BMJ Open Definitions and measurement of health literacy in health and medicine research: a systematic review

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ABSTRACT

Objectives The way health literacy is understood (conceptualised) should be closely linked to how it is measured (operationalised). This study aimed to gain insights into how health literacy is defined and measured in current health literacy research and to examine the relationship between health literacy definitions and instruments.

Design Systematic review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.

Data sources The MEDLINE, PsycINFO, ERIC and CINAHL databases were searched for articles published during two randomly selected months (March and October) in 2019.

Eligibility criteria We included articles with a quantitative design that measured health literacy, were peer-reviewed and original, were published in the English language and included a study population older than 16 years.

Data extraction and synthesis Six researchers screened the articles for eligibility and extracted the data independently. All health literacy definitions and instruments were considered in relation to category 1 (describing basic reading and writing skills, disease-specific knowledge and practical skills) and category 2 (social health literacy competence and the ability to interpret and critically assess health information). The categories were inspired by Nutbeam’s descriptions of the different health literacy levels.

Results 120 articles were included in the review: 60 within public health and 60 within clinical health. The majority of the articles (n=77) used instruments from category 1. In total, 79 of the studies provided a health literacy definition; of these, 71 were in category 2 and 8 were in category 1. In almost half of the studies (n=38), health literacy was defined in a broad perspective (category 2) but measured with a more narrow focus (category 1).

Conclusion Due to the high degree of inconsistency between health literacy definitions and instruments in current health literacy research, there is a risk of missing important information about health literacy considered important to the initial understanding of the concept recognised in the studies.

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INTRODUCTION

Health literacy is usually understood as cognitive and social skills that determine the motivation and ability to understand and use health information,1 and adequate health literacy is seen as a prerequisite for healthy behaviours. Researchers have increasingly worked to identify challenges associated with health literacy and investigate the role they play in an individual’s ability to comprehend self-care information and its relationship to health outcomes.2 Empirical studies have reported that low health literacy is associated with poor health-related outcomes, such as high hospital admission rates,3,4 low participation in preventive activities,5–9 poor self-management of chronic conditions,10 poor disease outcomes and high mortality.11–13

The concept of health literacy emerged in the 1970s when health education was viewed as social policy.14 A topic-specific query in the PubMed tools reveals a recent exponential growth of articles about health literacy, with 129 references between 1986 and 1990 increasing to more than 8000 in the past 5 years. Today, health literacy is seen as a global goal for enhancing health promotion through improved education and communication strategies to improve health outcomes.15

Health literacy is defined in numerous ways.14 16–18 In a systematic review by Sorensen...
et al., 14 17 different definitions and 12 conceptual models were reported on health literacy. Another systematic review found that 34 research articles between 2010 and 2015 had an explicit objective to define the concept of health literacy.15 Moreover, the literature has reported the use and development of more than 150 health literacy instruments over the last decade.19–21 Traditionally, health literacy approaches have focused on individual skill deficits and health education based on the communication of factual information regarding health risks as well as how to use the health system,22 with the majority of health literacy research having used instruments measuring reading and numerical skills.23 However, in recent years, more multidimensional perspectives and instruments measuring health literacy have been introduced, such as the Health Literacy Questionnaire24 and the Health Literacy Survey European Questionnaire.25 47

The current and sometimes confusing use of various and inconsistent interpretations of health literacy is a challenge for the development of valid and reliable measurements.16 In 2000, Nutbeam proposed a health literacy model that is now widely cited in the health literacy literature and is seen by many health literacy researchers as useful in analysing health literacy abilities required in various health situations.22 According to Nutbeam, health literacy contains three different levels, progressing from basic skills in reading and writing (functional health literacy), to the ability to derive meaning from different forms of communication and apply new information to changing situations (interactive health literacy) and to more advanced cognitive skills which, together with social skills, can be applied to critically analyse information and to achieve policy and organisational changes (critical health literacy).

