TITLE PAGE

Title: A systematic review of the physical activity assessment tools used in primary care.

Running Header: Physical activity assessments in primary care

Article Category: Systematic Review

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ABSTRACT

Background: Primary care is an ideal setting for physical activity interventions to prevent and manage common long-term conditions. To identify those who can benefit from such interventions and to deliver tailored support, primary care professionals (e.g. general practitioners, practice nurses, physiotherapists, healthcare assistants) need reliable and valid tools to assess physical activity. However, there is uncertainty about the best performing tool.

Objective: To identify the tools used in the literature to assess the physical activity in primary care and describe their psychometric properties.

Method: A systematic review of published and unpublished literature was undertaken up to 1st December 2016). Papers detailing physical activity measures, tools or approaches used in primary care consultations were included. A synthesis of the frequency and context of their use, and their psychometric properties, was undertaken. Studies were appraised using the Downs and Black critical appraisal tool and the COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN) initiative checklist.

Results: Fourteen papers reported 10 physical activity assessment tools. The General Practice Physical Activity Questionnaire (GPPAQ) was most frequently reported. None of the assessment tools identified showed high reliability and validity. Intra-rater reliability ranged from Kappa: 0.53 (Brief Physical Activity Assessment Tool (BPAAT)) to 0.67 (GPPAQ). Criterion validity ranged from Pearson's Rho: 0.26 (GPPAQ) to 0.52 (Physical Activity Vital Sign). Concurrent validity ranged from Kappa: 0.24 (GPPAQ) to 0.64 (BPAAT).

Conclusion: The evidence base about physical activity assessment in primary care is insufficient to inform current practice.

PROSPERO Registration number: CRD42016041243

Keywords: Physical inactivity; screening; primary care; health promotion; consultation

INTRODUCTION

Physical inactivity has been estimated to cause 6% to 10% of global deaths annually [1]. It is a risk factor for disability, obesity, type two diabetes, cardiovascular disease and some cancers [2,3]. The health benefits of physical activity have been well-documented [1]. Increasing physical activity is crucial to reduce mortality and morbidity associated with non-communicable diseases [2,3]. Physical activity can also improve quality of life, particularly in those who have a chronic disease [1]. The economic benefits of increasing physical activity in those with physical or mental health problems have been estimated to potentially save the National Health Service (NHS) approximately £0.9 billion annually [4], with an estimated £940 million cost saving to primary care services alone [5]. Despite this in England approximately 60% of men and 70% of women are reported to be insufficiently active to benefit their health [6].

Primary care offers an ideal setting for interventions to promote physical activity, as 78% of the population are seen each year [7]. In the UK, the National Institute for Health and Care Excellence [8,9] has recommended that all patients in primary care should receive a physical activity assessment to identify those who are not meeting recommended levels of physical activity and who could benefit from interventions to increase physical activity. In addition to identifying those at risk due to sedentary lifestyles, physical activity assessments facilitate the subsequent delivery of tailored advice regardless of patients' physical activity levels. For instance, patients could be encouraged to increase the intensity or duration of specific activities (e.g., gardening, walking) they are already doing, or to maintain their current activity levels.

In the physical activity literature, assessment tools have been used for four broad purposes: (1) identify those at risk of the adverse consequences of physical inactivity who may need further behaviour change support (e.g. NHS health checks); (2) tailor a subsequent physical activity intervention to physical activity readiness; (3) as a baseline assessment for a trial evaluating a physical activity intervention; and (4) a combination of trial baseline assessment and physical activity intervention tailoring. Previous literature has centred on evaluating physical activity interventions rather than assessment tools in clinical practice. There is therefore a paucity of understanding as to how these tools 'work' in clinical practice. Whilst physical activity assessments themselves will not lead to increased activity on their own, they are important to be able to identify individuals who could benefit from interventions that have been shown to have positive health benefits [7]. Therefore greater awareness and knowledge on what physical assessment tools clinicians should use in primary care, and which

assessment tools are most reliable and valid, could improve decision-making on which people should be provided with advice, guidance and support on physical activity interventions.

The purpose of this systematic review is to identify the tools used to assess physical activity in primary care and describe their psychometric properties.

METHODS

The review protocol was published in the PROSPERO register prior to commencing the literature search (Registration Number: CRD42016041243). This paper was prepared in accordance with the PRISMA reporting recommendation (Moher et al, 2009).

Search Process

The primary search strategy aimed to identify published papers from the following electronic databases: AMED, CINAHL, EMBASE, PsycINFO, MEDLINE and the Cochrane Library. Secondary searches were conducted for unpublished/grey literature using the databases and trial registries: OpenGrey, the WHO International Clinical Trials Registry Platform, Current Controlled Trials and clinicaltrials.gov. A search was conducted for briefing papers and guidelines from eight key organisations (Department of Health (DH), National Institute for Health and Care Excellence (NICE), Royal College of General Practitioners (RCGP), British Heart Foundation, Diabetes UK, Cancer UK, Age UK and the British Association of Sport and Exercise Medicine (BASEM) to provide a focused assessment of UK health policy. All database searches were conducted from database inception to 1st December 2016. The search was performed in two phases. Firstly, a search was performed to identify all physical activity assessment tools used in primary care settings. The search terms and Boolean operators used for the MEDLINE search (as an example) are presented in **Supplementary Table 1**. A second search was performed to identify papers reporting the psychometric properties of the tools identified through the first phase. The MEDLINE search strategy (as an example) is presented in **Supplementary Table 2**, The reference lists from all potentially eligible papers and review articles were scrutinised to identify any additional papers. Finally, corresponding authors from all included papers were contacted and asked to review the search results to identify any previously omitted papers.

Eligibility Criteria

All papers which reported specific measures, tools or approaches to assess physical activity used in primary care services were included. Studies assessing functional capability and performance rather than physical activity were excluded. Primary care services were defined as those assessing health and delivering care to people in primary care (e.g. general practice clinic, health centre).

