Health Literacy Measurement: An Inventory and Descriptive Summary of 51 Instruments

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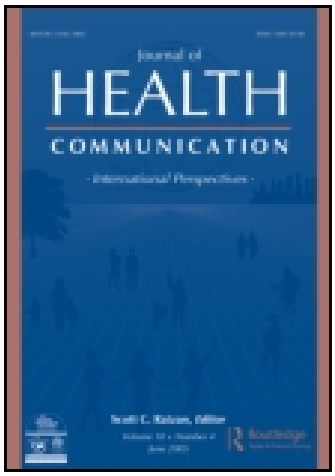

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Health Literacy Measurement: An Inventory and Descriptive Summary of 51 Instruments

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This article aimed to provide a descriptive review of the psychometric properties and conceptual dimensions of published health literacy measurement tools. PsycINFO and PubMed search from 1999 through 2013, review of the grey literature, and an environmental scan was conducted to identify health literacy measurement tools. For each tool, we evaluated the conceptual dimensions assessed, test parameters, and psychometric properties. Of the 51 tools identified, 26 measured general health literacy, and 15 were disease or content specific, and 10 aimed at specific populations. Most tools are performance based, require in-person administration, and are exclusively available in a pencil and paper testing mode. The tools assess 0 (proxy measure) to 9 of the 11 defined dimensions of health literacy. Reported administration times vary, from less than 1 to 60 minutes. Validation procedures for most of the tools are limited by inadequate power to ensure reliability across subgroups (i.e., race, age, ethnicity, and gender). The health literacy measurement tools currently

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available generally represent a narrow set of conceptual dimensions with limited modes of administration. Most of the tools lack information on key psychometric properties. Significant work is needed to establish important aspects of the construct, convergent, and predictive validity for many tools. As researchers develop new measures, inclusion of a full range of conceptual dimensions of health literacy, more representative sampling for testing, and additional modes of administration will allow a more refined and flexible approach to research in this field.

On the basis of significant data linking health literacy to health outcomes, the Institute of Medicine identified health literacy as a national priority (Nielsen-Bohlman, Panzer, & Kindig, 2004). Recent federal initiatives including the Affordable Care Act of 2010, the Department of Health and Human Services' National Action Plan to Improve Health Literacy, and the Plain Writing Act of 2010, emphasize the need for continued efforts to improve health literacy (Koh et al., 2012). In Europe, health literacy is highlighted as a strategic priority area for the European Commission (2007) and the European Office of the World Health Organization in terms (Regional Committee for Europe, 2012) to promote patient empowerment and population health. For these initiatives to be successful, health literacy will need to move from the margins to the frontline. Accurate measurement is a critical component of this process to better identify topics and populations most in need of support, to help tailor interventions, and to provide metrics to evaluate progress. (McCormack, Haun, Sørensen, & Valerio, 2013).

Instrument Proliferation

Numerous tools have been developed over the course of the past 20 years in an effort to measure health literacy in various contexts. Some of these tools were developed as screening tests and others were developed as more comprehensive assessments. Researchers have used a range of procedures to establish the validity of their tools including comparison of subjects' performance on the new tool to performance on general literacy measures (Markwardt & Service, 1989; Slosson, 2008; Wilkinson, 1993).

Health Literacy Instrument Variation

The diversity of health literacy instruments has led to inconsistencies in measurement, complicating the task of interpreting findings across disparate studies and choosing the appropriate tool for new studies. Several studies have examined the variation across the range of the most commonly used health literacy measures (Griffin et al., 2010; Haun, Luther, Dodd, & Donaldson, 2012). Such variations may stem from the fact that the tools measure different conceptual dimensions of health literacy. Variations may also stem from tools being more, or less, appropriate for a given context or population (Davis et al., 1991).

Goal of This Article

The purpose of this article is to review the psychometric properties, test parameters, and conceptual dimensions of published health literacy measurement tools. This work can serve as an inventory for researchers, decision makers, and practitioners who seek to identify validated measurement tools that are fitting for their research and practice.

Method

We systematically searched the peer-reviewed literature for health literacy measurement tools via the PsycINFO and PubMed databases. The search was limited to

peer-reviewed publications from 1999 to the end of 2013. These dates were selected to encompass the date of the first widely known health literacy measure, the Rapid Estimate of Ault Literacy in Medicine, to the date when the search was conducted. Our strategy involved a series of queries linking the term *health literacy* with each of the following terms: *measure, assessment, screening*, and *instrument*. In reviewing publications we found references to other tools that we also subsequently reviewed for inclusion. We also conducted an environmental scan in the field for additional references. This activity yielded a catalogue of health literacy measurement tools maintained by the organizers of the Health Literacy Annual Research Conference (Boston University, 2013), a set of measures reviewed in the Institute of Health Promotion Research's document, ''The Development and Validation of Measures of 'Health Literacy' in Different Populations'' (Kwan, Frankish, & Rootman, 2006) and a set of measures listed in the National Cancer Institute's (2012).

Abstracts gleaned by these methods were then reviewed by the research team for primary data relating to validation of health literacy measurement tools and full articles were obtained accordingly. Short forms of measures were not identified as distinct measures, but were included in the review of the original full-length versions (e.g., Test of Functional Health Literacy in Adults [TOFHLA] and S-TOFHLA). Additionally, the authors only included an instrument once it was subsequently translated into another language. Data abstraction included: name, indication of short-form options, year of publication, tool description, if the tool represents an objective or subjective (i.e., self-report) assessment, determination of self-administration, option for long distance administration, administration time, number of items/scales, training requirements, scoring details, target audience (i.e., general, specific disease population, or specific demographic population), and correlation with other tools.

To examine the specific skills and competencies measured by the different tools we used the taxonomy of skills identified by Sorensen and colleagues in their content analysis of health literacy definitions (Sørensen et al., 2012).The specified dimensions include *literacy*—the ability to perform basic reading tasks (Programme for International Student Assessment [PISA], 2006); *interaction*—the ability to communicate on health matters (Nutbeam, 2000); and *comprehension*—the ability to derive meaning from sources of information (Snow, 2002; University of California San Francisco Medical Center, n.d.). *Numeracy* was included as the ability to perform basic numerical tasks and arithmetic operations (PIAAC Numeracy Expert Group, 2009)—if focus was numeracy, credit was not given for prose literacy even though numeracy measures may require reading. Remaining dimensions include *information seeking*— which entails the ability to find health related information to manage one's health (Case, 2012); a*pplication/function*—the ability to use, process or act on health related information, and apply new information to changing circumstances (Nutbeam, 2000); *decision making/critical thinking*—the ability of making sound, health-related decisions and informed choices (Foundation for Critical Thinking, 2013); *evaluation*—the ability to filter, interpret, and evaluate information (University of California San Francisco Medical Center, n.d.); *responsibility*—the ability to take responsibility for one's health and health care decision making (Resnik, 2007). In addition, we included two dimensions regarding *confidence* (i.e., level of confidence to take action to improve personal and community health; Nutbeam, 2008) and *navigation* (i.e., level of skill to navigate in society and in health systems to manage one's health needs; U.S. Department of Health and Human Services, 2000).

Originally, the dimension *maintaining and promoting health* was defined as the ability to increase control over health, reduce health risks, and enhance and improve health to accomplish health related objectives and increase quality of life (World Health Organization, n.d.) was included in the taxonomy; however, the lack

of agreement in the review process on the application of this dimension resulted in its exclusion from the review.