Different understandings of health literacy and different measurement tools may be useful as they complement each other and provide different perspectives. However, the way health literacy is understood (conceptualised) should be closely linked to how it is measured (operationalised) in each study context.23 Nguyen et al has described this as a ‘conceptual stumbling block’ that needs to be resolved for the field to progress.23 A first useful step for addressing this might be to systematically explore how it appears in current health literacy research. Hence, by performing a systematic review, our aim was to gain insights into how health literacy is defined and measured in current health literacy research. In particular, we will examine the relationship between health literacy definitions and instruments. This review may increase our understanding of potential conceptual and methodological challenges or gaps that need to be addressed in future research.

**METHODS**

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement26 and registered in PROSPERO (https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=179699). The review was designed with a time frame limited to two randomly selected months in 2019 (March and October). Due to a high number of health literacy articles published every year, random selection was chosen in order to reflect current health literacy

### Table 1 Overview of study populations in clinical and public health studies

| Clinical health studies | Public health studies |
|-------------------------|-----------------------|
| **Populations classified by diseases and related health problems** | **Type of study population** |
| Diseases in the circulatory system | General population |
| Endocrine diseases | Students |
| Mental illness | Parents/caregivers |
| Cancer | Elderly people |
| Diseases in the respiratory system | Immigrants |
| Diseases in the urine and genital organs | Work-related populations |
| Infectious and parasite diseases | Young adults |
| Diseases in the ear | Veterans |
| Diseases in the musculoskeletal system and connective tissue | Health personnel |
| Diseases in the nervous system | Men |
| Diseases in the digestive system | Women |
| Pregnancy, birth, postnatal period | Pet owners |
| Others: general chronic conditions (n=2), chronic pain (n=3), patients in primary care (n=2), next of kin (n=2), patients in specialist care (n=1) | Relatives of patients with cancer |
| **Total** | **Total** |
| 60 | 60 |
Identification of studies

Records identified through searches restricted to March and October 2019
Databases: Medline, PsycINFO, ERIC and CINAHL (n=1038)

Records removed before screening:
Duplicate records removed (n = 87)
Records not initially published in 2019 (n=537)

Records screened (n = 414)

Records excluded (n=251)
Reason 1: HL was not mentioned in the title or abstract (n=35)
Reason 2: wrong design (n=115)
Reason 3: wrong publication type (n=28)
Reason 4: wrong population (n=27)
Reason 5: wrong outcome (n=43)
Reason 6: wrong language (n=3)

Reports assessed for eligibility (= 163)

Records excluded (n=43)
Reason 1: did not measure HL (n = 34)
Reason 2: duplicate (n = 5)
Reason 3: wrong language (n =2)
Reason 4: wrong population type (n=2)

Studies included in review (n =120)

Figure 1  Flow diagram shows the study selection process. HL, health literacy.

Figure 2  Overview of study designs of included studies. RCT, randomised controlled trial.
research. To ensure that March and October were not unique in terms of the number of articles published, we performed the same search strategy using the same databases for one other randomly selected month in 2019. This search yielded nearly the same number of articles.

Search strategy
Systematic literature searches were conducted in collaboration with a trained librarian (4 March 2020). The MEDLINE, PsycINFO, ERIC and CINAHL databases were searched for the term ‘health literacy’. For all databases except for ERIC (where this was not possible), the search was automatically restricted to two randomly selected months in 2019: March and October. Citations in ERIC were manually assessed for articles published in March 2019 and October 2019.

The search yielded a total number of 1038 citations. Endnote V.X9 was used to manage the generated research articles. After removing duplicates, 951 citations remained. All records not published for the first time in 2019 were removed, leaving 414 articles for screening (see online supplemental appendix 1 for the search history).

Selection criteria
The inclusion and exclusion criteria were developed a priori. The 414 published articles were distributed among six researchers (KHU, AKW, MHA, CRhB, SH and MHL), who worked in pairs. The articles were included if they fulfilled the following inclusion criteria: (1) ‘health literacy’ was mentioned in the title or abstract; (2) the article was peer reviewed; (3) the research was original; (4) it used a quantitative design; (5) it was published in the English language; and (6) the study population included individuals older than 16 years of age.

