid (Sallis et al., 1988).	Preliminary evidence of being reliable and valid.	Diverse populations have not been investigated.
Perceived Competence Scale (PCS). Williams, Freedman & Deci (1998).	Target group is the general population. 4 items, 1 scale; Perceived competence.	The PCS assesses participants' feelings of competence about different behaviors such as healthier behavior or participating in a physical activity regularly.	PCS is one of the most valid measurement designed to assess self-efficacy.	Perceived competence has been assessed in various studies and used to predict maintained behavior change. It is highly valid and reliable.	Based on SDT, as to why so some researchers suggest it difficult to use without SDT approaches (debatable).
Self-Efficacy for Exercise (SEE) Scale. Resnick & Jenkins (2000).	Target group is the general population. 9 items measuring 1 scale	This scale is a self-report of exercise self-efficacy.	The SEE has been found reliable and having good internal consistency. It has also been shown to have predictive validity, with mental and physical health scores on the SF-12. Predicting efficacy expectations as measured by the SEE Scale. Furthermore, SEE efficacy expectations predicted exercise behaviour (Resnick & Jenkins, 2000).	Has strong validity and reliability.	Developed for older adults. More research is needed with young adults and different socioeconomic and cultural groups.
New General Self-Efficacy Scale. Chen, Gully & Eden (2001).	Target group is the general population. 8 items.	Assesses how much people believe they can achieve their goals, despite difficulties.	The New General Self-Efficacy Scale has been found more reliable and valid than other self-efficacy measures (Scherbaum, Cohen-Charash, & Kern, 2006).	Reported as reliable and valid (Scherbaum, Cohen-Charash, & Kern, 2006).	More resilience oriented. May not be relevant in relation to PL.
Multidimensional outcome expectations for exercise scale (MOEES). Wójcicki, White & McAuley (2009).	Target group is the general population. 15 items and three subscales: physical, social, and self-evaluative. Developed from EXSE (The Exercise Self-Efficacy Scale) (McAuley, 1993).	MOEES is used to assess three related, but conceptually independent domains of outcome expectations for exercise.	MOEES has shown to be a reliable and valid measure of outcome expectations for exercise (McAuley et al., 2010).	Draw from social cognitive theory. Preliminary validity exists.	Based on an interpersonal theory and including intrapersonal perspectives.

Table 2. Instrument overview: affective domain (confidence)

Physical domain					
Instrument and	Tool description:	Construct(s)	Validation	Overall strengths	Limitations

authors	Target group, Items and Scales	assessed			
Physical Self Inventory – version b (PSI6-b). Ninot, Fortes & Delignières (2006).	Target group is the general population. The PSI6-b has six items and six subscales.	The scale assesses global self-esteem, physical self-worth, physical condition, sport competence, physical strength and attractive body.	Studies have found that PSI6-b had acceptable psychometric properties and external validity (Ninot et al., 2006).	Strong validity based on the PSI-6.	Non-conventional validation methods used in validating PSI6-b compared to PSI-6. More studies needed. Relevance to PL is unclear.
The sports competence subscale of the Physical Self-Perception Profile. Levy & Readdy (2009).	Target group is the general population. The measurement consisted of 6 items and 1 scale.	The tool assesses perception of competence for sport.	The tool has been found to have adequate internal consistency (Levy & Readdy, 2009).	Studies report good validity (Levy & Readdy, 2009).	May not capture all dimensions of important basic movement skills relevant for PL.
Self-reported physical fitness (SRFit) survey. Keith, Clark, Stump, Miller & Callahan (2014).	Target group is the general population. The SRFit has 22 items divided on six subscales.	The measurement assesses health related fitness level across health-domains included in the survey.	SRFit has been found to have a good reliability and construct and concurrent validity (Keith et al., 2014).	Initial evaluation supports the SRFit survey's validity and reliability.	Instrument created for 40+ adults. Time consuming.
Rasch assessment of everyday activity limitations (REAL) item bank. Oude Voshaar, ten Klooster, Vonkeman & van de Laar (2017).	Target group is the general population. The REAL consists of 47 items.	The purpose of the item bank is to assess disability in complex activities in daily living.	The REAL content validity has been supported (Oude Voshaar et al., 2017).	A newly developed item bank for measuring complex activities of daily living. Superior measurement performance compared to traditional pen and paper questionnaire.	Time consuming. Limited construct validity.

Table 3. Instrument overview: physical domain

Cognitive domain					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Level of knowledge of physical activity for health (adapted from Chapman's questionnaire of levels of smoking knowledge). Fredriksson, Alley, Rebar, Hayman, Vandelanotte & Schoeppe (2018).	Target group is the general population. 11 items/question divided in 4 subscales/levels.	The measure assesses the individual's level of knowledge concerning physical activity. The four levels assessed include: 1) knowing that physical activity is beneficial for health and physical inactivity is harmful to health; 2) knowing that specific health conditions are related to physical inactivity; 3) knowing exactly how much physical activity is needed for health, and 4) the probabilities of developing Physical inactivity related health conditions, knowing, and accepting that the risks and benefits of physical activity	Not validated.	Relative new measurement, more research need.	No validation studies exist. May not be relevant to knowledge and understanding of physical activity.

		(inherent in levels 1–3) apply to one’s own risk of developing such health conditions.			
Understanding Contemplators’ Knowledge and Awareness of the Physical Activity Guidelines. Piercy, Bevington, Vaux-Bjerke, Hilfiker, Arayasirikul & Barnett. (2020).	Target group is the general population. 7 items.	The measure assesses knowledge of health benefits from physical activity, and knowledge of physical activity dosage recommendations.	Not validated.	Relative new measurement, more research need.	No validation studies exist. May not be relevant to knowledge and understanding of physical activity.

Table 4. Instrument overview: knowledge domain

Discussion

The aim of this scoping review was to review the existing instruments for measuring the different elements that contributed to PL. The review has identified relevant instruments for assessing and monitoring aspects of especially the affective, and physical domain of PL in adult populations, whereas no validated measures were found for the cognitive domain. The review found most instruments within the affective and physical domain concerned with motivation and competence. This was expected as motivation and competence are commonly used concepts within many research fields including psychology, sport science and health [16]. Hence, the affective domain of PL seems relatively measurable with present and existing instruments, also considering that many of the included instruments in this domain are widely used and have strong validity [10]. Based hereon, it seems that a PL measurement tool, with regards to the affective domain for adults may very well be created/developed on the already established foundation of these instruments.

Additionally, questionnaire-based measures of aspects of the physical domain were reviewed. However, these included instruments have several weaknesses as measures of the physical domain of PL. Self-reported physical competence instruments are often considered unreliable [17]. Usually, overestimation and underestimation based on confidence levels are considered problematic [17-19], hence many researchers have suggested using more objective

1 direct measures of physical competences [20]. Thus, most instrument tools for measuring
2 physical abilities rely on a physical test (e.g., agility), but these tests are resource-demanding,
3 as they demand more staff/research hours to collect than a questionnaire based self-report
4 [21]. Compared to the more resource demanding physical testing, self-assessing instruments
5 of physical competences are in many cases more applicable especially for adult populations,
6 due to less demands and the ability to include them in surveys. Based on findings from this
7 review, self-assessing instruments do exist on the physical domain as an alternative to
8 physical tests.

9 For the knowledge and understanding elements of the cognitive domain, available
10 measures were particular scarce. None of the included instruments were validated, nor do they
11 measure enabling knowledge of physical activities (e.g., tactics in ball games or understanding
12 the 'rules and potentials' in given contexts), but rather physical activity guidelines or health
13 benefits of physical activity [1; 22]. Knowledge on how to apply physical competencies in
14 different contexts or knowledge of what contexts are beneficial for one's own physical activity
15 are not measured in these existing instruments. Such forms of knowledge would be more
16 relevant in relation to PL and considering the fact that knowledge of guidelines rarely leads
17 to more physical activity in the population [23], and from a public health perspective may be
18 more compelling. Thus, valid measures of the knowledge and understanding elements of PL
19 among adults are at the time not existing. Furthermore, the cognitive domain of PL implies a
20 focus on context-specific knowledge of physical active (e.g., tactics and organization) and not
21 generic as measurements focusing on physical activity guidelines. Such instruments exist
22 within children and adolescents (e.g., CAPL-2 and PL-C Quest) [24-25], but currently not
23 adults [5; 10], which makes the cognitive domain limited and difficult to access compared to
24 the other domains.

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3 1 The overall findings from this scoping review indicate that in the affective domain, a
4
5 2 range of valid and reliable instruments exist that should inform development of a tool to
6
7 3 measure adults' PL. However, instruments available for the physical and the cognitive
8
9 4 domains need adaptations and/or even new measurements to assess PL comprehensively
10
11 5 among adults. We recommend the readers of this scoping review to critically evaluate the
12
13 6 possible instruments, as PL definitions and understandings may vary from one country to
14
15 7 another [3-4; 22; 26]. However, the author group do find more merit in some of the
16
17 8 instruments compared to others, these include: affective domain (motivation); BREQ-3 [27],
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19 9 as it is based on self-determination theory [28], which is commonly considered central in the
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21 10 understanding of motivation and is not only specific to sport to exercise more generally;
22
23 11 affective domain (confidence): PCS, as instrument of relevance to self-efficacy making it a
24
25 12 good fit in PL; as a questionnaire based measurement for the Physical domain: the sports
26
27 13 competence subscale of the Physical Self-Perception Profile has some interesting properties.
28
29 14 That said, it may not capture the essential basic movement skills (e.g., balance, running and
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31 15 jumping), [1]; knowledge domain: the identified measures do not fully capture the PL
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33 16 knowledge/cognitive domain. Hence, more research is needed to develop such measures.
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40 17 This review is a foundation from which future researchers can base the development
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42 18 of PL measurement tools for adults upon. However, in order to adhere to the unique
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44 19 characteristics of PL as outlined by Whitehead [1] it could also be worthwhile to develop a
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46 20 more comprehensive PL measurement tool for adults by adjusting and adding to the identified
47
48 21 measures in this review to the PL theory and secondly validate these measures. A tool that
49
50 22 considers the holistic nature of physical literacy that aligns more with the philosophical
51
52 23 underpinnings of the concept as outlined by Whitehead [1]. We recommend more research
53
54 24 and development of instruments before it is fully possible to generate a complete measurement
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56 25 of PL in adults. An important consideration when developing new measurements tools should
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1 be the importance of considering context, but also strive to develop instrument tools useful in
2 large population surveys, if PL is to become important in public and population health
3 research [8].