The authors used a consensus process to determine the characteristics, dimensions, validation, strengths and limitations of each tool. Each tool was assigned to two authors and reviewed separately. Characteristics, validation, strengths, and limitations information was based on original article content. To conduct the dimension review, the authors completed a multistep review process. First, the authors evaluated each tool based on the functional definition of each dimension. In most cases determinations were able to be made based on defined subscales and/or item content reviewed in the original articles. In some cases, the dimension was implied in the tool items. In these cases, implied skills were accounted for in the dimension review. Next, the authors then met to present their reviews; when disagreements occurred, justifications were presented by the reviewers and a third reviewer was assigned to independently review the discrepancy to present a determination, upon which time all authors met to come to a consensus. Then, the tools were divided a final time among the authors for review, at which time all dimensions for each tool were finalized. Last, the authors had a final call to discuss the tools and finalize determinations.

Results

The PsycINFO search produced 575 publications on the basis of our search terms and the PubMed search yielded 2,614 publications. Upon initial review of the 3,189 abstract titles, 2,888 were excluded. Upon abstract review another 270 were excluded based on several factors including relevance, requirement for empirical data, exclusion of eHealth literacy and content and knowledge based measures. Ultimately the search ($n = 30$) and the environmental scan ($n = 21$) yielded 51 unique health literacy measurement tools with empirical data (see Figure 1). The 51 measurements included 26 general health literacy tools, 15 disease or content specific tools (e.g., diabetes, asthma, HIV, nutrition), and 10 tools for specific populations. Most tools are performance based, require in-person administration, and are exclusively available in a pencil-and-paper testing mode. Reported administration times vary from less than 1 to 60 min. Descriptive details of the measures are illustrated by type in Table 1. The tools assessed 0 (proxy measure) to 9 of the 11 defined health literacy dimensions, as seen in Table 2. Validation data, as well as our assessment of each tool's strengths and limitations, are illustrated in Table 3.

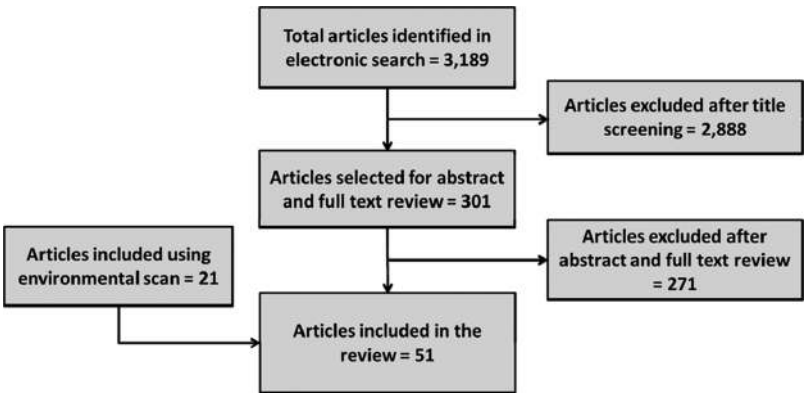

Figure 1. Literature search for health literacy tools.

Table 1. Health literacy measure characteristics

Full name	Year	Description	Objective or self-reported	Self-administered	Long-distance administration	Administration time (minutes)	Number of items and scales	Training required	Scoring	Target audience
General health literacy										
Comprehension of 50 medical terms (Samora, Saunders, & Larson, 1961)	1961	Verbal comprehension of common medical terms	OB	N	N	NR	50	Minimal	Interview responses categorized into one of four categories from no understanding to complete understanding	Adults
Rapid Estimate of Adult Literacy in Medicine (REALIM; Davis et al., 1991) and short forms (e.g, REALM-SF; Arozullah et al., 2007; Bass, Wilson, & Griffith, 2003)	1991	Health word recognition and pronunciation	OB	N	N	2–3	66; varies by version	Minimal	Sum score (0–66) converted to four grade categories: third grade or less, fourth through sixth grade, seventh or eighth grade, ninth grade or more	Adults
English and Spanish versions of the Test of Functional Health Literacy for Adults (TOFHLA; Parker, Baker, Williams, & Nurss, 1995); short form (Baker, Williams, Parker, Gazmararian, & Nurss, 1999); French, German, and Italian versions (Connor, Mantwill, & Schulz, 2013)	1995/ 1999	Cloze-style reading comprehension of health related content	OB	N	N	18–22/7	67; SF-9	Minimal	Sum score, categorized as inadequate, marginal and adequate	Adults
Three-item Numeracy Measure (Schwartz, Woloshin, Black, & Welch, 1997)	1997	Three numeracy and accuracy items	OB	Y	Y	NR	3	NR	Sum score	Adults
Medical Achievement Reading Test (MART; Hanson-Divers, 1997)	1997	Health word recognition and pronunciation	OB	N	N	NR	42	Minimal	Raw scores tabulated by adding the number of words correctly pronounced with the number	Adults

									of letters correctly pronounced	
Lipkus Expanded Health Numeracy Scale (Lipkus et al., 2001)	2001	Basic probability and math items to quantify and associate perceived health risk	OB	N	N	NR	10: 3 in the general scale, 7	NR	Sum score	Adults
Health Literacy Component of the NAAL (Kutner, Greenberg, Jin, & Paulsen, 2006)	2003	National assessment to measure adults' ability to read and understand health-related information	SR	N	Y	NR	4 clinical tasks; 14 preventive tasks 10; navigation tasks as part of National Assessment of Adult Literacy prose, document, and quantitative scores	NR	Scored by scale items as part of larger assessment	Adults
Health Activities Literacy Scale of NALS (Nielsen-Bohlman et al., 2004; Rudd, Kirsch, & Yomamoto, K, 2004)	2004	Used to estimate the distribution of literacy on health-related tasks among U.S. adults	OB	N	Y	Varies	191: subscales include 60 health promotion; 65 health protection; 18 disease prevention; 16 health care and maintenance; 32 systems navigation	Moderate	Sum score (0–500) that reflects a progression of health related literacy skills from level 1 to 5	Ages 16+ years
Three-item Health Literacy Screening (Chew, Bradley, & Boyko, 2004); Brief Health Literacy Screening Tool (Haun, Noland Dodd, Graham-Pole, Rienzo, & Donaldson, 2009)	2004/ 2009	Survey items with Likert-type responses to identify inadequate health literacy	SR	Y	Y	1–2	3–4	Minimal	Sum score (0–5 each item), categorized as inadequate, marginal, or adequate	Adults

(*Continued*)

Table 1. Continued

Full name	Year	Description	Objective or self-reported	Self-administered	Long-distance administration	Administration time (minutes)	Number of items and scales	Training required	Scoring	Target audience
Medical Data Interpretation Test (MDIT; Schwartz, Woloshin, & Welch, 2005)	2005	Examines the ability to compare risks and put risk estimates into context	OB	Y	Y	NR	18 items: 3 numeracy, 11 literacy items, 4 sociodemographic items	NA (mail survey)	Sum score transformed to 0–100 Scale	Adults
Newest Vital Sign (NVS; Weiss et al., 2005)	2005	Survey items about information presented on a nutrition label	OB	N	N	5	6	Minimal	Sum score (0–6) categorized, (0–1) high likelihood limited literacy; (2–3) possibility of limited literacy, (4–6) adequate literacy	Adults
Single Item Literacy Screener (SILS; Morris, MacLean, Chew, & Littenberg, 2006)	2006	Single survey item to identify inadequate health literacy	SR	Y	Y	1	1	Minimal	Response recorded on a 5-point Likert-type scale and categorized as inadequate, marginal or adequate	All ages
Subjective Numeracy Scale (SNS; Fagerlin et al., 2007)	2007	Self-assessment of quantitative ability	SR	Y	N	5	8	NR	Sum score	Adults
Demographic Assessment of Health Literacy (DAHL; Hanchate, Ash, Gazmararian, Wolf, & Paasche-Orlow, 2008)	2008	Based on demographics	NA	NA	NA	NA	NA—a regression of the Test of Functional Health Literacy in Adults and four demographic items	NA	Statistical score assigned based on regression of TOFHLA and demographics – inadequate health literacy for the 25% lowest DAHL scores	Ages 65 + years