To reduce selection bias, the researchers independently screened the articles for eligibility according to the criteria. They then met in pairs to compare their results, resolve any conflicting opinions and decide whether to include each article. Conflicting opinions in pairs were presented and solved by the whole team.

Data extraction (selection and coding)
To achieve consistency in the data extracted from the included articles, an Excel V. 2019 spreadsheet was created. The initial question in this spreadsheet was whether health literacy was measured. If the answer was no, the article was excluded. The data extracted from the articles included information about the study design and context, such as country of origin and whether the study was conducted in a public health or clinical health setting. For clinical studies that included participants with health problems, the different types of diseases were categorized according to the International Statistical Classification of Diseases and Related Health Problems.27 For the public health studies, we categorized type of study populations

Table 2  Most frequently used references for health literacy definitions in the included studies

| Reference                                | Definition                                                                 | Studies (n) |
|------------------------------------------|---------------------------------------------------------------------------|-------------|
| Jorm (1997) Jorm36                       | ‘Knowledge about appropriate treatment options; and attitudes that facilitate recognition and treatment-seeking’ | 5           |
|                                          | ‘Knowledge and beliefs about mental disorders which aid their recognition, management or prevention’ |             |
| American Medical Association (1999)59    | ‘The constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the healthcare environment’ | 1           |
| Nutbeam29,30–34                          | ‘The cognitive and social skills which determine the motivation and ability of individuals to gain access to understand and use information in ways which promote and maintain good health.’ | 19          |
| Sørensen et al14                         | ‘Health literacy entails people’s knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course.’ | 14          |
| The Institute of Medicine (2004)40       | ‘The individuals’ capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions.’ | 11          |
Supplemental appendix 1 for the search history. After the search yielded 1038 articles in total (see the online supplemental appendix 1 for the search history). After removing duplicates, 951 articles remained. Of the 163 articles that were read in full text, 1 was a duplicate, and 39 were excluded because they did not measure health literacy. Ultimately, 120 articles were included (see figure 1).

**Characteristics of included studies**

Sixty articles described studies with a clinical health focus, and 60 were conducted in public health settings. The clinical studies included a great variety of diseases, but the most frequent diseases were those in the circulatory system (n=11) and endocrine diseases (n=9) followed by mental illness (n=6) and cancer diseases (n=6). In the public health studies, the most frequent study group was the general population (n=19), looking into aspects such as vaccination programmes, oral care and mental health. Furthermore, a major part of the public health studies included students (n=13), mainly represented by health professional students. Six studies focused on parents/caregivers, while five studies focused on the elderly population (table 1).

The majority of the studies used a cross-sectional design (n=90). Nine studies used a randomised controlled design, and 10 studies were quasi-experimental. Four of the studies used a longitudinal design, while one was a case–control study. Figure 2 presents an overview of all study designs.

As figure 3 indicates, the majority of studies were conducted in North America (n=56) and Asia (n=31). The fewest studies were performed in Africa (n=4) and South America (n=3).

**Health literacy definitions and instruments**

Out of the 120 included studies, 88 used generic health literacy instruments, while 32 were context-specific. Eleven studies used a combination of health literacy instruments. A total of 77 studies used instruments from category 1 (describing basic reading and writing skills, disease-specific knowledge and practical skill competencies needed to function in everyday situations); and category 2 included definitions and instruments that also described health literacy as skills to communicate and interact with healthcare providers as well as the ability to interpret and critically analyse health information (online supplemental appendix 2 illustrates the coding for the data extractions).

The researchers first extracted data and considered independently the definitions and instruments related to the two categories. They then met in pairs to compare their results and resolve any conflicting opinions. The remaining conflicting opinions within pairs were presented and solved by the whole team in a group meeting.

**Patient and public involvement**

No patient was involved.