5 **Conclusions**

6 This review shows that a range of existing and validated instruments exist which cover
7 important aspects of two out of the three domains of PL, i.e., the affective and the physical
8 domains. However, for the knowledge domain no valid measurement tools could be found.
9 This scoping review provides a critical and comprehensive set of tools that researchers who
10 are interested in measuring PL in adults can draw upon. It has identified gaps in the research
11 (namely the cognitive domain) and also a gap in the research whereby there are no measures
12 that consider the inter-relatedness of the three domains (holistic nature of the concept). We
13 recommend conducting future research on measuring PL in adults to further develop
14 measurements tools in a more holistic manner that consider the inter-relatedness of the three
15 domains aligning with Whitehead's definition and philosophies [5]. This review is a
16 foundation from which future researchers can base the development of PL measurement tools
17 for adults upon.

18
19 **Contributorship statement:** KR conducted the review, analysed the data, prepared the first
20 draft of the paper, revised the manuscript and approved the final submission. AH conducted
21 the review, analysed the data, revised the manuscript and approved the final submission. PSM
22 analysed the data, revised the manuscript and approved the final submission. HTM analysed
23 the data, revised the manuscript and approved the final submission. PB analysed the data,
24 revised the manuscript and approved the final submission. NN conducted expert reviewing
25 on motivation measurement, revised the manuscript and approved the final submission. SS

1 conducted expert reviewing on knowledge measurement, revised the manuscript and
2 approved the final submission. GN conducted expert reviewing on physical measurement,
3 revised the manuscript and approved the final submission. PE analysed the data, revised the
4 manuscript and approved the final submission. Note: SB and LE both conducted expert
5 reviewing on motivation measurement and gave critical comments and reflections to the
6 manuscript (please see acknowledgement).

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9 **Data sharing statement:** Not relevant in this project.

10 **Ethics statement:** Ethical considerations has been conducted according to Danish law and
11 international guidelines.

12
13 Figure 1: PRISMA flow diagram showing the process of study identification and selection.

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34 and Physical Activity.

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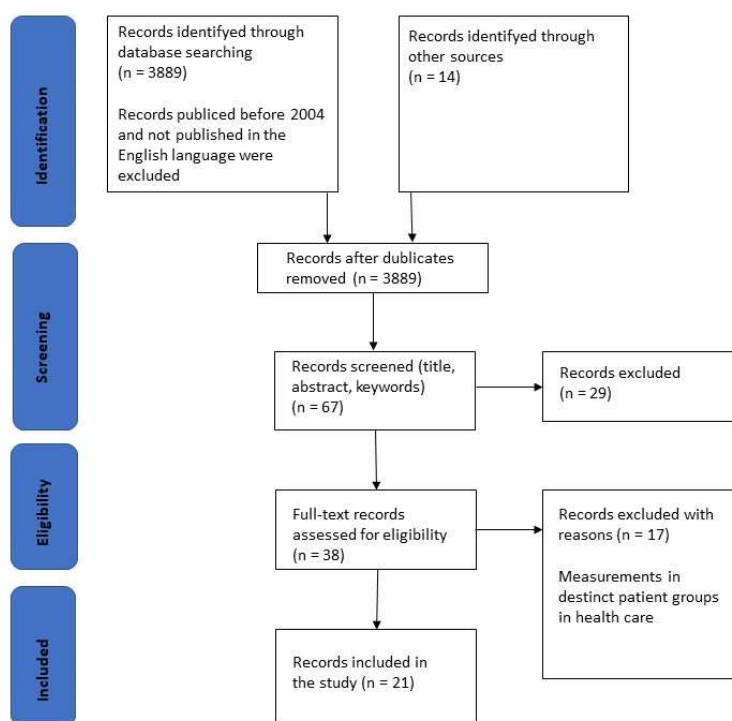


Figure 1: PRISMA flow diagram showing the process of study identification and selection.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1 +
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1+3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2+3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	1-3
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	3
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	3-5
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	3-5
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	3-5
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	1-3
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	3-5
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	3-5
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	53-5



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	3-5
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	5
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Tables
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Tables
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Tables
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	6
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	7
Limitations	20	Discuss the limitations of the scoping review process.	9
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	10
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No funding

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: 10.7326/M18-0850.



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Measurements of Physical Literacy in Adults: A Scoping Review

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Running head: Measurements of Physical Literacy in Adults

Measurements of Physical Literacy in Adults: A Scoping Review

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Abstract

Physical literacy (PL) is a comprehensive concept covering motivation, confidence, physical competence, knowledge and understanding of individuals' physical activity throughout life. PL has three overlapping domains; an affective, a physical and a cognitive domain. So far, PL has not been measured in the adults and no complete measurement has been developed to date. **Objectives:** The aim of this scoping review was to review existing instruments measuring different elements of domains of PL. **Method:** We reviewed Education Research Complete; Cochrane; Medline; ScienceDirect; Scopus and SPORTDiscus. The reporting followed the PRISMA-ScR Guidelines. Studies were coded using a thematic framework which was based on the three domains of PL. The eligibility criteria were: 1) age groups between 18-60 years; 2) meta-analyses, reviews or quantitative studies focusing on the measurement of at least one of the three domains of PL; and 3) instrument that were self-reported. We finalized search on 1st August 2021. **Results:** In total, 67 articles were identified as studies describing instruments reflecting the three domains of PL. Following full text reading, 21 articles that met our inclusion criteria were included. Several instruments of relevance to PL are available for assessing motivation, confidence, and the physical domain. However, few instruments exist that measure elements of the cognitive domain. **Conclusion:** This review showed that a range of existing and validated instruments exists, covering two out of the three domains of PL, namely affective and physical domains. However, for the knowledge domain no valid measurement tools could be found. This scoping review has identified gaps in the research (namely the cognitive domain) and also a gap in the research as no measures that consider the inter-relatedness of the three domains (holistic nature of the concept).

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2
3 1 Key words: Physical literacy, adults, instruments, motivation, confidence, physical
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5 2 competence, knowledge and understanding.
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10 4 Word count: 6220
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13 6 **Strengths and limitations**

- 14 7 • This scoping review only includes self-reporting instruments
- 15 8 • There has been little research on physical literacy and adults in general
- 16 9 • Furthermore, this review is limited by a shortage of particular cognitive domain
17 10 instruments
- 18 11 •
- 19 12 • This review showed validated and useful instruments exists, namely in the
20 13 affective and physical domains
- 21 14 • This review suggest possibilities of constructing a holistic instrument measuring
22 15 physical literacy in adults

23 16 24 17 **Introduction**

25 18 Physical literacy (PL) has become a key focus of physical activity promotion research
26 19 and practice in countries such as Australia, Canada, UK and USA, because of the suggested
27 20 importance for participation in lifelong physical activity [1]. Though this claim is still
28 21 disputed, longitudinal studies suggest that a versatile breadth of sporting experience
29 22 significant effect later exercise habits in life, partly supporting the claims of PL [2]. PL is a
30 23 comprehensive concept integrating components such as knowledge and understanding,
31 24 motivation, self-efficacy and physical competencies in relation to physical activity [1]. Even
32 25 though PL is a relative new concept, first proposed in 1993, various definitions exists [3-4].
33 26 Common for all such definitions are three domains: affective, physical and cognitive domain
34 27 [5]. Some definitions also include a behavioral domain [3] and others also incorporate a social
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1 domain [6]. International Physical Literacy Association define PL as "... the motivation,
2 confidence, physical competence, knowledge and understanding to value and take
3 responsibility for engagement in physical activities for life." (IPLA, 2017). This definition
4 highlights PL as interchangeable throughout life and thus useful in this paper.

5 PL is expected to improve the all-around health and wellbeing of individuals by
6 enhancing their ability to be physically active [7-9]. This makes PL important from a
7 population health perspective. Addressing the components of PL (motivation, knowledge,
8 competence and confidence) in physical activity interventions, and thereby targeting
9 participants' prerequisites and personal resources for being active has the potential for
10 impacting individuals' continued physical activity participation beyond the intervention
11 period. However, when such interventions or programs are to be evaluated, a valid and reliable
12 measure for adults PL is necessary.

13 While research on children and adolescents has examined the concept of PL
14 extensively in recent years, applications of this concept to adults' physical activity are scarce
15 [10]. A review by Edwards and colleagues [11] examined studies attempting to measure PL
16 and found limited empirical studies. Furthermore, they found that almost all the literature
17 focused on children and adolescent [11]. In an initial explorative desk research phase, we
18 found no systematic reviews nor validated measurements involving PL and adults (using
19 different search terms; physical literacy; review; adults; measurements); empirical research
20 in this area was also limited (for an exception, see Holler et al. 2019 [12], however this
21 measurement is yet to be validated). Thus, today no validated instrument for measuring PL
22 among adults exists.

23 However, several instruments from related fields and relevant to PL exists, which
24 potentially in combination could be used as a measurement tool for PL in adults. However,
25 no studies have mapped these instruments, reviewed, and understood them within a PL

1 theoretical framework. Therefore, the aim of this scoping review was to review existing
2 instruments useful for measuring the different elements of the three overall domains of PL
3 (i.e., affective, physical and cognitive).

5 Method

6 Study design

7 Scoping reviews are suitable for mapping broad topics and gaps in research related to
8 a defined topic, through systematic searches, selection criteria, and synthesizing knowledge
9 [13-14]. We adhered to the Preferred Reporting Items for Systematic reviews and Meta-
10 Analyses extension for Scoping Reviews (PRISMA-ScR) [15], which were used as a
11 framework for the reporting of the abstract, methodology and results. This checklist consists
12 of 20 essential reporting items and two optional items [15].