Functional Health Literacy Test (FHLT; Zhang, Thumboo, Fong, & Li, 2009)	2009	Cloze-style reading comprehension of health related content	OB	Y	Y	2–3	21	Minimal	Sum score categorized as proficient literacy (score >82), basic literacy (70–81), and below basic literacy (score <70)	Ages 18+ years
Medical Term Recognition Test (METER; Rawson et al., 2010)	2010	Medical word recognition test	OB	Y	N	2	40 medical words and 40 nonwords	Minimal	Sum score number of words correctly recognized	Adults
Health Literacy Skills Instrument (HLSI; McCormack et al., 2010); short form (Bann, McCormack, Berkman, & Squiers, 2012)	2010/ 2012	Survey items to assess ability to read and understand text and locate and interpret information for use in decision making	OB	Y	Y	5–10	25; SF-10	Minimal	Percentage of items answered correctly	Adults
Health Literacy Assessment Using Talking Touchscreen Technology (Health LiTT; Hahn, Choi, Griffith, Yost, & Baker, 2011)	2011	Items related to disease, insurance, and informed consent	OB	Y	Y	Varies	82	Minimal	Sum score and *t* scores	Adults
Numeracy Understanding in Medicine Instrument (NUMI; Schapira et al., 2012)	2012	Examines ability to communicate, and participate in one's health and medical decisions	OB	Y	N	NR	20	NR	Sum score	Adults
Swiss Health Literacy Survey (Wang, Schmid, & Thombs, 2012)	2012	Survey items to assess ability to seek, understand and use health information in the health care setting	SR	Y	Y	30	127 items across 30 domains	Minimal	Independent scales measuring different aspects of health literacy. Produces a health literacy needs profile.	Adults
Health Literacy Questionnaire (HLQ; Osborne, Batterham, Elsworth, Hawkins, & Buchbinder, 2013)	2013	Survey items measuring health literacy of individuals	SR	Y	Y	Self-administered 5–10 min; orally administered 10–15 min	44 items with 9 final scales	Minimal	Independent scales measuring proportions of nine competencies for health literacy	Adults

(*Continued*)

Table 1. Continued

Full name	Year	Description	Objective or self-reported	Self-administered	Long-distance administration	Administration time (minutes)	Number of items and scales	Training required	Scoring	Target audience
Health Literacy Management Scale (HeLMS; Jordan et al., 2013)	2013	Survey items to assess ability to seek, understand, and use health information within the health care setting	SR	Y	Y	NR	29 items and 8 domains	Moderate	Mean score of each domain	Adults
European Health Literacy Questionnaire (HLS-EU-Q; Sørensen et al., 2013)	2013	Survey items to assess the relation between abilities, system demands, and decision making	SR	Y	Y	12–15	47 in HLS-EU-Q47 including $3 \times 4 = 12$ subscales; 16 items in short form: HLS-EU-Q16	Moderate	The 47 items are adapted to a 50 point scale: 0–25: inadequate health literacy; 26–33: problematic health literacy; 33–42: sufficient health literacy; 42–50: excellent health literacy	Ages 15+ years
All aspects of Health Literacy Scale (AAHLS; Chinn & McCarthy, 2013)	2013	Measure functional, communicative, and critical health literacy	SR	Y	N	7	14; 4 functional, 3 communicative, 7 critical	Minimal	Sum score	Adults
General Health Numeracy Test (GHNT; Osborn et al., 2013); short form (GHNT-6)	2013	Assessment of a patient's health numeracy status	OB	N	N	NA	21/SF-6	Training required	Percentage correct	Adults
Signature Time (Sharp et al., 2013)	2013	Assess health literacy using time it takes to sign one's name	NA	NA	NA	<1	NA	Training required	Timed and categorized as inadequate ($M = 10.0$ s), marginal ($M = 7.3$ s), or adequate ($M = 4.7$ s) —6 s or less were highly likely to display adequate health literacy	Adults

Disease- or condition-specific health literacy										
Literacy Assessment for Diabetes (LAD; Nath, Sylvester, Yasek, & Gunel, 2001)	2001	Diabetes word recognition test	OB	N	N	3–5	60	Minimal	Sum score (0–60) can be converted to three grade range categories: fourth grade or less, fifth through eighth grade, ninth grade or more	Adults
Asthma Numeracy Questionnaire (ANQ; Apter et al., 2006)	2006	Asthma; self-management numerical skills	OB	N	N	3–4	4	NR	Sum of correct answers	Adults
Stieglitz Informal Reading Assessment of Cancer Text (SIRACT; Agre, Stieglitz, & Milstein, 2006)	2006	Informal reading inventory of cancer related text	OB	N	N	10–20	Varies depending on entry point	Minimal	Responses are recorded on a 5-point Likert-type scale	Adults
Test of Functional Health Literacy in Dentistry (TOFHLA iD; Gong et al., 2007)	2007	Measure of functional oral health literacy	OB	N	N	NR	68-item reading comprehension test; 12-item numerical ability	Moderate	Weighted score (0–100)	Adults
Nutritional Literacy Scale (NLS; Diamond, 2007)	2007	Understanding of nutrition label	OB	Y	Y	NR	28	Moderate	Sum score	Adults
Rapid Estimate of Adult Literacy in Dentistry 99 (READ-99; Richman et al., 2007); short form (READ 30; Lee, Rozier, Lee, Bender, & Ruiz, 2007)	2007	Word recognition in dentistry	OB	N	N	10/5	99/SF-30	Minimal	Sum score (0–99), sum score (0–30)	Adults
Diabetes Numeracy Test (DNT; Huizinga et al., 2008); short form (DNT15)	2008	Diabetes literacy and numeracy skill assessment	OB	Y	N	33/10–15	43/SF-15	Moderate	Percentage correct	Adults
Rapid Estimate of Adult Literacy in Genetics (REAL-G; Erby, Roter, Larson, & Cho, 2008); short form	2008	Word recognition in genetics	OB	N	N	NR	63/SF-8	Minimal	Sum score 0–21 = estimated literacy level less than fourth grade, 22–50 fourth through sixth grade, 51–60 seventh to eighth grade, 61–63 high school	Adults

(*Continued*)