**RESULTS**

The search yielded 1038 articles in total (see the online supplemental appendix 1 for the search history). After
| Study reference | Study context | Design | Health literacy definition reference | Category | Health literacy instrument | Category |
|----------------|--------------|--------|--------------------------------------|----------|---------------------------|----------|
| Cehuen Neto et al 2019 | Clinical | Cross-sectional | American Medical Association Ad Hoc Committee on Health, 1999 | 1 | Short Test of Functional Health Literacy in Adults (Parker et al 1999) | 1 |
| Clough et al 2019 | Public health | RCT | Jorm et al 2015 | 1 | Mental Health Literacy Scale (O’Connor and Casey, 2015) | 1 |
| Clough et al 2019 | Public health | Cross-sectional | Jorm et al 2015 | 1 | Mental Health Literacy Scale (O’Connor and Casey, 2015) | 1 |
| Joncho et al 2019 | Clinical | Cross-sectional | Jorm et al 2015 | 1 | Developed within the study context: Mental Health Literacy Questionnaire | 1 |
| Lichtveld et al 2019 | Public health | Cross-sectional | Finn and O’Fallon, 2019 Gray, 2018 | 1 | Developing and validating a questionnaire measuring environmental health literacy: measuring media-specific knowledge, attitudes, and behaviours | 1 |
| Nye et al 2019 | Public health | Longitudinal | US Department of Health and Human Services, 2010 | 1 | The Upper Peninsula Oral Health Assessment Survey | 1 |
| Waldmann et al 2020 | Clinical | Cross-sectional | Jorm 2015 | 1 | Mental Health Knowledge Schedule. Depression Literacy Scale (Wilson, 2015) | 1 |
| Williston et al 2020 | Public health | Longitudinal | Jorm et al 2015 | 1 | Mental Health Literacy Scale (O’Connor and Casey, 2015) | 1 |
| An et al 2019 | Public health | Cross-sectional | Nutbeam 2004 | 2 | The Health Literacy Scale (Chew, 2004) | 2 |
| Azizi et al 2019 | Public health | Mixed method | Nutbeam 2004 | 2 | Health Literacy Scale for Workers | 2 |
| Brandstetter et al 2019 | Public health | Cross-sectional | Sørensen et al 2014 | 2 | The European Health Literacy Survey (HLS-EU) (Sørensen et al 2013) | 2 |
| Degan et al 2019 | Clinical | Cross-sectional | WHO, 1998 | 2 | The Health Literacy Questionnaire (Osborn et al 2004) | 2 |
| Eo et al 2019 | Public health | Cross-sectional | Nutbeam 2004 | 2 | The Health Literacy Assessment Scale for Asian Immigrant Women (And and Yang, 2015) | 2 |
| Ernsting et al 2019 | Clinical | Cross-sectional | Sørensen et al 2014 | 2 | European Health Literacy Survey Questionnaire—short form (Sørensen et al 2013) and The eHealth Literacy Scale (Norman and Skinner 2013) | 2 |
| Erunal et al 2019 | Public health | RCT | Nutbeam 2004 | 2 | Turkish Health Literacy Scale-32 (Okyay et al 2016) | 2 |