All studies which assessed patients in an acute hospital setting or where it was not explicitly stated that the physical activity assessment was undertaken in primary care were excluded. If there was uncertainty as to the location of physical activity assessment, the reviewers contacted the corresponding authors to ascertain this. If this could not be confirmed, such papers were excluded. Studies were included regardless of age, gender, and occupational status of patients, co-morbidities or primary reason for attending primary care services, study design, year of publication, language of publication or country of origin of study. Commentary papers, letters, opinion papers and systematic (and non-systematic reviews) were included to aid the identification of assessment tools for the first phase of the literature review. Papers reporting qualitative research were excluded given that we searched for quantitative data about the assessment tools.

Study Identification

Two reviewers (TS, MM) independently reviewed the titles and abstracts from all potentially relevant papers using the pre-defined eligibility criteria. Full-texts of all potentially eligible papers were reviewed independently by the same two reviewers before making a final decision on eligibility. Studies which did not satisfy the eligibility criteria were excluded. Any disagreement between the reviewers on paper eligibility were resolved through discussion and adjudicated by a third reviewer (CS).

Data Extraction

Two reviewers (TS, MM) independently extracted all data onto a pre-defined data extraction table. Data extracted included: the study's geographical origin; the physical activity assessments used; setting (e.g. general practice clinic, health centre); who completed the physical activity assessment (e.g. patient or health professional); which patient populations were assessed (e.g. age, gender, medical presentation, co-morbidities, socioeconomic status); and reported psychometric data (reliability and validity) on physical assessments. For this review, accelerometry data was considered the 'gold-standard' reference for assessment of validity. Any

disagreements in data extraction between the two reviewers were resolved through discussion, adjudicated by a third reviewer (CS).

Assessment of Quality

Each included research paper (non-recommendation/guideline document) was critically appraised using the Downs and Black tool [10]. This is a reliable and valid critical appraisal tool for non-randomised controlled studies, and includes a total of 27-items assessing the quality of reporting, external validity, internal validity and power. Due to the research question posed by this review and the designs of the included studies, Items 8, 14, 15, 17, 19 and 21 to 25 were excluded as these related to randomised controlled trials or case-controlled studies which were not relevant to our research questions. To specifically assess the methodological quality of the included studies on the identified assessment tools, the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) checklist [11]. The COSMIN checklist assesses the following measurement properties: internal consistency, reliability, measurement error, content validity, structural validity, hypothesis testing, cross-cultural validity, criterion validity and responsiveness. The overall quality of how each measurement property was evaluated on a four-point scale: excellent, good, fair, or poor, as per the COSMIN guidance. The methodological quality score per property was then obtained by taking the lowest rating of any item in each box. For each tool's analysis, two reviewers (TS, MM) independently appraised quality. Any disagreements were resolved through discussion between the two reviewers and adjudicated by a third reviewer (CS).

Data Analysis

The primary aim was to determine what physical activity assessment tools have been used in general practice. To answer this, a narrative analysis synthesis was adopted to report the number of studies where each physical activity assessment was used. Similarly, a narrative analysis synthesis was adopted to determine the frequency with which each physical activity assessment tool was used for different clinical populations e.g. reason for assessment (opportunistic or planned appointment pertaining to physical activity), performed by patient or clinician, grade of clinician, and patient characteristics (age, gender, medical morbidities, socioeconomic status).

To assess the psychometric properties of the identified physical activity assessment tools when used in clinical practice, a narrative analysis approach was adopted. Summary ranges were used of intra-class correlation coefficients (ICC), Kappa, and sensitivity and specificity values for reliability; and validity and diagnostic test accuracy measures to determine the clinometric properties of each tool reported within the literature. Test-retest reliability is generally measured by the kappa statistic or ICC for assessments taken on two occasions. The Kappa statistic measures the proportion of maximal agreement beyond that expected by chance for categorical ratings. However values vary according to the scale being compared, its prevalence, and the number of items [12]. The weighted kappa statistic weights categories to represent the relative importance of disagreements and is a more appropriate measure of agreement when categories are ordinal [12]. The ICC is a reliability measure for continuous scales scored on repeated occasions by the same raters. Its value is influenced by the measures variance in the population [13]. Test validity is measured by the correlation with a 'gold standard' measure, either by Pearson's R for continuous measures or Spearman's Rho for ranked data. Alternatively, the Kappa statistic is sometimes used to compare two dichotomised categorical measures, typically into a binary 'sufficiently active' or 'not sufficiently active' definition. Again, Kappa values will depend on prevalence.

RESULTS

Search Results

A total of 2384 citations were identified from the search strategy. Fifty-eight papers were deemed potentially eligible. From these, 12 research papers [2, 14-24] and two national briefing papers [8,9] met the eligibility criteria and were included in the review. One paper was excluded as it did not report what physical activity assessment tool was used [25]. A summary of the search results is presented in **Figure 1**.

Quality Assessment

The quality of the studies was moderate (**Supplementary Table 3**). Strengths across the included studies included clear reporting of study aims and outcome measures (100%), clear description of participant characteristics (8/12; 67%), clear reporting the assessment of physical activity (100%) and clear reporting of reliability and validity findings (10/12; 83%). However the included papers poorly reported how representative

their study cohorts were of the wider population (3/12; 25%), and the characteristics of those lostto follow-up (3/12; 25%).