Table 1. Continued

Full name	Year	Description	Objective or self-reported	Self-administered	Long-distance administration	Administration time (minutes)	Number of items and scales	Training required	Scoring	Target audience
Rapid Estimate of Adult Literacy in Vascular Surgery (REAL-VS and REAL-VS SF; Wallace et al., 2009)	2009	Word recognition in vascular surgery	OB	N	N	NR	75/SF-8	NR	Sum score	Adults
Brief Estimate of Health Knowledge and Action—HIV Version (BEHKA-HIV; Osborn, Davis, Bailey, & Wolf, 2010)	2010	Items to assess HIV knowledge	OB	N	N	3	8	Minimal	Sum score Part 1: 0–3, Part 2: 0–5	Adults
HBP-Health Literacy Scale (Kim et al., 2012)	2012	Items to assess high blood pressure management	OB	Y	N	10–15	30 words and 13 self-administered items	Moderate	Sum score (0–30 and 0–10 for each self-administered item)	Korean American adults
Food Label Literacy for Applied Nutrition Knowledge Questionnaire (FFLANK; Reynolds et al., 2012)	2012	Word recognition in nutrition	OB	Y	Y	15	10	Minimal	Percentage score	Children
Chinese Health Literacy Scale for Chronic Care (CHLCC; Leung et al., 2013)	2013	Assess chronic care knowledge in Chinese adults with three subscales (understanding, applying, and analyzing)	OB	N	N	7	20: 7 understanding, 7 applying, 6 analyzing	NR	Sum score	Chinese patients with chronic illness
Chinese Health Literacy Scale for Diabetes (CHLSD Leung et al., 2013)	2013	Assess diabetes knowledge in Chinese adults with four scales (remembering, understanding, applying and analyzing)	OB	N	N	7	34: 18 remembering, 7 understanding, 5 applying, 4 analyzing	NR	Sum score	Chinese patients with diabetes

Nutrition Literacy Assessment Instrument (NLAI; Gibbs & Chapman-Novakofski, 2013; Gibbs, 2012)	2013	Assess skills for effective nutrition education	OB	N	N	4–15	40: 6 nutrition and health, 6 macronutrients, 6 food portions, 6 label reading, 16 food groups	Minimal	Percentage correct	Adults
Population- or language-specific health literacy										
Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen; Davis et al., 2006)	2006	Word recognition test to assess health literacy in adolescent population	OB	N	N	3	66	Minimal	Sum score	Adolescents (10–19 years)
Hebrew Health Literacy Test (HHLT; Baron-Epel, Balin, Daniely, & Eidelman, 2007)	2007	Assessment of health literacy in Hebrew	OB	N	N	NR	12	Minimal	Sum score	Adults who speak Hebrew
Korean Health Literacy Scale (KHLS; Lee, Kang, Lee, & Hyun, 2009)	2009	Screening test for limited health literacy for older Korean adults	OB	N	N	15–20	24 including 13 on comprehension and numeracy and 11 on 11 items on health-related terms	Moderate	Sum score	Older Korean Adults
Short Assessment of Health Literacy for Spanish-Speaking Adults (SAHLSA-S&E; Lee, Bender, Ruiz, & Cho, 2006)	2010	Word recognition test with multiple-choice questions was to verify the comprehension of the medical terms, designed in Spanish and English	OB	N	N	2–3	18	Minimal	Sum score	Spanish- and English-speaking adults
Instrument for Measuring Health Literacy for Canadian High School Students (Wu et al., 2010)	2010	Health-related passage with open-ended items to assess understanding	OB	N	N	NR	47: 30 understanding items, 17 evaluate items	Minimal	Sum score based on assessment criteria	Canadian high school students
Taiwan Health Literacy Scale (THLS; Pan, Su, & Chen, 2010); short form (Pan, 2010)	2010	Assesses understanding of the meaning and the associated medical treatment of terms	OB	N	N	>5/5	66, 9 categories; 15	Minimal	Sum score based on 5-point Likert-type scale	Chinese population in Taiwan

(*Continued*)

Table 1. Continued

Full name	Year	Description	Objective or self-reported	Self-administered	Long-distance administration	Administration time (minutes)	Number of items and scales	Training required	Scoring	Target audience
Parental Health Literacy Activities Test (PHLAT; Kumar et al., 2010); Spanish version (SPHALT; Yin et al., 2012); short form (PHLAT-8)	2010	Caregiver/parental health literacy skills-based assessment for Spanish speakers	OB	N	N	3	10/SF-8	Minimal	Percentage correct	Spanish Speaking caregivers/ parents
Mandarin Health Literacy Scale (MHLS; Tsai, Lee, Tsai, & Kuo, 2011)	2011	Health related task test items with 5-point Likert-type response	OB	N	N	Average 25	50: 33 text reading,17 quantitative	Minimal	Sum score with three levels of literacy: inadequate (0–30), marginal (31–42), and adequate (43–50)	Mandarin Chinese-speaking population
Cancer Message Literacy Tests Listening and Reading (CMLT-Listening and CMLT-Reading; Mazor et al., 2012)	2012	Comprehension of spoken, and written, health messages related to cancer prevention and screening	OB	Y	Y, touchscreen	10 reading, 60 listening	23 reading, 48 listening	NA	Computed score of total percentage correct	Adults
Health Literacy Test for Singapore (HLTS; Ko, Lee, Toh, Tang, & Tan, 2012)	2012	Adapted version of the short from of the Test of Functional Health Literacy Assessment for Singaporean population	OB	N	N	12	40 (4-item numeracy and 36-item reading comprehension)	Minimal	Sum score	Singaporean adults

Note. OB = objective; SR = self-reported; Y = Yes; N = No; NA = not applicable; NR = not reported.

Table 2. Dimensions assessed in health literacy measures

	Literacy	Interaction	Comprehension	Numeracy	Information seeking	Application/ function	Decision making/ critical thinking	Evaluation	Responsibility	Confidence (self-efficacy)	Navigation
General health literacy											
Comprehension of 50 medical terms	N	Y	Y	N	N	N	N	N	N	N	N
Rapid Estimate of Adult Literacy in Medicine; short form	Y	N	N	N	N	N	N	N	N	N	N
Test of Functional Health Literacy for Adults; short form	Y	N	Y	Y	N	N	N	Y	N	N	N
Three-item Numeracy Measure	N	N	Y	Y	N	Y	N	Y	N	N	N
Medical Achievement Reading Test	Y	N	N	N	N	N	N	N	N	N	N
Lipkus Expanded Health Numeracy Scale	N	N	Y	Y	N	Y	N	Y	N	N	N
Health Literacy Component of the NAAL*	Y	N	Y	Y	N	N	N	N	N	N	Y
Health Activities Literacy Scale of NALS	Y	N	Y	Y	Y	Y	Y	N	N	N	Y
3-Item Health Literacy Screening; 4-item Brief Health Literacy Screening Tool*	Y	Y	Y	N	N	N	N	N	N	Y	N
Medical Data Interpretation Test	N	N	Y	Y	N	Y	N	Y	N	N	N
Newest Vital Sign	Y	N	Y	Y	N	Y	N	Y	N	N	N
Single Item Literacy Screener*	Y	N	Y	N	N	N	N	N	N	N	N
Subjective Numeracy Scale*	N	N	Y	Y	N	Y	N	Y	N	N	N
Demographic Assessment of Health Literacy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(*Continued*)

Table 2. Continued

	Literacy	Interaction	Comprehension	Numeracy	Information seeking	Application/ function	Decision making/ critical thinking	Evaluation	Responsibility	Confidence (self-efficacy)	Navigation
Functional Health Literacy Test	Y	N	Y	N	N	Y	Y	Y	N	N	N
Medical Term Recognition Test	Y	N	N	N	N	N	N	N	N	N	N
Health Literacy Skills Instrument; short form*	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Health Literacy Assessment Using Talking Touchscreen Technology	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y
Numeracy Understanding in Medicine Instrument	N	N	Y	Y	N	Y	N	Y	N	N	N
Swiss Health Literacy Survey*	N	Y	N	N	Y	Y	N	N	N	N	N
Health Literacy Questionnaire*	N	Y	Y	N	Y	Y	Y	N	N	N	Y
The Health Literacy Management Scale*	N	Y	Y	N	Y	Y	N	N	N	Y	Y
The European Health Literacy Questionnaire*	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
All Aspects of Health Literacy Scale*	Y	Y	Y	N	Y	N	N	Y	N	N	N
General Health Numeracy Test; short form	N	N	Y	Y	N	Y	N	N	N	N	N
Signature Time	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Disease- or condition-specific health literacy											
Literacy Assessment for Diabetes	Y	N	N	N	N	N	N	N	N	N	N
Asthma Numeracy Questionnaire	N	N	Y	N	N	Y	N	N	N	N	N