Continued
| Study reference                  | Study context | Design    | Health literacy definition reference | Category | Health literacy instrument                                                                 | Category |
|---------------------------------|---------------|-----------|--------------------------------------|----------|----------------------------------------------------------------------------------------------|----------|
| Evans et al 2019                | Public health | Cross-sectional | Sørensen et al 2014                  | 2        | European Health Literacy Survey Questionnaire (Sørensen et al 2014)                          |          |
| Fernandez Gutierrez et al 2019  | Public health | Quasi-experimental | Nutbeam 2012                        | 2        | HLS EU-16 (Sørensen et al 2015) Health Literacy App Questionnaire+five practical tests       |          |
| Goto et al 2019                 | Public health | Cross-sectional | Nutbeam, 1998                        | 2        | The Functional Communicative and Critical HL Tool (Ishikawa et al 2008)                      |          |
| Guclu et al 2019                | Clinical      | Cross-sectional | WHO, 1998                            | 2        | European Health Literacy Survey Questionnaire (Sørensen et al 2013)                          |          |
| Güner et al 2019                | Public health | Cross-sectional | Nutbeam, 2000                        | 2        | Questionnaire developed within the study context (consisting of 21 questions about HL knowledge, practice and attitudes) |          |
| Hu et al 2019                   | Public health | Cross-sectional | Nutbeam, 2000                        | 2        | Health Literacy Management Scale (Jordan, 2013)                                             |          |
| Indino et al 2019               | Public health | Cross-sectional | Nutbeam, 2015                        | 2        | The Functional Communicative and Critical Health Literacy Tool (Ishikawa et al 2008)         |          |
| Kaper et al, 2019               | Public health | Quasi-experimental | Kwan, 2006                           | 2        | Questionnaire developed within the study context by combining subscales from other questionnaires |          |
| Kobayashi et al 2010            | Public health | Mixed method   | Sørensen et al 2014                  | 2        | European Health Literacy Survey Questionnaire (Sørensen et al 2013)                          |          |
| Lim et al 2019                  | Clinical      | Cross-sectional | Osborne et al 2013                   | 2        | Health Literacy Questionnaire (Osborne et al 2013)                                          |          |
| Logullo et al 2019              | Public health | Cross-sectional | Sørensen et al 2014                  | 2        | Short Assessment of Health Literacy for Portuguese Speaking Adults (Apolonario et al 2012)   |          |
| Lu et al 2020                   | Clinical      | Cross-sectional | Sørensen, 2012                       | 2        | HLS EU-16 (Sørensen et al 2013)                                                            |          |
| Lu et al 2019                   | Clinical      | Cross-sectional | Sørensen, 2012                       | 2        | HLS EU-16 (Sørensen et al 2013)                                                            |          |
| Ma et al 2019                   | Public health | Cross-sectional | Norman and Skinner 2011              | 2        | The eHealth Literacy Scale (Norman and Skinner)                                            |          |
| Nokes et al 2019                | Clinical      | Quasi-experimental | Norman and Skinner 2011             | 2        | The eHealth Literacy Scale (Norman and Skinner)                                            |          |
| Oh et al 2019                   | Public health | Cross-sectional | WHO, 1998                            | 2        | The eHealth Literacy Scale (Norman and Skinner)                                            |          |
| Oliffe et al 20                   | Public health | Cross-sectional | Peerson and Saunders, 2009, 2011      | 2        | The Health Literacy Questionnaire (Osborn et al 2013)                                       |          |

Continued
Table 3  Continued

| Study reference                      | Study context | Design    | Health literacy definition reference | Category | Health literacy instrument                                                                 |
|--------------------------------------|---------------|-----------|--------------------------------------|----------|------------------------------------------------------------------------------------------------|
| Pobhirun and Pinitsoontorn, 2019     | Public health | Cross-sectional | Nutbeam, 1998                        | 2        | A questionnaire developed within the study context including six dimensions: cognitive skills, access, communication skills, self-management, media literacy and decision-making skills |
| Rababah et al 2019                   | Public health | Cross-sectional | WHO, 2013, Sørensen et al            | 2        | The Health Literacy Questionnaire (Osborn et al 2013) |
| Ruëgg and Abel, 2019                 | Public health | Cross-sectional | Selden et al 2009                    | 2        | Short survey tool for public health and health promotion research (Abel et al, 2014) |
| Solhjoo et al 2019                   | Public health | Mixed method | Sørensen, 2012                       | 2        | The eHealth Literacy Scale (Norman and Skinner) |
| Størmer et al 2019                   | Clinical      | Cross-sectional | WHO, 1998                           | 2        | The Health Literacy Questionnaire (Osborn et al 2013) |
| Uysal et al 2019                     | Public health | Cross-sectional | Sørensen, 2012                       | 2        | European Health Literacy Survey Questionnaire (Sørensen et al) |
| Wang et al 2019                      | Clinical      | Cross-sectional | Kutner et al 2003                    | 2        | Chinese Health Literacy Scale for Diabetes (Leung, 2013) |
| Wang et al 2019                      | Clinical      | Cross-sectional | Nutbeam, 2009                        | 2        | Diabetes Health Literacy Scale (Lee et al, 2018) |
| Zhang et al 2019                     | Clinical      | Cross-sectional | Sørensen, 2012                       | 2        | Heart Failure-specific Health Literacy Scale (Matsuka et al 2018) |