13 Information Sources and Search Strategy

14 A literature search was conducted using the following six electronic databases: 1)
15 Cochrane Library; 2) Education Research Complete; 3) Medline; 4) ScienceDirect; 5) Scopus;
16 and; 6) SPORTDiscus. These databases cover a broad range of different fields related to PL,
17 including the fields of public health, behavioral and social science, sport, exercise, as well as
18 health education. The final search was conducted on 1st August 2021. The search strategy
19 covered three elements: instrument or measuring; adult; and constructs relating to the three
20 domains of PL: affective, physical, and cognitive. For example, search terms combined to
21 identify measures relating to the affective domain were “*instrument OR measuring AND adult*
22 *AND motivation*”. To provide a comprehensive coverage of possible instruments of the
23 cognitive domain of PL, a search on health literacy was also conducted “*instrument OR*
24 *measuring AND adult AND health literacy*”. To ensure the search results were as relevant as
25 possible, the term ‘physical activity’ was added as a fourth element [example of a search

1 string: *instrument OR measuring AND adult AND motivation AND “physical activity”*]. The
2 searches were limited to English language and peer-reviewed articles in all six databases.
3 Furthermore, the searches were limited to abstracts, title and keywords. The systematic
4 reviews by Edwards et al. [4; 11] were used to identify other articles through a chain search
5 based on the references in these reviews.

6 **Eligibility criteria and study records**

7 The eligibility criteria of inclusion were: 1) studies with age groups between 18-60
8 years; 2) meta-analyses, reviews or quantitative studies focusing on the measurement of at
9 least one of the three domains of PL; and 3) instrument that were self-reported.

10 Exclusion criteria were as follows: 1) articles not covering instruments of at least one
11 of the three domains concerning PL; 2) studies on children, adolescents (under 18 years), and
12 older people (above 60 years); 3) conference abstracts, position papers, editorials, forewords,
13 letters or comments; 4) non-English language instruments; and 5) instruments that were not
14 self-assessed (e.g. motor competence or fitness test).

15 Though self-reported instruments are often considered unreliable [16], we opted to
16 only include self-reported instruments, as these in large scale would be more applicable in
17 adult populations.

18 Two researchers from the author team used the above-mentioned criteria to review the
19 abstract from each article independently. The researchers (KR, PSM, HTM, PB & PE)
20 discussed discrepancies until agreement was reached. A collective list of instruments within
21 each domain was then presented to the full author team and experts within the field of each
22 domain (GN, SS, NN and other experts SB and LE, please see acknowledgements) who
23 reviewed the list. For each domain, mutual agreement on which instrument to be included was
24 required between the full research team (i.e., all authors) and the field experts. Figure 1 shows
25 the flow chart of the process of study identification and selection in the literature search.

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3 1
45 2 *Insert figure 1 here*
67
8 3 Figure 1: PRISMA flow diagram showing the process of study identification and selection.
910 4
1112 5 **Data Items and Data Synthesis**
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15 6 The data were summarized through content analysis [17] to highlight similarities and
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17 7 differences across the instruments and domains. A two-step method was used in the analysis
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19 8 process. First, the researchers became familiar with the instruments through a close reading
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21 9 of the included full-text articles. Based on these readings, the instruments were classified into
22
23 10 one of three themes representing measures of the affective, physical, and cognitive domains
24
25 11 of PL. Secondly, subthemes were generated based on the type of instrument (e.g., elements
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27 12 within each domain such as motivation and confidence of the affective domain). The results
28
29 13 for each theme/domain are shown in Tables 1-4, respectively. It was possible for one article
30
31 14 to be represented in multiple themes or subthemes if various instruments were described
32
33 15 herein. After identifying the different instruments, the following characteristics were
34
35 16 extracted (see Tables 1-4): author (year); tool description, outcome, psychometric validation
36
37 17 method, strengths and limitations.
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42 18 **Patient and Public Involvement**
4344 19 No patient involved.
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47 2048
49 2150
51 22 **Results**
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54 23 Our search in the six databases resulted in a total of 3,889 articles. Additionally, 14
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56 24 articles were identified via snowballing technique, hand-searching and reviewing reference
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1 were removed, 67 articles remained. After reading the full texts, 21 articles identifying
 2 instruments were included in this review (see Figure 1).

3 **Summary of measurements**

4 The papers and instruments identified and included in the scoping review are shown
 5 in Tables 1-4. Table 1-2 describe the included instruments within the affective domain of PL.
 6 Ten instruments were measures of motivation and five measured confidence. For the physical
 7 domain, four instruments of physical competence and capacity were included (Table 3). For
 8 the cognitive domain, two measures of knowledge were included (Table 4). Table 4 provides
 9 an overview of all included instruments and their strengths and limitations in the domains of
 10 PL based on theory-driven knowledge about PL and its domains.

11 An abundance of instruments in the affective domain was evident (15 out of 21 papers,
 12 71%). The physical domain is represented with four self-reported instruments (19%), which
 13 is a low number compared to the large number of test instruments and assessment tests related
 14 to this domain (e.g. tests delivered by professional health personal). As noticed earlier self-
 15 reported measurements can be seen as a limitation of this scoping review, but also equally
 16 important for pragmatically reasons with adults in mind as time and availability is key for
 17 large scale investigations (discussed further in discussion).

18 For the cognitive domain, only two relevant instruments were identified (9%) and
 19 these have not been validated, nor do they measure knowledge about physical activity, but
 20 rather knowledge about diseases affected by lack of physical activity or official government
 21 guidelines for physical activity.

22 The ordering in all tables is by year and is not indicative of any preferred order.

23 **Synthesis of results**

24 Table 1. Instrument overview: affective domain (motivation)

Affective domain: Motivation					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
The Exercise	Target group is the	Motivation to exercise	The factorial validity	Strong validation	EMI-2 is not

Motivations Inventory (EMI-2) and the Exercise Motives and Gains Inventory (EMGI). Markland and Hardy (1993).	whole population. The EMI-2 comprises 14 subscales and 56 items.	based on Deci and Ryan's (1985) self-determination theory.	and invariance of the factor structure across gender were rigorously tested using confirmatory factor analytic procedures (Markland & Ingledew, 1997).	results. Assess what people want to gain from PA compared to other measurement. Translated to numerous languages.	theory driven.
Motivation for Physical Activity Measure (MPAM-R). Ryan, Frederick, Lepes, Rubio, & Sheldon (1997).	Target group is the general population. The measurement consists of 30 items shared among five motivation subscales: interest/enjoyment motivation; competence motivation; appearance motivation; fitness motivation; and social motivation.	The tool assesses participants' motivation for sport and exercise activities.	Studies support that the MPAM-R is both valid and reliable measurement (Ryan et al., 1997).	The measurement has been shown to predict various behavioral outcomes (e.g., attendance, persistence, or maintained participation, and to predict mental health and well-being). Acceptable reliability and validity results. Easy to administrate.	Problems with cross-cultural adaptations.
Kerner & Grossmans intention to exercise scale: Four scales that measure the exercise behavior of individuals. Kerner & Grossman (2001).	Target group is the general population. The measurement consists of four subscales with 40 items in total: fitness attitude scale (19 items); expectations of others scale (7 items); perceived behavioral control scale (3 items); and intention to exercise scale (11 items).	The measurement predicts participation in physical activity and measures the different independent variables from the theory of planned behavior model (Ajzen, 1995).	Studies support that the four scales have content validity and reliability. (Kerner & Grossman, 2001).	Preliminary content validity and good scale reliability. Using theory (Theory of planned behavior).	Small scale pilot study. Problems with cross-cultural adaptations.
Behavioral regulation in exercise questionnaire-2 (BREQ-2). Markland & Tobin (2004).	Target group is the general population. The measurement consists of 19 items and five subscales: amotivation; three types of extrinsic motivation (external regulation; introjected regulation; identified regulation); and intrinsic motivation.	BREQ-2 assesses the level of self-determined motivation for the exercise activity in question.	Studies have supported the factorial and construct validity of BREQ-2. Furthermore, BREQ-2 has been shown to be a reliable instrument to determine the regulation levels of the amotivation-intrinsic motivation continuum (Markland & Tobin, 2004).	Adds the dimension of amotivation to BREQ. Strong validity.	Amotivation assessment in BREQ-2 has been criticized (Liu et al., 2020).
The Behavioral Regulation in Exercise Questionnaire (BREQ-3). Wilson, Rodgers, Loitz, & Scime (2006).	Target group is the general population. BREQ-3 consists of 24 items and six subscales, adding integrated regulation to BREQ-2.	The tool assesses the 6 types of motivation in self-determination theory as well as amotivation.	The BREQ-3 has been found to be a valid and a reliable measurement instrument to measure behavior regulations, stemming from self-determination theory, in the exercise domain. (Rodgers et al., 2006).	BREQ-3 is a valid and reliable measurement of behavior regulation underlying SDT in the exercise domain. Used broadly among researchers.	It has been suggested that it is difficult to translate some of the items to different language and cultural contexts directly (Cid et al., 2018).
Sports motivation scale (SMS-6): Revised six-factor sports motivation	Target group are athletes' motivation toward sport participation. SMS-6 consists of 24 items and 6	The SMS-6 is a measure of contextual motivation that is intended to identify the perceived reasons for participating in	Items measuring self-determining forms of extrinsic motivation have been found to possess satisfactory levels of construct	SMS-6 is preferable to the original SMS.	It measures motivation for sport, which make it less inclusive in term of general

scale. Mallett, Kawabata, Newcombe, Otero-Forero & Jackson (2007).	subscales, stemming from self-determination theory (Deci & Ryan, 1985).	sport.	validity. Moreover, it has been found that integrated regulation significantly and positively correlated with various aspects of flow (e.g., autotelic experience, sense of control) (Mallett et al., 2007).		PA.
The Behavioral Regulation in Sport Questionnaire (BRSQ). Lonsdale, Hodge and Rose (2008).	Target group are elite and nonelite athlete populations (competitive). Consists of 7 subscales and 36 items.	Measures intrinsic motivation, 4 types of extrinsic motivation, and amotivation (self-determination theory; Deci & Ryan, 1985).	BRSQ has shown good reliability and validity in elite and nonelite athlete populations. The test-retest reliability of the scores has been found acceptable. The factorial validity of the BRSQ scores has also been generally supported. The majority of the evidence also supports the nomological validity of the scores. (Lonsdale et al., 2008).	Strong reliability and validity.	Developed for competitive sports.
Basic Psychological Needs in Exercise Scale (BPNES). Vlachopoulos, Ntoumanis & Smith (2010).	Target group is the general population. The PNSE is an 18-item scale with three subscales.	Satisfaction/fulfilment of the three basic psychological needs during exercise	BPNES has shown satisfactory internal reliability coefficients, and evidence for the factor concurrent, discriminant, and nomological validity of the translated scale. Cross-cultural validity analyses supported configural invariance and partial metric, partial strong, and partial strict factorial invariance of the BPNES responses (Vlachopoulos et al., 2010).	Cross-cultural validated. Relatively short. Strong reliability and validity.	Possible gender measurement non-invariance.
Self-Motivation Inventory (SMI-10). André & Dishman (2012).	Target group are elderly participants. SMI-10 is a 10-item short version of the original SMS (40 items).	Measures participants' self-motivation for exercise adherence.	The SMI-10 shows acceptable internal consistency reliability, similar to the original SMI-40 score. (Andre & Dishman, 2012).	Predicts drop-out from exercise. Validated in English and French. The shortened version SMI-10 has acceptable internal consistency.	Mostly used among elders.
Sports motivation scale (SMS-II). Pelletier, Rocchi, Vallerand, Deci and Ryan (2013).	Target groups are sport participants. SMS-II consists of 18 items and six subscales.	The tool assesses the level of motivation towards sport, using the self-determination theory framework (Deci & Ryan, 1985).	Studies have found a good factor structure and adequate convergent validity. Furthermore, the construct validity has been supported (Pelletier et al., 2013).	Stronger measurement than SMS. Adds to BRSQ and SMS-6.	Needs more research on test-retest reliability. The invariance of the measurement with regards to different age groups is unknown.