Stieglitz Informal Reading Assessment of Cancer Text	Y	N	Y	N	N	N	Y	Y	N	N	N
Test of Functional Health Literacy in Dentistry	Y	N	Y	Y	N	N	N	Y	N	N	N
Nutritional Literacy Scale	Y	N	Y	Y	N	N	N	Y	N	N	N
Rapid Estimate of Adult Literacy in Dentistry 99 ; short form	Y	N	N	N	N	N	N	N	N	N	N
Diabetes Numeracy Test; short form	N	N	Y	Y	N	N	N	Y	N	N	N
Rapid Estimate of Adult Literacy in Genetics; short form	Y	N	N	N	N	N	N	N	N	N	N
Rapid Estimate of Adult Literacy in Vascular Surgery; short form	Y	N	N	N	N	N	N	N	N	N	N
Brief Estimate of Health Knowledge and Action—HIV Version	N	N	Y	N	N	N	N	Y	N	N	N
HBP-Health Literacy Scale	Y	N	Y	Y	N	N	N	Y	N	N	N
Food Label Literacy for Applied Nutrition Knowledge Questionnaire	Y	N	N	N	N	N	N	N	N	N	N
Chinese Health Literacy Scale for Chronic Care	Y	N	Y	N	N	N	Y	N	N	N	N
Chinese Health Literacy Scale for Diabetes	Y	N	Y	N	N	N	Y	N	N	N	N
Nutrition Literacy Assessment Instrument	Y	N	Y	Y	N	Y	Y	Y	N	N	N

(*Continued*)

Table 2. Continued

	Literacy	Interaction	Comprehension	Numeracy	Information seeking	Application/ function	Decision making/ critical thinking	Evaluation	Responsibility	Confidence (self-efficacy)	Navigation
Population- or language-specific health literacy											
Rapid Estimate of Adolescent Literacy in Medicine	Y	N	N	N	N	N	N	N	N	N	N
Hebrew Health Literacy Test	Y	N	Y	Y	N	Y	Y	Y	N	N	N
Korean Health Literacy Scale	Y	Y	Y	Y	Y	Y	Y	N	N	N	N
Short Assessment of Health Literacy for Spanish-speaking Adults	Y	N	Y	N	N	N	N	Y	N	N	N
Instrument for Measuring Health Literacy for Canadian High School Students	Y	N	Y	Y	N	Y	Y	Y	N	N	N
Taiwan Health Literacy Scale; short form	Y	N	Y	N	N	Y	N	N	N	N	N
Mandarin Health Literacy Scale	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y
Parental Health Literacy Activities Test; Spanish version; short form	Y	N	Y	Y	N	Y	N	Y	N	N	N
Cancer Message Literacy Tests Listening and Reading	Y	N	Y	Y	N	Y	Y	Y	N	N	N
Health Literacy Test for Singapore	Y	N	Y	Y	N	N	N	Y	N	N	N

Note. Y = Yes; N = No; NA = not applicable.
*Indicates subjective self-report measure of the identified health literacy dimensions.

Table 3. Validation, strengths, and weaknesses of health literacy measures

	Validation	Strengths	Limitations
General health literacy			
Comprehension of 50 medical terms	Interrater reliability of 96%. Content validity, supported based on feedback from patients, doctors, medical residents, and medical students	First measure of comprehension of health-related information	Requires skilled administration and is not quick to administer.
Rapid Estimate of Adult Literacy in Medicine; short forms	Correlated with WRAT-R2 ($r = 0.82$) WRAT-R3, (0.88); SORT-R, (0.95, 0.96); PIAT-R, (0.94, 0.97); TOHFLA, (0.30, 0.84). Test–retest reliability of 0.98 and 0.99. Interrater reliability of 0.99 ($p < .0001$). Content validity—words selected from education. Face validity—based on physician, staff, and patient receptivity to the test and its applicability to medical settings.	Quick and easy to administer; short version available. Minimal training is required to administer the test. Has high concentration of items at lower literacy levels increasing discriminatory power when administered to patients with limited reading ability.	Only measures one dimension of health literacy. Presence of a ceiling effect. Does not measure the patient's understanding of the words.
Test of Functional Health Literacy for Adults; short form	Correlated with WRAT-R3, (0.74); REALM, (0.84). Pearson's correlation, (0.71) for S-TOFHLA and REALM as continuous variables; as categorical variables (0.52). Internal consistency, Cronbach's $\alpha = .98$ for both English and Spanish versions; Cronbach's $\alpha > .95$ within each of 3 patient populations; intercorrelations among the Reading Comprehension and the Numeracy subtests were $r = 0.79$ and 0.70 for the English and Spanish versions. Test–retest reliability, Spearman-Brown equal-length coefficient of 0.92 for the English version, and 0.84 for the Spanish version. Content and face validity: based on commonly used hospital texts reviewed by a literacy expert.	Available in Spanish, German, French, and Italian. Short version available. Has been validated in several samples representing diverse populations.	Long versions are time-consuming/may overestimate health literacy. Longer version is more useful as a research tool than a clinical screening tool.
Three-item Numeracy Measure	Accuracy was related to numeracy, accuracy was 5.8% (95% CI, 0.8% to 10.7%) for a numeracy score of 0, 8.9% (CI, 2.5% to 15.3%) for a score of 1, 23.7% (CI, 13.9% to 33.5%) for a score of 2, and 40% (CI, 25.1% to 54.9%) for a score of 3.	Quick and can be self-administered remotely. Has been validated in several sample populations.	Does not address other dimensions of health literacy beyond numeracy
Medical Achievement Reading Test	Correlated with WRAT-R3 (0.97) and grade levels (0.98) with WRAT; reliability was demonstrated (0.98).	Validated using a randomized crossover design with 400 respondents representing a diverse sample. Measure is quick and easy to administer.	Measures word recognition only. Does not measure the patient's understanding of the words.
Lipkus Expanded Health Numeracy Scale	Correlations ranged from 0.44 to 0.49 across samples; alphas for the general numeracy scale were 0.57–0.63; alphas for the expanded numeracy scale were 0.70–0.75. Factor analysis indicated general and expanded risk numeracy items tapped the construct of global numeracy, a one- to three-factor	Relatively quick and objective measure of numeracy and risk.	Sample was not representative of the general U.S. population, and was primarily White and highly educated. Does not address other dimensions of health literacy beyond numeracy.