HLS EU, European Health Literacy Survey Questionnaire; RCT, randomised controlled trial.
the most cited health literacy definitions. Words in italics are examples of key words considered important in the decision to add the definition to category 1 or category 2. For instance, definitions that described health literacy with terms as ‘knowledge’, ‘skills’ and ‘attitude’ were referred to category 1, while definitions with terms like ‘appraise’ and ‘social skills’ were referred to category 2.

Regarding the connection between health literacy definitions and instruments in the 79 relevant studies, 41 articles used health literacy definitions and instruments characterised at the same level. Thirty-three of these were in category 2, and 8 were in category 1 (see figure 4 and table 3).

In the remaining 38 studies, there was a disconnect between levels of health literacy definitions and instruments. In all of these, health literacy definitions were from category 2, and all instruments were in category 1 (see table 4).

**DISCUSSION**

This systematic review aimed to gain insights into how current research defines and measures health literacy and, in particular, whether studies consistently used definitions and instruments. The high number of articles published in the defined time frame shows that health literacy is of high research interest in both public health and the clinical field in large parts of the world.

We found a large variety of instruments used, and the majority of the included studies (79 out of 120) presented a health literacy definition as part of the study’s theoretical background. However, there seems to be an inconsistency between the definitions and the instruments in a significant number of the studies. In nearly half of the studies, health literacy was defined in a broad perspective (including aspects such as social health literacy competence and the ability to process and appraise health information) while using instruments with a more narrow focus (measuring basic skills and knowledge). As a result, almost half of the articles in our review lacked data on the participants’ ability to critically appraise health information and their social health literacy competence despite the fact that the authors had stated such aspects to be health literacy. This concern has previously been addressed. Numerous systematic reviews have reported on the diversity of understandings of health literacy and the various use of instruments not aligned to the definitions in current research. However, the current study is, to the best of our knowledge, the first review to the best of our knowledge, the first review to base their research on a broad understanding of health literacy, what can be done to facilitate an increased use of broad measurements? A first step should be to make researchers aware about the existing mismatch in current research. Furthermore, it seems necessary to develop more instruments that can answer the research questions posed. Despite the high number of instruments, there still seems to be a need for questionnaires in the field of health literacy that capture more multidimensional dimensions besides the functional aspects.

Nutbeam’s description of three levels of health literacy inspired the categorisation of definitions and instruments. Initially, we planned to distinguish among the three levels. However, the line between levels 2 and 3 was challenging to distinguish. Therefore, it was decided to merge the two latter categories. In a recent publication from 2020, Nutbeam has provided a more thorough description of the three levels with a more detailed explanation of how the levels should be understood. Perhaps, these descriptions would have contributed to a clearer guidance in our work with the categorisation. However, this material was not available at the time of our work and, in general, this situation illustrates the challenge of adapting a theoretical model into practice.

The interpretation of terms used in the definitions and instruments that guided the choice of category also represented some challenges. These were resolved through discussions both in pairs and as a research team. For instance, definitions describing health literacy using terms like knowledge and ‘beliefs’ were included in category 1, while definitions using terms such as appraise’ and ‘understand and process’ were included in category 2. An interesting finding is that, among the eight studies providing a health literacy definition from category 1, the
Table 4  Studies categorised with conflicting levels of health literacy definitions and instruments (n=38)