1 Table 2. Instrument overview: affective domain (confidence)

Affective domain: Confidence					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Self-efficacy scales for health-related exercise and dietary behaviors.	Target group is the general population. The measurement consists of two exercise self-	Self-efficacy scales are assessed with respect to reported diet and exercise behaviors.	The self-efficacy scales for eating and exercise behaviors have been found to show preliminary evidence of	Preliminary evidence of being reliable and valid.	Diverse populations have not been investigated.

Sallis, Pinski, Grossman, Patterson, & Nader (1988).	efficacy subscales and five dietary self-efficacy subscales. 61 items.		being reliable and valid (Sallis et al., 1988).		
Perceived Competence Scale (PCS). Williams, Freedman & Deci (1998).	Target group is the general population. 4 items, 1 scale; Perceived competence.	The PCS assesses participants' feelings of competence about different behaviors such as healthier behavior or participating in a physical activity regularly.	PCS is one of the most valid measurement designed to assess self-efficacy.	Perceived competence has been assessed in various studies and used to predict maintained behavior change. It is highly valid and reliable.	Based on SDT, as to why so some researchers suggest it difficult to use without SDT approaches (debatable).
Self-Efficacy for Exercise (SEE) Scale. Resnick & Jenkins (2000).	Target group is the general population. 9 items measuring 1 scale	This scale is a self-report of exercise self-efficacy.	The SEE has been found reliable and having good internal consistency. It has also been shown to have predictive validity, with mental and physical health scores on the SF-12. Predicting efficacy expectations as measured by the SEE Scale. Furthermore, SEE efficacy expectations predicted exercise behaviour (Resnick & Jenkins, 2000).	Has strong validity and reliability.	Developed for older adults. More research is needed with young adults and different socioeconomic and cultural groups.
New General Self-Efficacy Scale. Chen, Gully & Eden (2001).	Target group is the general population. 8 items.	Assesses how much people believe they can achieve their goals, despite difficulties.	The New General Self-Efficacy Scale has been found more reliable and valid than other self-efficacy measures (Scherbaum, Cohen-Charash, & Kern, 2006).	Reported as reliable and valid (Scherbaum, Cohen-Charash, & Kern, 2006).	More resilience oriented. May not be relevant in relation to PL.
Multidimensional outcome expectations for exercise scale (MOEES). Wójcicki, White & McAuley (2009).	Target group is the general population. 15 items and three subscales: physical, social, and self-evaluative. Developed from EXSE (The Exercise Self-Efficacy Scale) (McAuley, 1993).	MOEES is used to assess three related, but conceptually independent domains of outcome expectations for exercise.	MOEES has shown to be a reliable and valid measure of outcome expectations for exercise (McAuley et al., 2010).	Draw from social cognitive theory. Preliminary validity exists.	Based on an interpersonal theory and including intrapersonal perspectives.

Table 3. Instrument overview: physical domain

Physical domain					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Physical Self Inventory – version b (PSI6-b). Ninot, Fortes & Delignières (2006).	Target group is the general population. The PSI6-b has six items and six subscales.	The scale assesses global self-esteem, physical self-worth, physical condition, sport competence, physical strength and attractive body.	Studies have found that PSI6-b had acceptable psychometric properties and external validity (Ninot et al., 2006).	Strong validity based on the PSI-6.	Non-conventional validation methods used in validating PSI6-b compared to PSI-6. More studies needed. Relevance to PL is unclear.
The sports competence subscale of the Physical Self-Perception Profile. Levy & Readdy	Target group is the general population. The measurement consisted of 6 items and 1 scale.	The tool assesses perception of competence for sport.	The tool has been found to have adequate internal consistency (Levy & Readdy, 2009).	Studies report good validity (Levy & Readdy, 2009).	May not capture all dimensions of important basic movement skills relevant for PL.

(2009).					
Self-reported physical fitness (SRFit) survey. Keith, Clark, Stump, Miller & Callahan (2014).	Target group is the general population. The SRFit has 22 items divided on six subscales.	The measurement assesses health related fitness level across health-domains included in the survey.	SRFit has been found to have a good reliability and construct and concurrent validity (Keith et al., 2014).	Initial evaluation supports the SRFit survey's validity and reliability.	Instrument created for 40+ adults. Time consuming.
Rasch assessment of everyday activity limitations (REAL) item bank. Oude Voshaar, ten Klooster, Vonkeman & van de Laar (2017).	Target group is people with disabilities, however is also used in the wider population. The REAL consists of 47 items.	The purpose of the item bank is to assess disability in complex activities in daily living.	The REAL content validity has been supported (Oude Voshaar et al., 2017).	A newly developed item bank for measuring complex activities of daily living. Superior measurement performance compared to traditional pen and paper questionnaire.	Time consuming. Limited construct validity.

1 Table 4. Instrument overview: knowledge domain

Cognitive domain					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Level of knowledge of physical activity for health (adapted from Chapman's questionnaire of levels of smoking knowledge). Fredriksson, Alley, Rebar, Hayman, Vandelanotte & Schoeppe (2018).	Target group is the general population. 11 items/question divided in 4 subscales/levels.	The measure assesses the individual's level of knowledge concerning physical activity. The four levels assessed include: 1) knowing that physical activity is beneficial for health and physical inactivity is harmful to health; 2) knowing that specific health conditions are related to physical inactivity; 3) knowing exactly how much physical activity is needed for health, and 4) the probabilities of developing Physical inactivity related health conditions, knowing, and accepting that the risks and benefits of physical activity (inherent in levels 1–3) apply to one's own risk of developing such health conditions.	Not validated.	Relative new measurement, more research need.	No validation studies exist. May not be relevant to knowledge and understanding of physical activity.
Understanding Contemplators' Knowledge and Awareness of the Physical Activity Guidelines. Piercy, Bevington, Vaux-Bjerke, Hilfiker, Arayasirikul & Barnett. (2020).	Target group is the general population. 7 items.	The measure assesses knowledge of health benefits from physical activity, and knowledge of physical activity dosage recommendations.	Not validated.	Relative new measurement, more research need.	No validation studies exist. May not be relevant to knowledge and understanding of physical activity.

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Discussion

The aim of this scoping review was to review the existing instruments for measuring the different elements that contributed to PL. The review has identified relevant instruments for assessing and monitoring aspects of especially the affective, and physical domain of PL in adult populations, whereas no validated measures were found for the cognitive domain. The review found most instruments within the affective and physical domain concerned with motivation and competence. This was expected as motivation and competence are commonly used concepts within many research fields including psychology, sport science and health [18]. Hence, the affective domain of PL seems relatively measurable with present and existing instruments, also considering that many of the included instruments in this domain are widely used and have strong validity [11]. Based hereon, it seems that a PL measurement tool, with regards to the affective domain for adults may very well be created/developed on the already established foundation of these instruments.

Additionally, questionnaire-based measures of aspects of the physical domain were reviewed. However, these included instruments have several weaknesses as measures of the physical domain of PL. Self-reported physical competence instruments are often considered unreliable [16]. Usually, overestimation and underestimation based on confidence levels are considered problematic [15; 19-20], hence many researchers have suggested using more objective direct measures of physical competences [21]. Thus, most instrument tools for measuring physical abilities rely on a physical test (e.g., agility), but these tests are resource-demanding, as they demand more staff/research hours to collect than a questionnaire based self-report [22]. Compared to the more resource demanding physical testing, self-assessing instruments of physical competences are in many cases more applicable especially for adult populations, due to less demands and the ability to include them in surveys. Based on findings

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3 1 from this review, self-assessing instruments do exist on the physical domain as an alternative
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5 2 to physical tests.
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8 3 For the knowledge and understanding elements of the cognitive domain, available
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10 4 measures were particular scarce. None of the included instruments were validated, nor do they
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12 5 measure enabling knowledge of physical activities (e.g., tactics in ball games or understanding
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14 6 cultural and contextual aspects important for engaging in different physical activity contexts),
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16 7 but rather physical activity guidelines or health benefits of physical activity [1; 23].
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18 8 Knowledge on how to apply physical competencies in different contexts or knowledge of
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20 9 what contexts are beneficial for one's own physical activity are not measured in these existing
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22 10 instruments. Such forms of knowledge would be more relevant in relation to PL and
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24 11 considering the fact that knowledge of guidelines rarely leads to more physical activity in the
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26 12 population [24], and from a public health perspective may be more compelling. Thus, valid
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28 13 measures of the knowledge and understanding elements of PL among adults are at the time
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30 14 not existing. Furthermore, the cognitive domain of PL implies a focus on context-specific
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32 15 knowledge of physical active (e.g., tactics and organization) and not generic as measurements
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34 16 focusing on physical activity guidelines. Such instruments exist within children and
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36 17 adolescents (e.g., CAPL-2 and PL-C Quest) [25-26], but currently not adults [4; 11], which
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38 18 makes the cognitive domain limited and difficult to access compared to the other domains.
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45 19 The overall findings from this scoping review indicate that in the affective domain, a
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47 20 range of valid and reliable instruments exist that should inform development of a tool to
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49 21 measure adults' PL. However, instruments available for the physical and the cognitive
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51 22 domains need adaptations and/or even new measurements to assess PL comprehensively
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53 23 among adults. We recommend the readers of this scoping review to critically evaluate the
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55 24 possible instruments, as PL definitions and understandings may vary from one country to
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57 25 another [3-6; 23; 27]. However, the author group do find more merit in some of the
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1 instruments compared to others, these include: affective domain (motivation); BREQ-3 [28],
2 as it is based on self-determination theory [29], which is commonly considered central in the
3 understanding of motivation and is not only specific to sport to exercise more generally;
4 affective domain (confidence): PCS, as instrument of relevance to self-efficacy making it a
5 good fit in PL; as a questionnaire based measurement for the Physical domain: the sports
6 competence subscale of the Physical Self-Perception Profile has some interesting properties.
7 That said, it may not capture the essential basic movement skills (e.g., balance, running and
8 jumping), [1]; knowledge domain: the identified measures do not fully capture the PL
9 knowledge/cognitive domain. BREQ-3, PCS and the physical Self-Perception Profile all show
10 some relevance, towards a comprehensive measurement of adults PL, as they cover domains
11 of PL, are validated and used within PA. However, it is important to consider the lifelong
12 perspective and the holistic nature of PL, whereas the above highlighted measurements needs
13 to be considered thoroughly and maybe adjusted to fully fit the concept of PL. Hence, more
14 research and measurement development is needed to develop such measures.