The results of the psychometric properties of each physical assessment tool using the COSMIN checklist [11] are presented in **Supplementary Table 4**. None of the studies evaluated all of the measurement properties included in the COSMIN checklist; for instance, responsiveness was not assessed for any of the assessment tools. Internal consistency was only assessed for the GPPAQ and GPPAQ-walk tools. Reliability and criterion validity were the most frequently assessed properties, reported for all tools except the GPPAQ-walk, Physical Activity Vital Sign (PAVS) and Speedy Nutrition and Physical Activity Assessment (SNAP) tools. The psychometric properties of the Brief Physical Activity Assessment Tool (BPAAT) and the 7-Day Physical Activity Recall (7DPAR) assessment tools were most frequently rated as 'good', but no property of any assessment tool was rated as 'excellent'.

Physical Activity Assessments in Primary Care.

Ten unique physical activity assessment tools were identified as having been used in primary care. A summary of the properties of these tools is presented in **Supplementary Table 5**. The most frequently reported tool was the GPPAQ. This was reported in five papers [2,14-17] and two national guidelines [8,9]. Eight other assessment tools listed in **Supplementary Table 5** were reported in a maximum of two papers each.

Populations and Context of Physical Activity Assessment

A summary of the characteristics of the included 12 research papers is presented in **Table 1**. The included studies were conducted in five different countries. Four studies were conducted in Australia [16-18,21], three in the United States of America (USA) [19,20,24], two in Northern Ireland [14,15], two in Spain [22,23] and one in England [2].

The characteristics of the cohorts assessed are presented in **Table 1**. A total of 45,541 adults (sample sizes ranged from 41 to 1184) were assessed using the 10 different physical activity assessment tools. One study did not report how many participants were assessed with the GPPAQ [11]. No studies assessed adolescent or paediatric cohorts.

Eleven studies documented who completed the physical activity assessments. This was a healthcare professional in eight studies [14-19,22,23], and self-administered by patients in three studies [14,20,24]. None of the assessment tools were exclusively completed by General Practitioners (GPs) in the UK examples [2,14,15]. Heron et al [14] specified that 79% of GPPAQ assessments were performed by a GP, whilst it was not reported who completed the other 21%.

Psychometric Properties: Reliability

A summary of the reliability, validity and diagnostic test accuracy data is presented in **Table 2**. Intra-rater reliability, expressed as the Kappa statistic, ranged from 0.53 (95% confidence intervals (CI): 0.33 to 0.72) for the English version of the BPAAT to 0.72 (95% CI: 0.55 to 0.83) for the Catalan Translation of the BPAAT [23]. The GPPAQ presented with broadly similar intra-rater reliability across its different language versions. The English-language version demonstrated a Kappa of 0.63 [2], the Spanish translation 0.67 [23] and the Catalan translation 0.63 [23]. When intra-rater reliability was assessed using the ICC, GPPAQ demonstrated moderate to high agreement (ICC: 0.82 to 0.95)[17], the 3Q Physical Activity Questionnaire high agreement (ICC: 0.94 to 0.98)[17], whilst the Rapid Assessment Disuse Index (RADI) demonstrated moderate intra-rater reliability (ICC: 0.79; 95% CI: 0.73 to 0.85)[24].

Psychometric Properties: Validity

Criterion validity was reported for the GPPAQ, 2Q and 3Q Physical Activity Questionnaire, PAVS, SNAP, and the BPAAT (English and Spanish translation versions). Studies reported low to moderate criterion validity for all assessments when compared to objectively measured physical activity using accelerometery. The highest criterion validity was for the PAVS assessment (R: 0.50)[20]. Whilst the English-language version of the BPAAT had a Kappa value of 0.40 (95% CI: 0.12 to 0.69)[21], the Spanish language version demonstrated low criterion validity (R: 0.28; 95% CI: 0.17, 0.39)[22].

Concurrent validity was moderate to good across the physical activity assessment tools where another measure of physical activity was completed at the same time as the tools. Those with the highest levels of agreement with other self-reported measures of physical activity included the BPAAT (Spanish Translation: Kappa: 0.61; 95% CI: 0.50 to 0.81)[23]; Catalan Translation: Kappa: 0.58; 95% CI: 0.43 to 0.77),[23] and the 2Q Physical Activity Questionnaire (Rho: 0.54; 95% CI: 0.44 to 0.63)[18]. The GPPAQ presented with the lowest criterion validity (Kappa: 0.24)[2].

Psychometric Properties: Diagnostic Test Accuracy

Data were available on the sensitivity and specificity of four physical activity assessment tools against accelerometry as the reference test (gold-standard). This determined physical activity levels against whether participants met physical activity guidelines using accelerometry. In Ball et al's [20] study of 45 patients, two patients who met physical activity guidelines were correctly identified using the PAVS or SNAP (sensitivity of 1.0), whilst the specificity of each test was 0.91 and 0.60 respectively. Although GPPAQ and GPPAQ-walk showed low sensitivity (0.19 and 0.40) in Ahmad et al's [2] study, they were found to be reasonably specific (0.85 and 0.71).

DISCUSSION

We identified ten unique physical activity assessment tools which have been used in primary care. No tool showed high reliability and validity. The psychometric properties of the 2Q and 3Q Physical Activity Questionnaires, RADI, PAVS and GPPAQ have been most frequently reported within the literature. However, this evidence is based on moderate quality studies with limited assessment of the psychometric properties of these assessment tools.

Whilst we identified ten physical activity assessment tools, a number of physical activity measures, most notably the Stanford Brief Activity Survey, the Scottish Physical Activity Questionnaire, the International Physical Activity Questionnaire (IPAQ) and the WHO Global Physical Activity Questionnaire, were ineligible for this review. This was because these have been reported used for research purposes rather than clinical practice. Future study is therefore recommended to evaluate their performance in routine primary care consultations, particularly given their favorable psychometric properties when used in non-primary care research studies [27-29].

Health care professionals are more likely to use physical activity assessment tools when they can understand its value, its fit in current service provision (or perceived potential fit), and if the participants (healthcare professionals and patients) have sufficient support to implement the proposed change [26]. The value of the assessment tools, from design and presentation, to their interpretation, and perceived value should be determined

when considering prior to clinical adoption. This review has highlighted that there is insufficient evidence on each of these aspects, making further research on implementation a key 'next-step' once an optimal physical activity assessment tool is identified.