| Study reference | Study context | Design | Health literacy definition reference | Category | Health literacy instrument | Category |
|-----------------|---------------|--------|--------------------------------------|----------|---------------------------|----------|
| Anderson et al 2019 | Clinical | Cross-sectional | Defined within the study context (no reference provided) | 2 | S-TOFHLA (Parker et al) | 1 |
| Avci et al 2019 | Public health | Cross-sectional | US Department of Health and Human Services, 2000 | 2 | NVS (Weiss et al) and REALM (Davis, 1993) | 1 |
| Bonaccorsi et al 2019 | Public health | Cross-sectional | Sørensen et al | 2 | NVS (Weiss et al) | 1 |
| Bonaccorsi et al 2019 II | Public health | Cross-sectional | Sørensen et al | 2 | NVS (Weiss et al) | 1 |
| Carducci et al 2019 | Public health | Cross-sectional | Ratzan and Parker, 2000; Nutbeam, 2000 | 2 | TOFHLA (Parker, 1995) | 1 |
| Chen et al 2019 | Clinical | Cross-sectional | Nutbeam, 2000 | 2 | Health Literacy Scale for Diabetes (Lee et al 2016) | 1 |
| de Melo et al 2019 | Clinical | Cross-sectional | Cavanaugh, 2011 | 2 | Short Test of Functional Health Literacy in Adults (Parker et al) | 1 |
| Flynn et al 2019 | Public health | Cross-sectional | American Dental Association Council, 2011 | 2 | Oral Health Literacy Adults Questionnaire (Sistani et al 2014) | 1 |
| Gaikwad, 2019 | Public health | Cross-sectional | Ratzan and Parker, 2000 | 2 | Rapid Estimation of Adult Literacy in Dentistry 30-word version (Lee et al 2007) | 1 |
| Güner et al 2019 | Public health | Cross-sectional | Nutbeam | 2 | Developed within the context of the study | 1 |
| Han et al 2019 | Public health | Cross-sectional | Sørensen et al; Nutbeam | 2 | Assessment of Health Literacy in Cancer Screening (Han et al 2014) | 1 |
| Himes et al 2019 | Public health | Cross-sectional | Institute of Medicine, US, Committee HL, 2004 | 2 | Chew et al's (2004) set of brief questions | 1 |
| Irvin et al 2019 | Public health | Cross-sectional | Peters et al 2012 | 2 | The Water Environmental Literacy Level Scale (Irvin et al 2019) | 1 |
| Kaur et al 2019 | Public health | RCT | Healthy People, 2010 (Oral health) | 2 | TS-REALD Two-Stage Rapid Estimate of Adult Literacy (Stucky et al 2011) | 1 |
| Kim et al 2019 | Public health | Cross-sectional | Ratzan and Parker, 2000 | 2 | Three questions, each addressing oral, listening, and written literacies (no reference) | 1 |
| Kim et al 2019 | Public health | Quasi-experimental | Joint Committee on National Education Standards, 1995 | 2 | Knowledge questions developed in the study context | 1 |
| Kim et al 2019 | Clinical | RCT | Institute of Medicine, US, Committee HL, 2004 | 2 | S-TOFHLA (Parker et al) | 1 |
| Kino et al 2020 | Public health | Cross-sectional | Inst of Medicine, 2004 | 2 | Three indicators of HL | 1 |