(*Continued*)

Table 3. Continued

	Validation	Strengths	Limitations
	solution was computed to examine the dimensionality of all the numeracy items, the biserial correlations ranged from 0.678 to 0.907; the factor loadings ranged from 0.549 to 0.826. Pooling all items, the coefficient alpha was 0.78.		
Health Literacy Component of the National Assessment of Adult Literacy	Subscale of larger National Assessment of Adult Literacy assessment, not tested for reliability or correlated with standard existing health literacy tests	First national-level assessment of health literacy, including measure of numeracy.	Designed to be used as a subscale of a larger instrument, length is time consuming; cannot be quickly administered.
Health Activities Literacy Scale of NALS	Subscale of larger NALS survey. Using item response theory, the stability of item parameters were good. Content validity demonstrated by researchers' ability to fit the items into the health activities framework.	Computer adapted; sensitive to change post intervention; Short version available.	Designed to be used as a subscale of a larger instrument, length is time consuming; cannot be quickly administered.
Three-item Health Literacy Screening; four-item Brief Health Literacy Screening Tool	Tested against STOFHLA, items AUROC curve ranged from 0.76- 0.87 (95% CI). The grouped items, including a fourth item about verbal information, (BRIEF), demonstrated an AUROC curve of .79 (95% CI) for identifying inadequate skills. Correlations as grouped items against S-TOFHLA (0.42) and REALM (0.40) in multiple demonstrating moderate correlation.	Validated in several diverse sample populations. Quick, easy, and inexpensive to administer; addresses functional domains associated with inadequate health literacy. Less likely to induce anxiety and shame.	Methods typically relied on convenience samples. Self-assessment has potential for self-report bias.
Medical Data Interpretation Test	Reliability (test–retest correlation (0.67), Cronbach's alpha (0.71). Construct validity, higher scores were found for respondents with highest versus lowest numeracy (71 vs. 36, $p < .001$), highest quantitative literacy (65 vs. 28, $p < .001$), and highest education (69 vs. 42, $p = .004$).	Measure provides functional objective measure of risk and numeracy within the context of health information.	Tested in a relatively small convenience sample. Several items could be perceived as subjective based on item wording.
Newest Vital Sign	Reliability Cronbach's alpha in English (0.76) and in Spanish (0.69) and correlated with the TOFHLA (0.49). AUROC curve is 0.88 for the English version and 0.72 for the Spanish version.	Quick functional health literacy assessment that includes numeracy. Tested in English speaking and Spanish speaking sample. Validated Spanish version.	Validation sample did not fully represent a demographically diverse population. Test format might intimidate respondents.
Single Item Literacy Screener	Tested using S-TOFHLA, sensitivity in detecting limited reading ability was 54% [95% CI: 47%, 61%] and the specificity was 83% [95% CI: 81%, 86%] with an AUROC of 0.73 [95% CI: 0.69, 0.78].	Quick and easy to administer; available in Spanish	Self-assessment has potential for self-report bias.
Subjective Numeracy Scale	Factor analysis confirmed that, with the exception of a minority of questions, the items fell into 3hypothesized factors: experience, interest, and ability. Final Subjective Numeracy Scale correlated with Lipkus/others' objective numeracy scale (0.63 to 0.68); reliability was .82.	Validated in a large sample of the general population using an iterative testing process.	Sampling method was convenience and data was collected using self-administration and thus could have resulted of self-exclusion of those with lower levels of numeracy. Items are not presented within health information context.

Demographic Assessment of Health Literacy	The S-TOHFLA and Demographic Assessment of Health Literacy are correlated (0.58), and a linear regression of the Demographic Assessment of Health Literacy on S-TOHFLA gives a coefficient estimate of 0.93. The AUROC was 0.81, 95% CI [0.79, 0.83]. Interaction terms resulted in C-statistic at 0.81.	Data elements needed for assessments are often readily available.	Does not assess skills and is not a precise measure. Validated only for older adults.
Functional Health Literacy Test	Reliability was demonstrated for general public and rheumatic patients (0.72, 0.68). Convergent validity was demonstrated with correlation between Functional Health Literacy Test and REALM (0.65, 0.68). Divergent validity was shown by weak correlation between the Functional Health Literacy Test score and education level (0.33, 0.28) Test-retest reliability of the Functional Health Literacy Test among rheumatic patients was shown to be high (ICC = 0.95).	Assesses multiple health literacy domains.	Computer based assessment may be confounded by computer literacy issues.
Medical Term Recognition Test	Correlated with REALM (0.74). METER showed a high degree of reliability (0.93). To demonstrate predictive validity the magnitude of the associations between METER and the medical variables, health behaviors, and neuropsychological measures were similar to the magnitude of the associations between REALM and these measures.	Quick and easy to administer.	Only measures one dimension of health literacy. Does not measure the patient's understanding of the words.
Health Literacy Skills Instrument; short form	Correlated with S-TOFHLA (0.36) and demonstrated good internal consistency (0.86). The higher order confirmatory factor analysis model fit well (CFI = 0.95, TLI = 0.98, and RMSEA = 0.03).	Assesses multiple health literacy domains with a skills-based approach. Available in short form.	Primarily focusing on functional health literacy using different means such as documents, oral communication and Internet.
Health Literacy Assessment Using Talking Touchscreen Technology	Correlated with REALM (0.69), TOFHLA (0.65), Newest Vital Sign (0.56). Three-factor model had slightly better fit compared to a one factor model. However, correlations among the three factors (grouped by prose, document and quantitative items) were 0.90–0.95, suggesting good evidence for unidimensionality. The 2-PL item response theory model also fit the data well.	Self-administered; computer adapted; available in Spanish.	Not able to distinguish higher levels of health literacy. Computer-based assessment may be confounded by computer literacy issues.
Numeracy Understanding in Medicine Instrument	Correlated with WRAT-Arithmetic (0.73), Lipkus (0.69), MDIT (0.75), STOFHLA (0.43).	A comprehensive measure assessing several dimensions of health numeracy	Does not address other dimensions of health literacy beyond numeracy.
Swiss Health Literacy Survey	Exploratory and confirmatory factor analyses supported a four factor model with reasonably good fit. Factor intercorrelations ranged from −0.05 to 0.81, suggesting distinct components.	Assesses multiple health literacy domains.	Length of assessment increases response burden.
Health Literacy Questionnaire	A nine-factor model was fit using 44 final items with no cross-loadings or correlated residuals. Model fit	Self-administered; measures multiple domains of health literacy.	Self-assessment has potential for self-report bias.

(*Continued*)

Table 3. Continued

	Validation	Strengths	Limitations
	was satisfactory CFI = 0.936 = 0.930, RMSEA = 0.076, and WRMR = 1.698. Correlations between factors showed a clear distinction between the agree/disagree scales, but less distinction for cannot do/very easy scales.		
The Health Literacy Management Scale	Confirmatory factor analysis indicated good fit of the data with the model RMSEA = 0.07, SRMR = 0.05, CFI = 0.97. A full eight-factor model was evaluated. No cross loadings or correlated errors were allowed and good model fit resulted.	Assessment of multiple domains can target or tailor patient needs.	Is validated for Australia with its specific health care system, but may perform differently when applied in other countries.
The European Health Literacy Questionnaire	Correlated with NVS (0.25). A multivariate linear regression model with the total sample measured the relation between social variables and health literacy yielding an adjusted $R^2 = 17.4\%$, $p = .00$. Financial deprivation was the strongest predictor of health literacy.	Comprehensive, conceptual based measure of most dimensions of health literacy; available in 10+ languages.	Length of assessment increases response burden. Self-assessment has potential for self-report bias.
All Aspects of Health Literacy Scale	Principal component analysis indicated that the scale items loaded on four factors with eigenvalues greater than 1 accounting for 59% of the variance. Subscale correlations ranged from $r = 0.186$, $p = .017$ to $r = 0.59$, $p = .036$. Overall scores and different subscale scores were associated with ethnic minority status, educational level, and self-rated health status, but the overall picture was complex.	Comprehensive, conceptually based tool referring to Nutbeam's three level of health literacy.	Self-assessment has potential for self-report bias.
General Health Numeracy Test; short form	Correlated with WRAT-3 (0.64, 0.65), REALM (0.54, 0.45), SNS (0.57, 0.58), demonstrated reliability (0.87, 0.77), and both were associated with income, education, health literacy, objective numeracy, and subjective numeracy ($p < .001$).	General health numeracy test assessing various dimensions of numeracy.	Small study sample and from a single academic medical center.
Signature Time	Tested against REALM (adjusted OR = 0.785, CI = 0.66–0.93). Signature time differentiated participants with adequate and marginal literacy versus inadequate literacy (OR = 0.719, CI [0.608–0.851], AUC = 0.7609), as well as those with adequate literacy versus marginal and inadequate literacy (OR = 0.544, CI [0.409–0.725], AUC = 0.8290).	Does not require administration and can be easily assessed.	Does not provide precise measure and cover none of the dimensions in health literacy apart from literacy.
Disease- or condition-specific health literacy			
Literacy Assessment for Diabetes	Correlated with WRAT-3 (0.81) and REALM (0.90); and demonstrated test–retest reliability (0.86)	Quick and easy to administer.	Only measures one dimension of health literacy; does not discriminate above a ninth grade; gives grade range estimate; not specific.