15 This review is a foundation from which future researchers can base the development
16 of PL measurement tools for adults upon. However, in order to adhere to the unique
17 characteristics of PL as outlined by Whitehead [1] it could also be worthwhile to develop a
18 more comprehensive PL measurement tool for adults by adjusting and adding to the identified
19 measures in this review to the PL theory and secondly validate these measures. A tool that
20 considers the holistic nature of physical literacy that aligns more with the philosophical
21 underpinnings of the concept as outlined by Whitehead [1]. We recommend more research
22 and development of instruments before it is fully possible to generate a complete measurement
23 of PL in adults. An important consideration when developing new measurements tools should
24 be the importance of considering context, but also strive to develop instrument tools useful in

1 large population surveys, if PL is to become important in public and population health
2 research [8].

4 **Conclusions**

5 This review shows that a range of existing and validated instruments exist which cover
6 important aspects of two out of the three domains of PL, i.e., the affective and the physical
7 domains. However, for the knowledge domain no valid measurement tools could be found.
8 This scoping review provides a critical and comprehensive set of tools that researchers who
9 are interested in measuring PL in adults can draw upon. It has identified gaps in the research
10 (namely the cognitive domain) and also a gap in the research whereby there are no measures
11 that consider the inter-relatedness of the three domains (holistic nature of the concept). We
12 recommend conducting future research on measuring PL in adults to further develop
13 measurements tools in a more holistic manner that consider the inter-relatedness of the three
14 domains aligning with Whitehead's definition and philosophies [1]. This review is a
15 foundation from which future researchers can base the development of PL measurement tools
16 for adults upon.

17
18 **Contributorship statement:** KR conducted the review, analysed the data, prepared the first
19 draft of the paper, revised the manuscript and approved the final submission. AH conducted
20 the review, analysed the data, revised the manuscript and approved the final submission. PSM
21 analysed the data, revised the manuscript and approved the final submission. HTM analysed
22 the data, revised the manuscript and approved the final submission. PB analysed the data,
23 revised the manuscript and approved the final submission. NN conducted expert reviewing
24 on motivation measurement, revised the manuscript and approved the final submission. SS
25 conducted expert reviewing on knowledge measurement, revised the manuscript and

1 approved the final submission. GN conducted expert reviewing on physical measurement,
2 revised the manuscript and approved the final submission. PE analysed the data, revised the
3 manuscript and approved the final submission.

4 **Competing interests:** No competing interests to report.

5 **Funding:** No funding was received for this project.

6 **Data sharing statement:** Not relevant in this project.

7 **Ethics statement:** Ethical considerations has been conducted according to Danish law and
8 international guidelines.

9
10 Figure 1: PRISMA flow diagram showing the process of study identification and selection.

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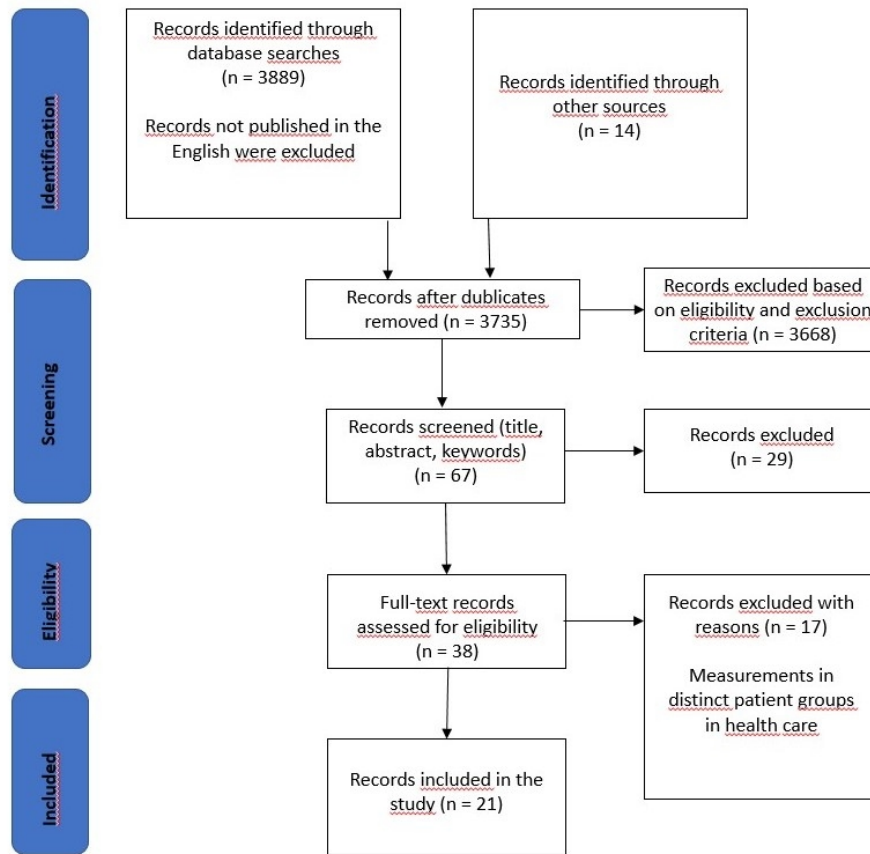


Figure 1: PRISMA flow diagram showing the process of study identification and selection.

228x197mm (96 x 96 DPI)

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1 +
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1+3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2+3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	1-3
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	3
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	3-5
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	3-5
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	3-5
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	1-3
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	3-5
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	3-5
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	53-5



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	3-5
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	5
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Tables
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Tables
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Tables
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	6
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	7
Limitations	20	Discuss the limitations of the scoping review process.	9
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	10
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No funding

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



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Running head: Self-reported Measurements of Physical Literacy in Adults

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3 **1 Self-reported Measurements of Physical Literacy in Adults: A Scoping Review**

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Abstract

Physical literacy (PL) is a comprehensive concept covering motivation, confidence, physical competence, knowledge and understanding of individuals' physical activity throughout life. PL has three overlapping domains; an affective, a physical and a cognitive domain. So far, PL has not been measured in the adults and no complete measurement has been developed to date. **Objectives:** The aim of this scoping review was to review existing self-reported instruments measuring different elements of domains of PL. **Method:** We reviewed Education Research Complete; Cochrane; Medline; ScienceDirect; Scopus and SPORTDiscus. The reporting followed the PRISMA-ScR Guidelines. Studies were coded using a thematic framework which was based on the three domains of PL. The eligibility criteria were: 1) age groups between 18-60 years; 2) meta-analyses, reviews or quantitative studies focusing on the measurement of at least one of the three domains of PL; and 3) instrument that were self-reported. We finalized search on 1st August 2021. **Results:** In total, 67 articles were identified as studies describing instruments reflecting the three domains of PL. Following full text reading, 21 articles that met our inclusion criteria were included. Several instruments of relevance to PL are available for assessing motivation, confidence, and the physical domain. However, few instruments exist that measure elements of the cognitive domain. **Conclusion:** This review showed that a range of existing and validated instruments exists, covering two out of the three domains of PL, namely affective and physical domains. However, for the knowledge domain no valid measurement tools could be found. This scoping review has identified gaps in the research (namely the cognitive domain) and also a gap in the research as no measures that consider the inter-relatedness of the three domains (holistic nature of the concept).

1
2
3 1 Key words: Physical literacy, adults, instruments, motivation, confidence, physical
4
5 2 competence, knowledge and understanding.
6
7
8 3

9
10 4 Word count: 6348
11
12 5

13 6 **Strengths and limitations**

- 14 7 • This scoping review only includes self-reporting instruments
- 15 8 • There has been little research on physical literacy and adults in general
- 16 9 • Furthermore, this review is limited by a shortage of particular cognitive domain
17 10 instruments
- 18 11 • This review showed validated and useful instruments exists, namely in the
19 12 affective and physical domains
- 20 13 • This review suggest possibilities of constructing a holistic instrument measuring
21 14 physical literacy in adults
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36 16 **Introduction**

37 17 Physical literacy (PL) has become a key focus of physical activity promotion research
38 18 and practice in countries such as Australia, Canada, UK and USA, because of the suggested
39 19 importance for participation in lifelong physical activity [1]. Though this claim is still
40 20 disputed, longitudinal studies suggest that a versatile breadth of sporting experience
41 21 significant effect later exercise habits in life, partly supporting the claims of PL [2]. PL is a
42 22 comprehensive concept integrating components such as knowledge and understanding,
43 23 motivation, self-efficacy and physical competencies in relation to physical activity [1]. Even
44 24 though PL is a relative new concept, first proposed in 1993, various definitions exists [3-4].
45 25 Common for all such definitions are three domains: affective, physical and cognitive domain
46 26 [5]. Some definitions also include a behavioral domain [3] and others also incorporate a social
47 27 domain [6]. International Physical Literacy Association define PL as "... the motivation,

1 confidence, physical competence, knowledge and understanding to value and take
2 responsibility for engagement in physical activities for life.” (IPLA, 2017). This definition
3 highlights PL as interchangeable throughout life and thus useful in this paper.