In the UK, NICE [8] have recommended that the GPPAQ should be used to identify adults seen in primary care who do not meet recommended levels of physical activity and who could benefit from interventions/advice to increase physical activity. However, as the COSMIN checklist [11] has highlighted, the psychometric properties of this physical activity assessment tool have been insufficiently evaluated to support its adoption based on research evidence. Furthermore, the GPPAQ includes a large number of items assessing occupational physical activity, and items focus on patients with no physical limitations. Therefore its utility may be limited for those who are not in paid employment (e.g., retired adults) and have mobility difficulties. Future studies should examine the utility of this tool amongst a wide range of patient groups, particularly adults post-retirement and those with physical limitations who may have significant health gains from becoming more physically active[26].

Based on the findings from this systematic review, the evidence-base remains insufficient to support the adoption of a specific physical activity assessment tool in primary care. Whilst ten tools have been identified as being used in this setting, the evaluation of their psychometric properties, as assessed against the COSMIN checklist, are at best of moderate quality. Given the high numbers of patients who could benefit from physical activity interventions [1,6], a research priority is therefore to firstly evaluate the psychometric properties of the identified physical activity assessment tools using rigorous approaches, and secondly to assess the implementation of the optimal methods within routine 'real-world' primary care practice.

This systematic review has two principal limitations which should be considered when interpreting these findings. Firstly, only physical activity assessment tools reported as being used in primary care were included in the review. As a result, a number of tools which could be used but have not been reported within the literature such as the IPAQ or WHO Global Physical Activity Questionnaire which were not eligible but may be valuable if tested in primary care settings in the future. Secondly, due to the limited data for each of the ten individual assessment tools, and the limited data presented, it was not possible to pool the data on the psychometric

properties of physical activity assessment tools. Therefore the current data is based on a relatively small number of individuals.

Based on our findings, there is continued uncertainty about which physical activity assessment tool can best be adopted in primary care. Whilst ten tools were identified, the evaluation of their psychometric properties, as assessed against the COSMIN checklist, are at best of moderate quality. Given the high numbers of patients who could benefit from physical activity interventions [1,6], a research priority is therefore to robustly evaluate the psychometric properties of the ten physical activity assessment tools, and then to assess the implementation of the best-performing tools within routine 'real-world' primary care practice.

CONCLUSION

Physical inactivity is a major risk factor for mortality and morbidity. Physical activity assessment tools enable health professionals to identify people who could benefit from increasing their physical activity, and to deliver tailored behaviour change support. We identified ten tools, but none showed satisfactory reliability and validity, and assessment of their psychometric properties was limited. This included the GPPAQ which is recommended by NICE. The evidence-base supporting its adoption is weak. High-quality studies are required to develop and optimise physical activity assessment tools for opportunistic use in primary care which are reliable, valid, and suitable for the wide range of patients seen in primary care. This is an important 'next-step' to improve physical activity assessment and prescription across primary care.

DECLARATIONS

ETHICS - No ethical approval required for this study.

FUNDING - The study was funded by departmental resources.

DISCLOSURES - Wendy Hardeman has done consultancy work for AbbVie Ltd. All other authors declare that they have no conflict of interest in relation to this study or paper.

FIGURE AND TABLE LEGENDS

Figure 1: PRISMA flow-chart of study eligibility

Table 1: Characteristics of included studies

Table 2: Reliability and validity of the physical activity assessments.

Supplementary Table 1: Search strategy adopted for MEDLINE search to identify physical activity assessment tools used in primary care.

Supplementary Table 2: Search strategy adopted for MEDLINE search to identify studies assessing the psychometric properties of physical activity assessment tools used in primary care.

Supplementary Table 3: Downs and Black quality assessment results

Supplementary Table 4: Summary of the psychometric properties of physical activity assessment tools using the COSMIN checklist.

Supplementary Table 5: Summary of the ten physical activity assessments identified.

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449 **Figure 1:** PRISMA flow-chart of study eligibility