Asthma Numeracy Questionnaire	Correlated with S-TOFHLA (0.47) and REALM (0.41). Internal consistency was 0.57. Rasch model goodness-of-fit testing was found with various tests ($p = .74$), ($p = .44$), ($p = .69$).	Quick and easy to administer. Based on guidelines specific asthma management recommendations.	High range of numeracy scores on two questions. Validated in a small sample of primarily females.
Stieglitz Informal Reading Assessment of Cancer Text	Not tested for validity or reliability nor correlated with standard existing health literacy tests.	Tests readability as well as comprehension of cancer informational text. Designed to reduce shame.	Limited testing in small sample and not validated.
Test of Functional Health Literacy in Dentistry	Correlated with REALD-99 (0.82), TOFHLA, (0.52), and REALM (0.53); was positively correlated with OHIP-14 ($P < 0.05$), but not with parent or child oral health. Reliability was 0.63.	Includes a test of numeracy.	Long version may be time consuming, validated in small population with high education attainment.
Nutritional Literacy Scale	Correlated with S-TOFHLA (0.61), and demonstrated internal consistency (0.84). Scores among groups were different with overweight respondents scoring lower and those interested in nutrition scored higher ($F = 6.74$, $p < .001$).	May add to understanding of nutritional literacy and health outcomes.	Small sample used for validation with little discrimination 2% scored in the inadequate range and 93% in the adequate range.
Rapid Estimate of Adult Literacy in Dentistry 99; short form	REALD-99 correlated with REALM (0.80), self-perceived oral health status of the parent (0.61) and the OHIP-14 (0.73); was associated with parents' OHIP-14 score in multivariate analysis; and demonstrated reliability (0.86).	Quick and easy to administer.	Only measures one dimension of health literacy and validated with convenience sample. Does not measure the patient's understanding of the words.
Diabetes Numeracy Test; short form	Correlated with REALM (0.54), WRAT (0.62), and Diabetes Knowledge Test (0.71); and had internal reliability (0.95). Construct validity was indicated by correlation with education, literacy and math skills ($p < .05$). DNT15 had good internal reliability (0.90 and 0.89); split sample analysis, correlated with the full DNT in both subsamples (0.96 and 0.97).	Tests numeracy associated with diabetes management.	Validated in highly educated sample and resulted in mean score correct of 61%—may be difficult or require high numeracy skills.
Rapid Estimate of Adult Literacy in Genetics; short form	REAL-G correlated with REALM (0.83), and identified readers at the sixth grade level or below (95.4% sensitivity and 88.5% specificity). Scores on the 8-item REAL-G were correlated with the eight-item REALM (0.80) and REALM (0.80).	Quick and easy to administer.	Only measures one dimension of health literacy. Does not measure the patient's understanding of the words.
Rapid Estimate of Adult Literacy in Vascular Surgery	Correlated with REALM (0.91, 0.82); both measures demonstrated high internal consistency (0.98, 0.86).	Quick and easy to administer.	Only measures one dimension of health literacy. Does not measure the patient's understanding of the words.
Brief Estimate of Health Knowledge and Action—HIV Version	PC analysis mapped onto two factors, item-total correlations were significant: knowledge (0.63) and action (0.94). Scores predicted medication adherence with a sensitivity of 0.76, and specificity of 0.82.	Assessment of knowledge of HIV can be integrated into health care.	Limited psychometric testing.
HBP-Health Literacy Scale	Correlated with TOFHLA (0.80), NVS (0.76), and the total functional health literacy subscale (0.82), and	Focus on functional health literacy.	Limited testing in specific population Korean Americans.

(*Continued*)

Table 3. Continued

	Validation	Strengths	Limitations
	theoretically selected variables (education, 0.67; high blood pressure knowledge, 0.33). Testing indicated reliability (0.98).		
Food Label Literacy for Applied Nutrition Knowledge Questionnaire	Demonstrated reliability (0.77) and test–retest correlation (0.68).	Designed as assessment of change in understanding following participation in a nutrition program.	Only measures one dimension of health literacy. Not rigorously validated against like construct measures.
Chinese Health Literacy Scale for Chronic Care	Correlated with Chinese literacy level (0.80) was negatively correlated with age (−0.31), had good internal reliability (0.91), and good test–retest reliability (0.77).	Assessment of remembering, understanding, applying and analyzing in population with comorbidities.	Tested only in Chinese older adult population.
Chinese Health Literacy Scale for Diabetes	Correlated with Diabetic Knowledge Scale (0.40), the Diabetic Management. Self-Efficacy Scale (0.26), Preschool and Primary Chinese Literacy Scale (0.82), Chinese Value of Learning Scale (0.30). CHLSD and its four subscales demonstrated reliability (0.88), (0.89), (0.67), (0.65), (0.72).	Assessment of diabetes decision making.	Tested in small sample.
Nutrition Literacy Assessment Instrument	Correlation with REALM was not significant (0.38, $p = .06$).	Quick and easy to administer.	Tested in small sample. Validation testing was inadequate.
Population- or language-specific health literacy			
Rapid Estimate of Adolescent Literacy in Medicine	Correlated with WRAT-3 (0.83), SORT-R (0.93). Internal consistency was demonstrated (0.94).	Addresses specific needs of adolescence; quick and easy to administer. It is short, can be easily administered with minimal training, and is strongly correlated with standardized literacy assessments. Test scores, which are expressed as grade-level estimates can be compared with actual grade level.	Only measures one dimension of health literacy. Does not measure the patient's understanding of the words. It can only detect reading grade ranges and below-grade reading levels (low literacy), not specific grades. It cannot diagnose learning problems. It requires an interviewer to administer it and focuses on literacy versus health literacy. Only available in English and appropriate for a limited target audience of teens.
Hebrew Health Literacy Test	Correlation with subjective level 0.67 ($p < .0001$). In a linear regression model, sex, age, and education explained 53% of the variance in the levels of HHLT and the three variables were significantly associated with health literacy levels in the model.	Predictive validity was good as results of HHLT corresponded with studies in the United States regarding association with age, sex, education.	Developed using a convenience sample of only 119 people.
Korean Health Literacy Scale	The overall fit of the two-factor model of the scale was assessed by root mean square error of approximation (0.039), indicating a good fit (criterion .05 or less); with an internal consistency of 0.89.	Measure uses questionnaire format containing short passages, pictures, and graphs with multiple-choice answer format, providing a skills-based approach to measurement. Authors used factor analysis methods for development.	Developed using a convenience sample of 411 community members. No concurrent validity assessed due to lack of a comparative instrument. 10% of study participants needed assistance from interviewers.