4 PL is expected to improve the all-around health and wellbeing of individuals by
5 enhancing their ability to be physically active [7-8]. This makes PL important from a
6 population health perspective. Addressing the components of PL (motivation, knowledge,
7 competence and confidence) in physical activity interventions, and thereby targeting
8 participants’ prerequisites and personal resources for being active has the potential for
9 impacting individuals’ continued physical activity participation beyond the intervention
10 period. However, when such interventions or programs are to be evaluated, a valid and reliable
11 measure for adults PL is necessary.

12 PL is best grasped utilizing both objective measures (e.g. physical testing,
13 accelerometers and pedometers) and questionnaires [9], as done in the comprehensive
14 Canadian Assessment of Physical Literacy (CAPL) for children. Involving objective
15 measures requires significant time, economy and space for testing (e.g. The National Health
16 and Nutrition Examination Survey). Such endeavours should be encouraged on adult PL,
17 however they should advantageously be supplemented with larger investigations on PL
18 among adults from a population health perspective. Self-reported questionnaires are more
19 easily accessible in such perspectives and chosen as the focus point of this review.

20 While research on children and adolescents has examined the concept of PL
21 extensively in recent years, applications of this concept to adults’ physical activity are scarce
22 [10]. A review by Edwards and colleagues [11] examined studies attempting to measure PL
23 and found limited empirical studies. Furthermore, they found that almost all the literature
24 focused on children and adolescent [11]. In an initial explorative desk research phase, we
25 found no systematic reviews nor validated measurements involving PL and adults (using

1 different search terms; physical literacy; review; adults; measurements); empirical research
2 in this area was also limited (for an exception, see Holler et al. 2019 [12], however this
3 measurement is yet to be validated). Thus, today no validated instrument for measuring PL
4 among adults exists.

5 However, several instruments from related fields and relevant to PL exists, which
6 potentially in combination could be used as a measurement tool for PL in adults. However,
7 no studies have mapped these instruments, reviewed, and understood them within a PL
8 theoretical framework. Therefore, the aim of this scoping review was to review existing self-
9 reported instruments useful for measuring the different elements of the three overall domains
10 of PL (i.e., affective, physical and cognitive) in a population health perspective.

11 12 **Method**

13 **Study design**

14 Scoping reviews are suitable for mapping broad topics and gaps in research related to
15 a defined topic, through systematic searches, selection criteria, and synthesizing knowledge
16 [13-14]. We adhered to the Preferred Reporting Items for Systematic reviews and Meta-
17 Analyses extension for Scoping Reviews (PRISMA-ScR) [15], which were used as a
18 framework for the reporting of the abstract, methodology and results. This checklist consists
19 of 20 essential reporting items and two optional items [15].

20 **Information Sources and Search Strategy**

21 A literature search was conducted using the following six electronic databases: 1)
22 Cochrane Library; 2) Education Research Complete; 3) Medline; 4) ScienceDirect; 5) Scopus;
23 and; 6) SPORTDiscus. These databases cover a broad range of different fields related to PL,
24 including the fields of public health, behavioral and social science, sport, exercise, as well as
25 health education. The final search was conducted on 1st August 2021. The search strategy

1 covered three elements: instrument or measuring; adult; and constructs relating to the three
2 domains of PL: affective, physical, and cognitive. For example, search terms combined to
3 identify measures relating to the affective domain were “*instrument OR measuring AND adult*
4 *AND motivation*”. To provide a comprehensive coverage of possible instruments of the
5 cognitive domain of PL, a search on health literacy was also conducted “*instrument OR*
6 *measuring AND adult AND health literacy*”. To ensure the search results were as relevant as
7 possible, the term ‘physical activity’ was added as a fourth element [example of a search
8 string: *instrument OR measuring AND adult AND motivation AND “physical activity”*]. The
9 searches were limited to English language and peer-reviewed articles in all six databases.
10 Furthermore, the searches were limited to abstracts, title and keywords. The systematic
11 reviews by Edwards et al. [4; 11] were used to identify other articles through a chain search
12 based on the references in these reviews.

13 **Eligibility criteria and study records**

14 The eligibility criteria of inclusion were: 1) studies with age groups between 18-60
15 years; 2) meta-analyses, reviews or quantitative studies focusing on the measurement of at
16 least one of the three domains of PL; and 3) instrument that were self-reported.

17 Exclusion criteria were as follows: 1) articles not covering instruments of at least one
18 of the three domains concerning PL; 2) studies on children, adolescents (under 18 years), and
19 older people (above 60 years); 3) conference abstracts, position papers, editorials, forewords,
20 letters or comments; 4) non-English language instruments; and 5) instruments that were not
21 self-assessed (e.g. motor competence or fitness test).

22 Though self-reported instruments are often considered unreliable [16], we opted to
23 only include self-reported instruments, as these in large scale would be more applicable in
24 adult populations.

1 Two researchers from the author team used the above-mentioned criteria to review the
2 abstract from each article independently. The researchers (KR, PSM, HTM, PB & PE)
3 discussed discrepancies until agreement was reached. A collective list of instruments within
4 each domain was then presented to the full author team and experts within the field of each
5 domain (GN, SS, NN and other experts SB and LE, please see acknowledgements) who
6 reviewed the list. For each domain, mutual agreement on which instrument to be included was
7 required between the full research team (i.e., all authors) and the field experts. Figure 1 shows
8 the flow chart of the process of study identification and selection in the literature search.

9
10 *Insert figure 1 here*

11 Figure 1: PRISMA flow diagram showing the process of study identification and selection.

12 13 **Data Items and Data Synthesis**

14 The data were summarized through content analysis [17] to highlight similarities and
15 differences across the instruments and domains. A two-step method was used in the analysis
16 process. First, the researchers became familiar with the instruments through a close reading
17 of the included full-text articles. Based on these readings, the instruments were classified into
18 one of three themes representing measures of the affective, physical, and cognitive domains
19 of PL. Secondly, subthemes were generated based on the type of instrument (e.g., elements
20 within each domain such as motivation and confidence of the affective domain). The results
21 for each theme/domain are shown in Tables 1-4, respectively. It was possible for one article
22 to be represented in multiple themes or subthemes if various instruments were described
23 herein. After identifying the different instruments, the following characteristics were
24 extracted (see Tables 1-4): author (year); tool description, outcome, psychometric validation
25 method, strengths and limitations.

1 Patient and Public Involvement

2 No patient involved.

4 Results

5 Our search in the six databases resulted in a total of 3,889 articles. Additionally, 14
6 articles were identified via snowballing technique, hand-searching and reviewing reference
7 lists of relevant papers. After the title and abstracts of the articles were screened and duplicates
8 were removed, 67 articles remained. After reading the full texts, 21 articles identifying
9 instruments were included in this review (see Figure 1).

10 Summary of measurements

11 The papers and instruments identified and included in the scoping review are shown
12 in Tables 1-4. Table 1-2 describe the included instruments within the affective domain of PL.
13 Ten instruments were measures of motivation and five measured confidence. For the physical
14 domain, four instruments of physical competence and capacity were included (Table 3). For
15 the cognitive domain, two measures of knowledge were included (Table 4). Table 4 provides
16 an overview of all included instruments and their strengths and limitations in the domains of
17 PL based on theory-driven knowledge about PL and its domains.

18 An abundance of instruments in the affective domain was evident (15 out of 21 papers,
19 71%). The physical domain is represented with four self-reported instruments (19%), which
20 is a low number compared to the large number of test instruments and assessment tests related
21 to this domain (e.g. tests delivered by professional health personal). As noticed earlier self-
22 reported measurements can be seen as a limitation of this scoping review, but also equally
23 important for pragmatically reasons with adults in mind as time and availability is key for
24 large scale investigations (discussed further in discussion).

1 For the cognitive domain, only two relevant instruments were identified (9%) and
 2 these have not been validated, nor do they measure knowledge about physical activity, but
 3 rather knowledge about diseases affected by lack of physical activity or official government
 4 guidelines for physical activity.

5 The ordering in all tables is by year and is not indicative of any preferred order.

6 Synthesis of results

7 Table 1. Instrument overview: affective domain (motivation)

Affective domain: Motivation					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
The Exercise Motivations Inventory (EMI-2) and the Exercise Motives and Gains Inventory (EMGI). Markland and Hardy (1993).	Target group is the whole population. The EMI-2 comprises 14 subscales and 56 items.	Motivation to exercise based on Deci and Ryan's (1985) self-determination theory.	The factorial validity and invariance of the factor structure across gender were rigorously tested using confirmatory factor analytic procedures (Markland & Ingledew, 1997).	Strong validation results. Assess what people want to gain from PA compared to other measurement. Translated to numerous languages.	EMI-2 is not theory driven.
Motivation for Physical Activity Measure (MPAM-R). Ryan, Frederick, Lepes, Rubio, & Sheldon (1997).	Target group is the general population. The measurement consists of 30 items shared among five motivation subscales: interest/enjoyment motivation; competence motivation; appearance motivation; fitness motivation; and social motivation.	The tool assesses participants' motivation for sport and exercise activities.	Studies support that the MPAM-R is both valid and reliable measurement (Ryan et al., 1997).	The measurement has been shown to predict various behavioral outcomes (e.g., attendance, persistence, or maintained participation, and to predict mental health and well-being). Acceptable reliability and validity results. Easy to administrate.	Problems with cross-cultural adaptations.
Kerner & Grossmans intention to exercise scale: Four scales that measure the exercise behavior of individuals. Kerner & Grossman (2001).	Target group is the general population. The measurement consists of four subscales with 40 items in total: fitness attitude scale (19 items); expectations of others scale (7 items); perceived behavioral control scale (3 items); and intention to exercise scale (11 items).	The measurement predicts participation in physical activity and measures the different independent variables from the theory of planned behavior model (Ajzen, 1995).	Studies support that the four scales have content validity and reliability. (Kerner & Grossman, 2001).	Preliminary content validity and good scale reliability. Using theory (Theory of planned behavior).	Small scale pilot study. Problems with cross-cultural adaptations.
Behavioral regulation in exercise questionnaire-2 (BREQ-2). Markland & Tobin (2004).	Target group is the general population. The measurement consists of 19 items and five subscales: amotivation; three types of extrinsic motivation	BREQ-2 assesses the level of self-determined motivation for the exercise activity in question.	Studies have supported the factorial and construct validity of BREQ-2. Furthermore, BREQ-2 has been shown to be a reliable instrument to determine the	Adds the dimension of amotivation to BREQ. Strong validity.	Amotivation assessment in BREQ-2 has been criticized (Liu et al., 2020).