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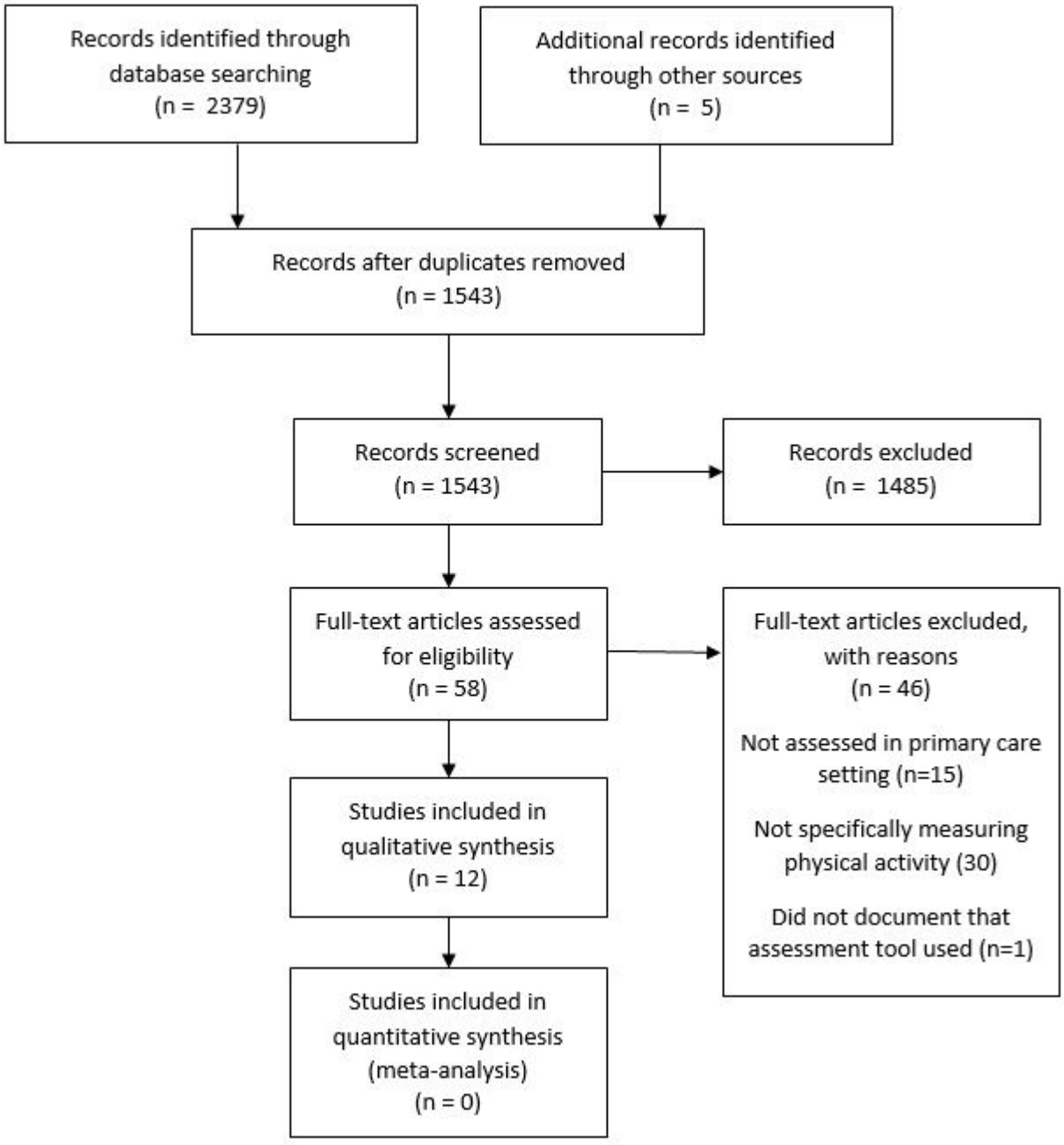

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Table 1: Characteristics of included studies

Study	Country	Physical Activity Assessment	Performed during routine appointment or opportunistic	Setting	Person conducting the assessment	Population Assessed	Psychometric Properties Reported	Measures to compare Validity	Time dufference test/re-test
Ahmad [2]	England	GPPAQ and GPPAQ-WALK	NR	GP practice	NR	298 (60-74 years)	Test Re-Test; Criterion Validity; DTA	Accelerometry	3 and 12 months
Ball [20]	USA	PAVS and SNAP	Research project	Primary Care Clinic	Patient	45 adults	Criterion Validity; DTA	Accelerometry	NA
Bull [16]	Australia	GPPAQ	Research project	Primary Care clinic	GP, nurses, HCA	449 adults 16-74 year)	NR	NA	NA
Dutton [17]	Australia	GPPAQ and 3Q Physical Activity Tool	NR	Primary Care Clinic	Practice nurse and patient	100 adults	Test Re-Test; Criterion Validity	Accelerometry	1 week
Greenwood [19]	USA	PAVS	Research project	Primary Care clinic	NR	261 (21-65 years, mean age 38.4 years)	Content Validity	Within question assessment	NA
Heron [14]	N. Ireland	GPPAQ	Routine appointment	GP practice	79% by GP 21% NR	41 adults	NR	NA	NA
Heron [15]	N. Ireland	GPPAQ	Routine appointment	GP practice	GP, practice nurse, patient	192 adults (35-75 years)	NR	NA	NA
Marshall [21]	Australia	BPAAT	Research project	Primary Care clinic	GP	75 (20-60 years)	Test Re-Test; Criterion Validity	Accelerometry	Within 1 week
Puig-Ribera [22]	Spain	BPAAT (Spanish and Catalan Version) and 7DPAR	Research project	Primary Care clinic	Healthcare Professional	1184 adults (mean age 58.9 years)	Construct Validity	IPAQ	14 to 28 days
Puig-Riberia [23]	Spain	BPAAT (Spanish and Catalan Version) and GPPAQ (Spanish and Catalan	Research project	Primary Care clinic	GP	105 adults (mean age 58 years)	Test Re-Test; Criterion Validity	Accelerometry; 7-day Physical Activity Recall	Within 2 months

		Version)							
Shuval [24]	USA	RADI	Research project	Primary Care clinic	Computer and face-to-face by patient	179 Adults (40-79 years)	Test Re-Test; Criterion Validity; DTA	Accelerometry	12 to 16 days
Smith [18]	Australia	2Q and 3Q Physical Activity Tool; Active Australia Questionnaire (AAQ)	Research project	Primary Care clinic	GP	509 adults	Test Re-Test; Criterion Validity	Accelerometry	3 days

7DPAR - 7-Day Physical Activity Recall; BPAAT - Brief Physical Activity Assessment Tool; DTA – diagnostic test accuracy (sensitivity and specificity); GPPAQ – General Practice Physical Activity Questionnaire; HCA – health care assistants; IPAQ – International Physical Activity Questionnaire; N/A – not assessed; NR – not reported; RADI; Rapid Assessment Disuse Index; PAVS - Physical Activity Vital Sign; SNAP - Speedy Nutrition and Physical Activity Assessment

Table 2: Reliability and validity of the physical activity assessments.