Continued
| Study reference          | Study context   | Design           | Health literacy definition reference | Category | Health literacy instrument          | Category |
|-------------------------|-----------------|------------------|--------------------------------------|----------|-------------------------------------|----------|
| Lin et al 2019          | Public health   | Quasi-experimental | Nutbeam, 2000                        | 2        | Mandarin Health Literacy Scale (Lee et al 2011) | 1        |
| Lindahl et al 2020      | Clinical        | Cross-sectional  | Nutbeam and Kickbusch, 2000          | 2        | The three-item Brief Health Literacy Screen (Cavanaugh et al 2013) | 1        |
| Mackert et al 2019      | Public health   | Cross-sectional  | Berkman et al 2010                   | 2        | NVS (Weiss et al)                  | 1        |
| Mayer et al 2019        | Clinical        | Cross-sectional  | Nutbeam                            | 2        | Developed within the context of the study | 1        |
| Meyers et al 2019       | Clinical        | Cross-sectional  | Institute of Medicine, 2004         | 2        | NVS (Weiss et al)                  | 1        |
| Miranda, 2019           | Clinical        | Cross-sectional  | Sørensen et al                      | 2        | REALM-D (Davis, 1993)               | 1        |
| Mock et al 2019         | Clinical        | Cross-sectional  | Institution of Medicine, 2004       | 2        | Single Item Literacy Screening (Morris, 2006), S-TOFHLA (Parket al) | 1        |
| Mora-Pinzon et al 2019  | Clinical        | Cross-sectional  | Institute of Medicine, 2004         | 2        | S-TOFHLA (Parker, 1995)             | 1        |
| Noback et al 2019       | Clinical        | Cross-sectional  | Paasche-Orlow et al 2007, Berkman et al 2010 | 2        | NVS (Weiss et al 2005)              | 1        |
|                        |                 |                  |                                      |          | Musculoskeletal specific literacy survey (LIMP questionnaire) developed within the study context |          |
| O’Conor et al 2019      | Clinical        | Cross-sectional  | Institute of Medicine, 2004         | 2        | S-TOFHLA (Parker et al)             | 1        |
| Penaloza et al 2019     | Clinical        | Cross-sectional  | Nutbeam and Institute of Medicine, 2004 | 2        | Short Assessment of Health Literacy Spanish (Lee et al 2006) | 1        |
| Rafferty et al 2019     | Clinical        | Cross-sectional  | Institute of Medicine, 2004         | 2        | Questions focusing on health advice and information-seeking skills, oral literacy, and print literacy | 1        |
| Tavakoly Sany et al 2019| Clinical        | Quasi-experimental | US Health Resources and Services Administration | 2        | TOFHLA (Parker et al)              | 1        |
| Scrivner et al 2019     | Clinical        | Cross-sectional  | Nutbeam, 2008                       | 2        | Three questions assessing health literacy (no reference) | 1        |
| Tucker et al 2019       | Public health   | Quasi-experimental | Ratzan and Parker, 2000            | 2        | NVS (Weiss et al 2005)              | 1        |
| Van Wormer et al 2019   | Public health   | Cross-sectional  | Institute of Medicine, 2004         | 2        | Oral Health Literacy in Adults Questionnaire (Sistani et al 2013) | 1        |
| Weaver et al 2019       | Public health   | Cross-sectional  | Ratzan and Parker, 2000 Nutbeam    | 2        | REALM (Davis, 1993)                | 1        |

Table 4 Continued
The present study has some limitations. First, this study did not cite the primary source of the health literacy definitions but instead referred to secondary sources (other researchers presenting definitions of health literacy). Referring to the original sources should be the first choice and would perhaps make it easier for readers to recognize the definition’s affiliation.

The present study has some limitations. First, this study was designed to analyze and describe health literacy research in two randomly selected months. This period may not be representative of health literacy research in general. However, a large number of health literacy studies are published every year. A random selection can therefore give a good picture of health literacy research. Second, we did not conduct a quality assessment screening of the included studies. This was considered less relevant for the current study as the aim of the current study was to explore connections between health literacy definitions and instruments rather than to assess methodology. Furthermore, searches were limited to the English language only. It is possible that similar studies may have been published in languages other than English.

The current review included only quantitative measurements. However, qualitative approaches might provide valuable and more in-depth insights into the field. For future research, it would be interesting to also explore how qualitative research links health literacy definitions to the research questions posed.

**CONCLUSION**

There seems to be an inconsistency between the definitions and the instruments used in a significant part of current health literacy research. This situation raises the risk of missing information about health literacy that was considered to be important in the initial understanding of the concept recognized in the studies. This gap should be taken into consideration in future health literacy research. We hope our work contributes to making explicit where the problem might be rooted and that it can be useful in the discussion about strategies for moving forward to better align health literacy measurement with definitions of health literacy.

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