	(external regulation; introjected regulation; identified regulation); and intrinsic motivation.		regulation levels of the amotivation-intrinsic motivation continuum (Markland & Tobin, 2004).		
The Behavioral Regulation in Exercise Questionnaire (BREQ-3). Wilson, Rodgers, Loitz, & Scime (2006).	Target group is the general population. BREQ-3 consists of 24 items and six subscales, adding integrated regulation to BREQ-2.	The tool assesses the 6 types of motivation in self-determination theory as well as amotivation.	The BREQ-3 has been found to be a valid and a reliable measurement instrument to measure behavior regulations, stemming from self-determination theory, in the exercise domain. (Rodgers et al., 2006).	BREQ-3 is a valid and reliable measurement of behavior regulation underlying SDT in the exercise domain. Used broadly among researchers.	It has been suggested that it is difficult to translate some of the items to different language and cultural contexts directly (Cid et al., 2018).
Sports motivation scale (SMS-6): Revised six-factor sports motivation scale. Mallett, Kawabata, Newcombe, Otero-Forero & Jackson (2007).	Target group are athletes' motivation toward sport participation. SMS-6 consists of 24 items and 6 subscales, stemming from self-determination theory (Deci & Ryan, 1985).	The SMS-6 is a measure of contextual motivation that is intended to identify the perceived reasons for participating in sport.	Items measuring self-determining forms of extrinsic motivation have been found to possess satisfactory levels of construct validity. Moreover, it has been found that integrated regulation significantly and positively correlated with various aspects of flow (e.g., autotelic experience, sense of control) (Mallett et al., 2007).	SMS-6 is preferable to the original SMS.	It measures motivation for sport, which make it less inclusive in term of general PA.
The Behavioral Regulation in Sport Questionnaire (BRSQ). Lonsdale, Hodge and Rose (2008).	Target group are elite and nonelite athlete populations (competitive). Consists of 7 subscales and 36 items.	Measures intrinsic motivation, 4 types of extrinsic motivation, and amotivation (self-determination theory; Deci & Ryan, 1985).	BRSQ has shown good reliability and validity in elite and nonelite athlete populations. The test-retest reliability of the scores has been found acceptable. The factorial validity of the BRSQ scores has also been generally supported. The majority of the evidence also supports the nomological validity of the scores. (Lonsdale et al., 2008).	Strong reliability and validity.	Developed for competitive sports.
Basic Psychological Needs in Exercise Scale (BPNES). Vlachopoulos, Ntoumanis & Smith (2010).	Target group is the general population. The PNSE is an 18-item scale with three subscales.	Satisfaction/fulfilment of the three basic psychological needs during exercise	BPNES has shown satisfactory internal reliability coefficients, and evidence for the factor concurrent, discriminant, and nomological validity of the translated scale. Cross-cultural validity analyses supported configural invariance and partial metric, partial strong, and partial strict factorial invariance of the BPNES responses (Vlachopoulos et al., 2010).	Cross-cultural validated. Relatively short. Strong reliability and validity.	Possible gender measurement non-invariance.
Self-Motivation Inventory (SMI-10). André & Dishman (2012).	Target group are elderly participants. SMI-10 is a 10-item short version of the original SMS (40 items).	Measures participants' self-motivation for exercise adherence.	The SMI-10 shows acceptable internal consistency reliability, similar to the original SMI-40 score. (Andre & Dishman, 2012).	Predicts drop-out from exercise. Validated in English and French. The shortened	Mostly used among elders.

				version SMI-10 has acceptable internal consistency.	
Sports motivation scale (SMS-II). Pelletier, Rocchi, Vallerand, Deci and Ryan (2013).	Target groups are sport participants. SMS-II consists of 18 items and six subscales.	The tool assesses the level of motivation towards sport, using the self-determination theory framework (Deci & Ryan, 1985).	Studies have found a good factor structure and adequate convergent validity. Furthermore, the construct validity has been supported (Pelletier et al., 2013).	Stronger measurement than SMS. Adds to BRSQ and SMS-6.	Needs more research on test-retest reliability. The invariance of the measurement with regards to different age groups is unknown.

1 Table 2. Instrument overview: affective domain (confidence)

Affective domain: Confidence					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Self-efficacy scales for health-related exercise and dietary behaviors. Sallis, Pinski, Grossman, Patterson, & Nader (1988).	Target group is the general population. The measurement consists of two exercise self-efficacy subscales and five dietary self-efficacy subscales. 61 items.	Self-efficacy scales are assessed with respect to reported diet and exercise behaviors.	The self-efficacy scales for eating and exercise behaviors have been found to show preliminary evidence of being reliable and valid (Sallis et al., 1988).	Preliminary evidence of being reliable and valid.	Diverse populations have not been investigated.
Perceived Competence Scale (PCS). Williams, Freedman & Deci (1998).	Target group is the general population. 4 items, 1 scale; Perceived competence.	The PCS assesses participants' feelings of competence about different behaviors such as healthier behavior or participating in a physical activity regularly.	PCS is one of the most valid measurement designed to assess self-efficacy.	Perceived competence has been assessed in various studies and used to predict maintained behavior change. It is highly valid and reliable.	Based on SDT, as to why so some researchers suggest it difficult to use without SDT approaches (debatable).
Self-Efficacy for Exercise (SEE) Scale. Resnick & Jenkins (2000).	Target group is the general population. 9 items measuring 1 scale	This scale is a self-report of exercise self-efficacy.	The SEE has been found reliable and having good internal consistency. It has also been shown to have predictive validity, with mental and physical health scores on the SF-12. Predicting efficacy expectations as measured by the SEE Scale. Furthermore, SEE efficacy expectations predicted exercise behaviour (Resnick & Jenkins, 2000).	Has strong validity and reliability.	Developed for older adults. More research is needed with young adults and different socioeconomic and cultural groups.
New General Self-Efficacy Scale. Chen, Gully & Eden (2001).	Target group is the general population. 8 items.	Assesses how much people believe they can achieve their goals, despite difficulties.	The New General Self-Efficacy Scale has been found more reliable and valid than other self-efficacy measures (Scherbaum, Cohen-Charash, & Kern, 2006).	Reported as reliable and valid (Scherbaum, Cohen-Charash, & Kern, 2006).	More resilience oriented. May not be relevant in relation to PL.
Multidimensional outcome expectations for exercise scale (MOEES). Wójcicki, White & McAuley (2009).	Target group is the general population. 15 items and three subscales: physical, social, and self-evaluative. Developed from EXSE (The Exercise Self-Efficacy Scale)	MOEES is used to assess three related, but conceptually independent domains of outcome expectations for exercise.	MOEES has shown to be a reliable and valid measure of outcome expectations for exercise (McAuley et al., 2010).	Draw from social cognitive theory. Preliminary validity exists.	Based on an interpersonal theory and including intrapersonal perspectives.

	(McAuley, 1993).				
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2 Table 3. Instrument overview: physical domain

Physical domain					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Physical Self Inventory – version b (PSI6-b). Ninot, Fortes & Delignières (2006).	Target group is the general population. The PSI6-b has six items and six subscales.	The scale assesses global self-esteem, physical self-worth, physical condition, sport competence, physical strength and attractive body.	Studies have found that PSI6-b had acceptable psychometric properties and external validity (Ninot et al., 2006).	Strong validity based on the PSI-6.	Non-conventional validation methods used in validating PSI6-b compared to PSI-6. More studies needed. Relevance to PL is unclear.
The sports competence subscale of the Physical Self-Perception Profile. Levy & Readdy (2009).	Target group is the general population. The measurement consisted of 6 items and 1 scale.	The tool assesses perception of competence for sport.	The tool has been found to have adequate internal consistency (Levy & Readdy, 2009).	Studies report good validity (Levy & Readdy, 2009).	May not capture all dimensions of important basic movement skills relevant for PL.
Self-reported physical fitness (SRFit) survey. Keith, Clark, Stump, Miller & Callahan (2014).	Target group is the general population. The SRFit has 22 items divided on six subscales.	The measurement assesses health related fitness level across health-domains included in the survey.	SRFit has been found to have a good reliability and construct and concurrent validity (Keith et al., 2014).	Initial evaluation supports the SRFit survey's validity and reliability.	Instrument created for 40+ adults. Time consuming.
Rasch assessment of everyday activity limitations (REAL) item bank. Oude Voshaar, ten Klooster, Vonkeman & van de Laar (2017).	Target group is people with disabilities, however is also used in the wider population. The REAL consists of 47 items.	The purpose of the item bank is to assess disability in complex activities in daily living.	The REAL content validity has been supported (Oude Voshaar et al., 2017).	A newly developed item bank for measuring complex activities of daily living. Superior measurement performance compared to traditional pen and paper questionnaire.	Time consuming. Limited construct validity.

3 Table 4. Instrument overview: knowledge domain

Cognitive domain					
Instrument and authors	Tool description: Target group, Items and Scales	Construct(s) assessed	Validation	Overall strengths	Limitations
Level of knowledge of physical activity for health (adapted from Chapman's questionnaire of levels of smoking knowledge). Fredriksson, Alley, Rebar, Hayman, Vandelanotte & Schoeppe (2018).	Target group is the general population. 11 items/question divided in 4 subscales/levels.	The measure assesses the individual's level of knowledge concerning physical activity. The four levels assessed include: 1) knowing that physical activity is beneficial for health and physical inactivity is harmful to health; 2) knowing that specific health conditions are related to physical inactivity; 3) knowing exactly how much physical activity is needed for health, and 4) the probabilities of developing Physical inactivity	Not validated.	Relative new measurement, more research need.	No validation studies exist. May not be relevant to knowledge and understanding of physical activity.

		related health conditions, knowing, and accepting that the risks and benefits of physical activity (inherent in levels 1–3) apply to one’s own risk of developing such health conditions.			
Understanding Contemplators’ Knowledge and Awareness of the Physical Activity Guidelines. Piercy, Bevington, Vaux-Bjerke, Hilfiker, Arayasirikul & Barnett. (2020).	Target group is the general population. 7 items.	The measure assesses knowledge of health benefits from physical activity, and knowledge of physical activity dosage recommendations.	Not validated.	Relative new measurement, more research need.	No validation studies exist. May not be relevant to knowledge and understanding of physical activity.