Assessment Methods	Reliability	Validity		Diagnostic Test Accuracy	
	Intra-Rater	Criterion	Concurrent	Sensitivity	Specificity
GPPAQ	ICC=0.82-0.95 [14] wK: 0.63 [2]	Rho=0.26 [17]	wK: 0.24 [2]	0.19 [2]	0.85 [2]
GPPAQ-walk	NR	NR	NR	0.40 [2]	0.71 [2]
GPPAQ (Spanish Translation)	K: 0.67 (95% CI: 0.35-0.74) [23]	NR	K: 0.49 (95% CI: 0.45-0.56) [23]	NR	NR
GPPAQ (Catalan Translation)	K: 0.63 (95% CI: 0.43-0.77) [23]	NR	K: 0.42 (95% CI: 0.27-0.69) [23]	NR	NR
2Q Physical Activity Tool	Rho: 0.61 (95% CI: 0.53-0.69) [18]	Rho: 0.39 (95% CI: 0.28-0.49) [18] K: 0.18 (95% CI: 0.04-0.33) [8]	K: 0.47 (95% CI: 0.36-0.58) [18] Rho: 0.54 (95% CI: 0.44-0.63) [18]	NR	NR
3Q Physical Activity Tool	ICC=0.94-0.98 [17] Rho: 0.63 (95% CI: 0.53-0.70) [18]	Rho: 0.45 [17] Rho: 0.31 (95% CI: 0.18-0.43) [18] K: 0.24 (95% CI: 0.12-0.37) [18]	K: 0.43 (95% CI: 0.32-0.53) [18]	NR	NR
RADI	ICC: 0.79 (95% CI: 0.73-0.85) [24]	NR	Rho: 0.40 (p<0.001) [24]	0.79 [24]	0.59 [24]
PAVS	NR	R: 0.50 [20]	NR	1.00 [20]	0.91 [20]
SNAP	NR	Rho: 0.32 [20]	NR	1.00 [20]	0.60 [20]
BPAAT	K: 0.53 (95% CI: 0.33-0.72) [21]	K: 0.40 (95% CI: 0.12-0.69) [21]	NR	NR	NR
BPAAT (Spanish Translation)	K: 0.70 (95% CI: 0.53-0.82) [23]	R: 0.28 (95% CI: 0.17-0.39) [22]	K: 0.45 (95% CI: 0.41-0.51) [22] K: 0.64 (95% CI: 0.50-0.81) [23]	NR	NR
BPAAT (Catalan Translation)	K: 0.72 (95% CI: 0.55-0.83) [23]	NR	K: 0.58 (95% CI: 0.43-0.77) [23]	NR	NR

BPAAT – Brief Physical Activity Assessment Tool; GPPAQ – General Practice Physical Activity Questionnaire; HCA – health care assistants; ICC- Intraclass correlation coefficient; K – Kappa statistic; N/A – not applicable; NR – not reported; Rapid Assessment Disuse Index; PAVS - Physical Activity Vital Sign; R – Pearson's R; Rho – Spearman's Rho Correlation Coefficient; SNAP - Speedy Nutrition and Physical Activity Assessment; wK – weighted Kappa statistic

Supplementary Table 1: Search strategy adopted for MEDLINE search to identify physical activity assessment tools used in primary care.

1. exp exercise/
2. physical inactivity.mp.
3. physical activity.mp.
4. exp motor activity/
5. (physical education and training).mp.
6. exp "Physical Education and Training"/
7. exp physical fitness/
8. sedentary.ab. or sedentary.ti.
9. exp life style/
10. exp leisure activities/
11. exp walking/
12. exp sports/
13. exp dancing/
14. dancing.mp.
15. exp exercise therapy/
16. (exercise$ adj aerobic$).ti,ab
17. (physical$ adj5 (fit$ or train$ or activ$ or endur$)).ti,ab
18. (exercis$ adj5 (train$ or physical$ or activ$)).ti,ab
19. sport$.ti,ab
20. walk$.ti,ab
21. cycle$.ti,ab
22. (("lifestyle" or life-style) adj5 activ$).ti,ab
23. OR/1-22
24. (primary adj3 (care or health*))
25. (family or general or community) adj4 (medic$ or doctor$ or physician$ or practi$* or health$)
26. (GP or “GP’s”).ti,ab
27. (community adj3 (care or health$))
28. OR/24-27
29. exp mass screening/
30. systematic risk assessment$.ti,ab
31. case finding.ti,ab
32. ((screen$ or assess$ or test$ or diagnos$ or surveill$ or identifi$)
33. Risk Assessment/
34. (risk$ adj3 assess$).ti,ab
35. OR/29-34
36. AND/23,28,35

Supplementary Table 2: Search strategy adopted for MEDLINE search to identify studies assessing the psychometric properties of physical activity assessment tools used in primary care.

1. exp exercise/
2. physical inactivity.mp.
3. physical activity.mp.
4. exp motor activity/
5. (physical education and training).mp.
6. exp "Physical Education and Training"/
7. exp physical fitness/
8. sedentary.ab. or sedentary.ti.
9. exp life style/
10. exp leisure activities/
11. exp walking/
12. exp sports/
13. exp dancing/
14. dancing.mp.
15. exp exercise therapy/
16. (exercise$ adj aerobic$).ti,ab
17. (physical$ adj5 (fit$ or train$ or activ$ or endur$)).ti,ab
18. (exercis$ adj5 (train$ or physical$ or activ$)).ti,ab
19. sport$.ti,ab
20. walk$.ti,ab
21. cycle$.ti,ab
22. (("lifestyle" or life-style) adj5 activ$).ti,ab
23. OR/1-22
24. (primary adj3 (care or health*))
25. (family or general or community) adj4 (medic$ or doctor$ or physician$ or practi$* or health$)
26. (GP or “GP’s”).ti,ab
27. (community adj3 (care or health$))
28. OR/24-27
29. exp mass screening/
30. systematic risk assessment$.ti,ab
31. case finding.ti,ab
32. ((screen$ or assess$ or test$ or diagnos$ or surveill$ or identifi$)
33. Risk Assessment/
34. (risk$ adj3 assess$).ti,ab
35. OR/29-34
36. validit$
37. reliability
38. sensitivity
39. specificity
40. psychometr$
41. measurement accuracy
42. measurement error
43. measurement precition
44. measurement repearability
45. OR/36-44
46. AND/23,28,35,45

Supplementary Table 3: Downs and Black quality assessment results

	Reporting										External Validity			Internal validity (bias)							Internal validity (selection)						Power
Criteria/Study	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Ahmad [2]	1	1	1	1	1	1	1	/	0	0	1	1	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Ball [20]	1	1	1	1	0	1	1	/	0	0	0	0	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Bull [16]	1	1	0	0	0	1	0	/	0	0	0	0	1	/	/	1	/	0	/	0	/	/	/	/	/	0	0
Dutton [17]	1	1	0	1	0	1	1	/	0	1	0	0	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Greenwood [19]	1	1	1	1	1	1	1	/	1	1	1	0	1	/	/	1	/	1	/	1	/	/	/	/	/	1	0
Heron [14]	1	1	1	1	0	1	1	/	0	1	1	0	1	/	/	1	/	0	/	1	/	/	/	/	/	1	0
Heron [15]	1	1	0	1	1	1	0	/	0	0	1	0	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Marshall [21]	1	1	1	1	0	1	1	/	0	0	1	1	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Puig-Ribera [22]	1	1	1	1	0	1	1	/	1	1	0	0	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Puig-Riberia [23]	1	1	1	1	0	1	1	/	0	1	0	0	1	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Shuval [24]	1	1	0	1	1	1	1	/	0	0	0	0	0	/	/	1	/	1	/	1	/	/	/	/	/	0	0
Smith [18]	1	1	1	1	1	1	1	/	0	1	1	1	1	/	/	1	/	1	/	1	/	/	/	/	/	1	0

1 – satisfied; 0 – no satisfied.

Critical Appraisal Items:

1. Is the hypothesis/aim/objective of the study clearly described?
2. Are the main outcomes to be measured clearly described in the Introduction or Methods sections?
3. Are the characteristics of the patients included in the study clearly described?
4. Are the interventions of interest clearly described?

5. Are the distributions of principal confounders in each group of subjects to be compared clearly described?
6. Are the main findings of the study clearly described?
7. Does the study provide estimates of the random variability in the data for the main outcomes?
8. Have all important adverse events that may be a consequence of the intervention been reported?
9. Have the characteristic of patients lost to follow-up been described?
10. Have actual probability values been reported (e.g. 0,035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?
11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?
12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?
13. Were the staff, places and facilitates where the patients were treated representative of the treatment the majority of patients received?
14. Was an attempt made to blind study subjects to the intervention they have received?
15. Was an attempt made to blind those measuring the main outcomes of the intervention?
16. If any of the results of the study were based on "data dreading" was this made clear?
17. In trials and cohort studies, were the analyses adjused for different lengths of follow-up of patients, or in case-control studies, was the time period between the intervention and outcome the same for cases and controls?
18. Were the statistical tests used to assess the main outcome appropriate?
19. Was compliance with the intervention/s reliable?
20. Were the main outcome measures used accurate (i.e. valid and reliable)?
21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?
22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same time?
23. Were study subjects randomized to intervention groups?
24. Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?
25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?
26. Were losses of patients to follow-up taken into account?
27. Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance <5%

Supplementary Table 4: Summary of the psychometric properties of physical activity assessment tool using the COSMIN checklist.

	Internal consistency	Reliability	Measurement Error	Content validity	Structural validity	Hypothesis testing	Cross-cultural validity	Criterion Validity	Responsiveness
General Practice Physical Activity Questionnaire (English/Spanish/Catalan version)									
Ahmed [2]	Poor	Poor	Poor	Poor	Poor	NR	NR	NR	NR
Bull [16]	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dutton [17]	NR	Poor	Poor	NR	NR	NR	NR	Poor	NR
Heron [14]	NR	NR	NR	NR	NR	Fair	NR	NR	NR
Heron [15]	NR	NR	NR	NR	NR	NR	NR	NR	NR
Puig-Riberia [23]	NR	Fair	NR	Fair	NR	NR	Poor	NR	NR
General Practice Physical Activity Questionnaire-WALK									
Ahmed [2]	Poor	Poor	Poor	Poor	Poor	NR	NR	NR	NR
2Q Physical Activity Tool									
Smith [18]	NR	Fair	NR	Fair	NR	NR	NR	Poor	NR
3Q Physical Activity Tool									
Dutton [17]	NR	Poor	Poor	NR	NR	NR	NR	Poor	NR
Smith [18]	NR	Fair	NR	Fair	NR	NR	NR	Poor	NR
Active Australia Questionnaire									
Smith [18]	NR	Fair	NR	Fair	NR	NR	NR	Poor	NR
Rapid Assessment Disuse Index									
Shuval [24]	NR	Good	NR	NR	NR	NR	NR	Good	NR
Physical Activity Vital Sign									
Ball [20]	NR	NR	NR	Poor	NR	NR	NR	NR	NR
Greenwood [19]	NR	NR	NR	Poor	NR	NR	NR	NR	NR
Speedy Nutrition and Physical Activity Assessment									
Ball [20]	NR	NR	NR	Poor	NR	NR	NR	NR	NR
Brief Physical Activity Assessment Tool (English/Spanish/Catalan versions)									
Marshall [21]	NR	Fair	NR	NR	NR	NR	NR	Fair	NR
Puig-Ribera [22]	NR	NR	NR	Fair	NR	Good	NR	Good	NR
Puig-Riberia [23]	NR	Fair	NR	Fair	NR	NR	Poor	NR	NR
7-Day Physical Activity Recall									
Puig-Riberia [22]	NR	NR	NR	Fair	NR	Good	NR	Good	NR

NR – Not reported

Supplementary Table 5: Summary of the ten physical activity assessments identified.