Discussion

The aim of this scoping review was to review the existing instruments for measuring the different elements that contributed to PL. The review has identified relevant instruments for assessing and monitoring aspects of especially the affective, and physical domain of PL in adult populations, whereas no validated measures were found for the cognitive domain. The review found most instruments within the affective and physical domain concerned with motivation and competence. This was expected as motivation and competence are commonly used concepts within many research fields including psychology, sport science and health [18]. Hence, the affective domain of PL seems relatively measurable with present and existing instruments, also considering that many of the included instruments in this domain are widely used and have strong validity [11]. Based hereon, it seems that a PL measurement tool, with regards to the affective domain for adults may very well be created/developed on the already established foundation of these instruments.

Additionally, questionnaire-based measures of aspects of the physical domain were reviewed. However, these included instruments have several weaknesses as measures of the physical domain of PL. Self-reported physical competence instruments are often considered

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3 1 unreliable [16]. Usually, overestimation and underestimation based on confidence levels are
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5 2 considered problematic [15; 19-20], hence many researchers have suggested using more
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7 3 objective direct measures of physical competences [21]. Thus, most instrument tools for
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9 4 measuring physical abilities rely on a physical test (e.g., agility), but these tests are resource-
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11 5 demanding, as they demand more staff/research hours to collect than a questionnaire based
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13 6 self-report [22]. Compared to the more resource demanding physical testing, self-assessing
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15 7 instruments of physical competences are in many cases more applicable especially for adult
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17 8 populations, due to less demands and the ability to include them in surveys. Based on findings
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19 9 from this review, self-assessing instruments do exist on the physical domain as an alternative
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21 10 to physical tests.
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26 11 For the knowledge and understanding elements of the cognitive domain, available
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28 12 measures were particular scarce. None of the included instruments were validated, nor do they
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30 13 measure enabling knowledge of physical activities (e.g., tactics in ball games or understanding
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32 14 cultural and contextual aspects important for engaging in different physical activity contexts),
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34 15 but rather physical activity guidelines or health benefits of physical activity [1; 23].
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36 16 Knowledge on how to apply physical competencies in different contexts or knowledge of
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38 17 what contexts are beneficial for one's own physical activity are not measured in these existing
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40 18 instruments. Such forms of knowledge would be more relevant in relation to PL and
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42 19 considering the fact that knowledge of guidelines rarely leads to more physical activity in the
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44 20 population [24], and from a public health perspective may be more compelling. Thus, valid
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46 21 measures of the knowledge and understanding elements of PL among adults are at the time
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48 22 not existing. Furthermore, the cognitive domain of PL implies a focus on context-specific
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50 23 knowledge of physical active (e.g., tactics and organization) and not generic as measurements
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52 24 focusing on physical activity guidelines. Such instruments exist within children and
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1 adolescents (e.g., CAPL-2 and PL-C Quest) [25-26], but currently not adults [4; 11], which
2 makes the cognitive domain limited and difficult to access compared to the other domains.

3 The overall findings from this scoping review indicate that in the affective domain, a
4 range of valid and reliable instruments exist that should inform development of a tool to
5 measure adults' PL. However, instruments available for the physical and the cognitive
6 domains need adaptations and/or even new measurements to assess PL comprehensively
7 among adults. We recommend the readers of this scoping review to critically evaluate the
8 possible instruments, as PL definitions and understandings may vary from one country to
9 another [3-6; 23; 27]. However, the author group do find more merit in some of the
10 instruments compared to others, these include: affective domain (motivation); BREQ-3 [28],
11 as it is based on self-determination theory [29], which is commonly considered central in the
12 understanding of motivation and is not only specific to sport to exercise more generally;
13 affective domain (confidence): PCS, as instrument of relevance to self-efficacy making it a
14 good fit in PL; as a questionnaire based measurement for the Physical domain: the sports
15 competence subscale of the Physical Self-Perception Profile has some interesting properties.
16 That said, it may not capture the essential basic movement skills (e.g., balance, running and
17 jumping), [1]; knowledge domain: the identified measures do not fully capture the PL
18 knowledge/cognitive domain. BREQ-3, PCS and the physical Self-Perception Profile all show
19 some relevance, towards a comprehensive measurement of adults PL, as they cover domains
20 of PL, are validated and used within PA. However, it is important to consider the lifelong
21 perspective and the holistic nature of PL, whereas the above highlighted measurements needs
22 to be considered thoroughly and maybe adjusted to fully fit the concept of PL. Hence, more
23 research and measurement development is needed to develop such measures.

24 This review is a foundation from which future researchers can base the development
25 of self-reported PL measurement tools for adults upon. However, in order to adhere to the

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3 1 unique characteristics of PL as outlined by Whitehead [1] it could also be worthwhile to
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5 2 develop a more comprehensive (e.g. including objective measures [9]) PL measurement tool
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7 3 for adults by adjusting and adding to the identified measures in this review. Such a tool should
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9 4 consider the holistic nature of physical literacy that aligns more with the philosophical
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11 5 underpinnings of the concept as outlined by Whitehead [1]. We recommend more research
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13 6 and development of instruments before it is fully possible to generate a complete measurement
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15 7 of PL in adults. An important consideration when developing new measurements tools should
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17 8 be the importance of considering context, but also strive to develop instrument tools useful in
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19 9 large population surveys, if PL is to become important in public and population health
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21 10 research [8]. Thus, to fully understand PL in adults, we need comprehensive measurements
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23 11 with objectively measured tasks and questionnaires like CAPL for children, but we also need
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25 12 a more large-scale population surveys with the potential of monitoring and widening the use
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27 13 of PL among adults. Efforts in these two areas may move the area of PL and adults out of the
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29 14 shadows.
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16 **Conclusions**

40 17 This review shows that a range of existing and validated instruments exist which cover
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42 18 important aspects of two out of the three domains of PL, i.e., the affective and the physical
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44 19 domains. However, for the knowledge domain no valid measurement tools could be found.
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46 20 This scoping review provides a critical and comprehensive set of tools that researchers who
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48 21 are interested in measuring PL in adults can draw upon. It has identified gaps in the research
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50 22 (namely the cognitive domain) and also a gap in the research whereby there are no measures
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52 23 that consider the inter-relatedness of the three domains (holistic nature of the concept). We
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54 24 recommend conducting future research on measuring PL in adults to further develop
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56 25 measurements tools in a more holistic manner that consider the inter-relatedness of the three
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1 domains aligning with Whitehead's definition and philosophies [1]. This review is a
2 foundation from which future researchers can base the development of self-reported PL
3 measurement tools for adults upon.

4
5 **Contributorship statement:** KR conducted the review, analysed the data, prepared the first
6 draft of the paper, revised the manuscript and approved the final submission. AH conducted
7 the review, analysed the data, revised the manuscript and approved the final submission. PSM
8 analysed the data, revised the manuscript and approved the final submission. HTM analysed
9 the data, revised the manuscript and approved the final submission. PB analysed the data,
10 revised the manuscript and approved the final submission. NN conducted expert reviewing
11 on motivation measurement, revised the manuscript and approved the final submission. SS
12 conducted expert reviewing on knowledge measurement, revised the manuscript and
13 approved the final submission. GN conducted expert reviewing on physical measurement,
14 revised the manuscript and approved the final submission. PE analysed the data, revised the
15 manuscript and approved the final submission.

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21 **Funding:** No funding was received for this project.

22 **Data sharing statement:** Not relevant in this project.

23 **Ethics statement:** Not applicable.

24
25 Figure 1: PRISMA flow diagram showing the process of study identification and selection.

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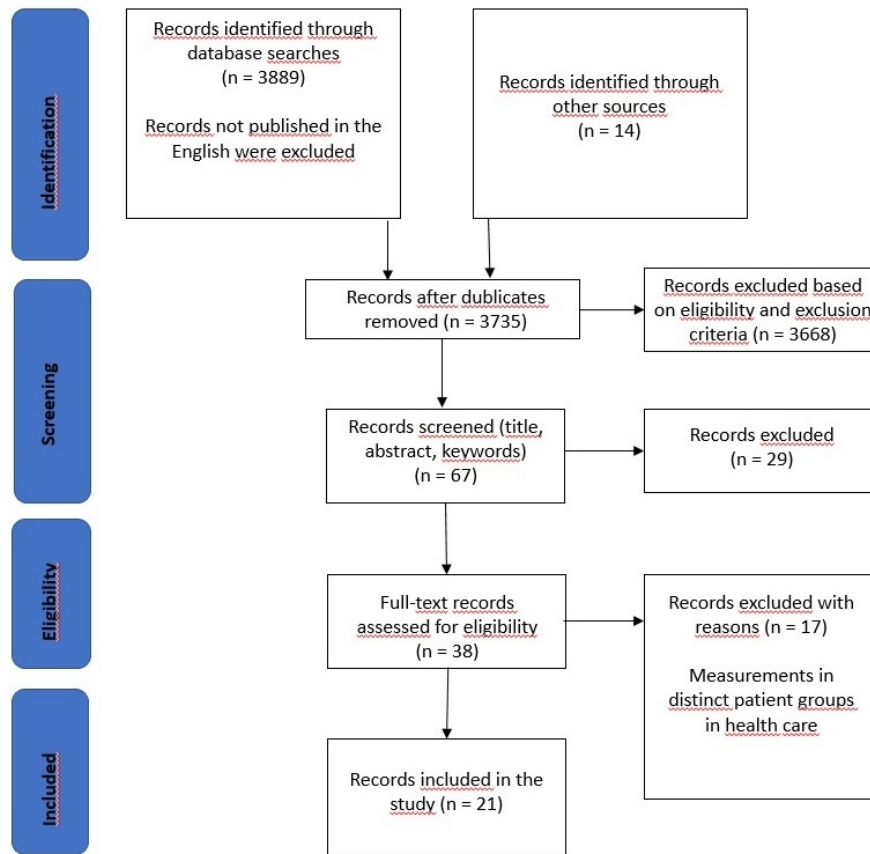


Figure 1: PRISMA flow diagram showing the process of study identification and selection.

228x197mm (96 x 96 DPI)

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1 +
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1+3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2+3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	1-3
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	3
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	3-5
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	3-5
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	3-5
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	1-3
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	3-5
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	3-5
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	53-5



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	3-5
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	5
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Tables
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Tables
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Tables
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	6
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	7
Limitations	20	Discuss the limitations of the scoping review process.	9
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	10
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No funding

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).