Assessment Methods	Description
GPPAQ	**Target Population:** Adults aged 16-74 years. **Setting:** routine general practice. **Completed by:** self-completion by patients in the waiting area before the consultation. **Assessment Tool:** pertaining to physical activity at work including housework/childcare and gardening/DIY **Estimated completion time:** approximately 60 seconds **Responses:** patients are categorised into 4 levels: active, moderately active, moderately inactive or inactive **Recommended period for re-assessment:** the assessment should be repeated every 5 years and for those with a long-term condition, annually.
GPPAQ-WALK	This assessment is identical to the GPPAQ but includes an additional question about walking. Participants who report walking at a brisk or fast pace for ≥3 hours/week are recoded as active.
3Q Physical Activity Tool	**Target Population:** Not specified. **Setting:** Routine medical consultations. Setting not specified. **Completed by:** Self-administered. **Assessment Tool:** Assesses (1) the number of bouts of vigorous-intensity activity which are ≥20 minutes in durations; (2) the number of bouts of walking which is ≥30 minutes duration; (3) the number of bouts of moderate-intensity activity in a usual week. **Estimated completion time:** Not specified. **Responses:** Not specified. **Repeated:** Not specified.
2Q Physical Activity Tool	**Target Population:** Not specified. **Setting:** Routine medical consultations. Setting not specified. **Completed by:** Self-administered. **Assessment Tool:** Assesses (1) the number of bouts of vigorous-intensity activity of ≥20 minutes in duration; (2) the number of bouts of walking of ≥30 minutes duration; (3) the number of bouts of moderate-intensity activity in a usual week. **Estimated completion time:** Not specified. **Responses:** Not specified. **Recommended period for re-assessment:** Not specified.
Active Australia Questionnaire (Survey)	**Target Population:** Not specified **Setting:** Not specified **Completed by:** Self-administered by patients. **Assessment Tool:** 9-assessment measuring the frequency of walking (for ≥10 minutes), moderate- and vigorous-intensity activities such as gardening, yard-work, household chores, and sports and exercise, in the past week, and the total time spent doing each of these types of activities. **Estimated completion time:** Not specified **Responses:** Not specified

	Recommended period for re-assessment: Not specified
RADI	**Target Population:** Not specified. **Setting:** Not specified. **Completed by:** Self-administered. **Assessment Tool:** Three-item assessment assessing (1) how many hours a day do you typically spend moving around on your feet?; (2) about how many flights of stairs do you typically climb each day; (3) about how many hours a day do you typically spend sitting (including sitting at work/home, watching TV, and video/DVDs, on the computer at home and at work, eating meals, etc)? Each question is assessed in the past week, month and year. The two questions on lifestyle activity (moving about and stair climbing) are reverse scores, where higher scores are indicative of less mobile and few stair climbing. A higher sitting score is indicative of more sitting time. **Estimated completion time:** approximately 5 minutes. **Responses:** The scores range from 3 to 15 for each column by time-point, where total cumulative scores range from 9 to 45. Highers score indicate higher levels of 'disuse'. **Recommended period for re-assessment:** Not specified.
PAVS	**Target Population:** Adults **Setting:** out-patient healthcare **Completed by:** Health care practitioners ask patients **Assessment Tool:** a 2-question tool: (1) "how many days in a typical week have you performed physical activity where you heart beats faster and your breathing is harder than normal for 30 minutes or more?" and (2) "how many days in a typical week do you perform activity such as this?" **Estimated completion time:** approximately 30 seconds. **Responses:** minimum score is 0, maximum score is 7. **Recommended period for re-assessment :** not specified.
Speedy Nutrition and Physical Activity Assessment (SNAP)	**Target Population:** No specified **Setting:** Not specified **Completed by:** assessor asks patients **Assessment Tool:** Physical activity components of SNAP asks one question: (1) how active are you for activities such as walking, housework, work in the yard or garden, dancing, jobs that require walking, lifting or other hard work or exercise; and then asks individuals to consider "are you active for 30 minutes on 5 days of the week, cycling the responses (a) no, but I have no plants to be more active,; (2) no, but I have been thinking about being more active, (3) sometimes I am active for 30 minutes, but not all the time; (4) yes, I am active for 30 minutes on 5 days of the week". **Estimated completion time:** less than one minute to complete. **Responses:** Not specified **Recommended period for re-assessment:** No specified
Brief Physical Activity Assessment Tool	**Target Population:** Adults **Setting:** Not specified **Completed by:** Assessor asking patient. **Assessment Tool:** a 2-question tool (1) "How many times a week, do you usually do 20 minutes of vigorous physical activity that

	makes you sweat or puff and pant? (for example, jogging, heavy lifting, digging, aerobics, or fast bicycling); and (2) How many times a week, do you usually do 30 minutes of moderate physical activity or walking that increases your heart rate or makes you breath harder than normal? (for example, mowing the lawn, carrying light loads, bicycling at a regular pace, or playing doubles tennis). **Estimated completion time:** Not specified **Responses:** Each question scores 0 to 4 with total scores less than 4 equating to 'insufficiently' active and ≥4 'sufficiently' active. **Recommended period for re-assessment:** Not specified
7-day Physical Activity Recall	**Target Population:** Adults **Setting:** Any **Completed by:** Assessor interviewing patient. **Assessment Tool:** Semi-structured interview (10-15 minutes) providing a self-estimated number of hours dedicated to physical or occupational activities requiring at least moderate effort in the previous 7 days. Categories for physical activity are 'moderate', 'vigorous' or 'very vigorous'. **Estimated completion time:** **Responses:** Scores are interpreted based on people being 'sufficiently' or 'insufficiently active' by gender and different age groups (<40 years old; 40-64 years; >65 years). **Recommended period for re-assessment:** Not specified