Short Assessment of Health Literacy for Spanish-Speaking Adults	Correlated with SAHLSA (0.88), Spanish TOFHLA (0.62). English version correlates better than Spanish version with years of schooling.	Available in Spanish and English. The instrument has only 18 items, is easy to administer and takes 2–3 min. Used item response theory analysis methods and found SAHL-Spanish and English score was highly reliable.	Is based on standard "dictionary" Spanish and English. Focuses on reading skill in the health care context and does not address numeracy and interpersonal communication.
Instrument for Measuring Health Literacy for Canadian High School Students	Correlated with Understand and Evaluate scores (0.80), and the overall scores (0.97, 0.92). Regression model with 15 variables explained 57% of the variation in the health literacy dependent variable. Moderate positive correlations of domain/overall scores with both self-reported grade point average and academic skills.	Performance-based appropriate that entails tasks that measure student's ability to understand and evaluate health information.	Developed using a convenience sample of 275 individuals. Focuses only on adolescents.
Taiwan Health Literacy Scale; short form	Factors that significantly differentiate the various levels of health literacy were education, female gender, age, family members of stroke victims, experience with patient care, and health professionals.	This population specific measure was validated for short-form use.	Convenience sample of 686. Focus appears to be on health knowledge.
Parental Health Literacy Activities Test; Spanish version; short form	Correlated with S-TOFHLA (0.53), WRAT-3 Arithmetic (0.55). Greater scores were associated with greater years of education, level of confidence filling out forms and decreased frequency of needing help from others to understand information.	Uses a skills-based approach and includes numeracy.	Developed using a convenience sample of 176 caregivers.
Mandarin Health Literacy Scale	Exploratory factor analysis identified eight factors and they explain 63% of the variance. Confirmatory factor analysis indicates good model fit. Satisfactory item-total correlations. Of the 63 items, 48 had item-total correlations of .40.	Used item response theory for tool development. Skills-based approach to measurement.	Relatively small sample used for development, but authors say that it was random.
Cancer Message Literacy Tests Listening and Reading	Comparison of mean scores by education level revealed significant differences between those with a four year college degree and those without on one the reading component but not the listening component.	Addresses spoken health information in the assessment. Addresses comprehension and includes a variety of message types.	Developed as part of a pilot study using only 79 participants.
Health Literacy Test for Singapore	Correlated with NVS (0.55). Inadequate health literacy was associated with lower education and older age. Those with adequate health literacy had a higher mean score on the chronic disease knowledge test.	This population specific measure was moderately correlated with the NVS and provides across several dimensions of health literacy.	Used a convenience sample of 466 patients in waiting areas.

Note. AUC = area under the curve; AUROC = area under receiver operating characteristic; CFI = comparative fit index; CHLSD = Chinese Health Literacy Scale for Diabetes; DNT = Diabetes Numeracy Test; HHLT = Hebrew Health Literacy Test; Lipkus = Lipkus Expanded Health Numeracy Scale; METER = Medical Term Recognition Test; NALS = National Adult Literacy Survey; NVS = Newest Vital Sign; OHIP = Oral Health Impact Profile; REALD = Rapid Estimate of Adult Literacy in Dentistry; REAL-G = Rapid Estimate of Adult Literacy in Genetics; REALM = Rapid Estimate of Adult Literacy in Medicine; RMSEA = root mean square error of approximation; S-TOFHLA = short form of the Test of Functional Health Literacy in Adults; SAHLSA = Short Assessment of Health Literacy for Spanish-Speaking Adults; SORT = Slosson Oral Reading Test; SRMR = standard root mean square residual; TLI = Tucker-Lewis Index; WRAT = Wide Range Achievement Test.

Discussion

This work presents the most comprehensive inventory of health literacy measures to date. The measures vary from basic screening items to more comprehensive performance-based assessments. Instruments vary in how they operationalize the concept of health literacy into a measureable construct. Most measures address a limited set of the conceptual dimensions of health literacy. While some measures address communication and comprehension; others focus on function, participation, and decision making. Performance based measures vary from word recognition to cloze style—fill in the blank, and question-and-answer based on some type of stimuli (e.g., food label). Mode and administration styles vary, including self-report, in-person timed performance assessments, and remote electronic data collection. The time and resources needed to implement measures varies considerably across the measures. Scoring approaches and categories/levels of health literacy on the basis of measure performance also vary.

While some studies used psychometric analyses including exploratory and confirmatory factor analysis, others used regression analyses to examine the relationships between their new measure and demographic and social variables. Many measures were correlated with the REALM or TOFHLA (S-TOFHLA), as gold standards. Few measures were examined for all the key types of validity including content, construct, criterion, internal, and predictive validity.

Despite the large number of tools available, significant gaps in health literacy measurement exist. Health literacy measurement will advance when available tools assess all of the defined dimensions of health literacy. This will allow investigators to examine and compare the predictive validity of the different dimensions in various settings and populations. This can then lead to further refinement of conceptual models and ultimately to improvements in intervention design. The dearth of assessment of *navigation* may be due to challenges in operationalizing the concept into a form that is amenable to the testing modes being developed. The dimension *confidence* has also been rarely represented in these tools; however, multiple other tools outside the scope of this paper are dedicated to measuring self-efficacy. The dimension *responsibility* has also rarely been included in these tools, but this may be due to lack of consensus for the inclusion of this concept as a dimension of health literacy. Consensus about the conceptual dimensions of health literacy and assessment of these dimensions in tool development will guide future efforts in health literacy measurement design, validation, and reporting (McCormack et al., 2013).

This article provides an extensive inventory of health literacy measures; however limitations should be considered when evaluating the presented information. First, health literacy is a broad concept without a single definition; thus, it is a challenge to place distinct parameters on the definition of what should be accepted as a health literacy measure. For example, a tool described as a measure of mental health literacy was not included in this review as it was deemed by the authors to be a measure of mental health knowledge and not a measure of health literacy. Second, several publications did not report all information necessary to complete a comprehensive review of their properties. We were able in some cases to identify additional validation data from subsequent sources, but we did not contact authors to obtain unpublished details which may exist. Furthermore, more comprehensive validation information for these tools may have been presented in subsequent publications not included in this review. Third, we made assessments of the instruments' dimensions, strengths, and weaknesses on the basis of our own experience and judgment; as such, this was a subjective review. To minimize the effect of the issue of subjectivity, each measure was analyzed by multiple authors, and any discrepancy was addressed by all the authors and resolved through discussion. Throughout the dimension

review process we struggled to find consensus on the dimensions and are acutely aware that the field is still evolving as to how dimensions are operationalized. We anticipate there is much room for growth in crystalizing the dimensions of health literacy and how they are directly measured—we propose this dimension review as a starting point—a point for discussion and debate to help move the field forward in the context of measuring the dimensions of health literacy.

Practice Implications

As instruments for measuring health literacy continue to be published, we advise clinicians, health professionals and researchers to evaluate available health literacy measurements for a conceptual and practical match with the goals of their work when choosing a health literacy instrument. When selecting a practical match, style of administration, purpose for measurement, and availability of time and resources should be considered. Choosing a health literacy measurement closely aligned with the topic or task under consideration and one that has been validated in a similar target population may be important to have an accurate measure of the domain being assessed. In addition measures should be considered given their predictive qualities and appropriateness for assessment of changes in health literacy and outcomes over time.

In some contexts brief screening tools and/or subjective measures may be the most efficient and appropriate choice; it depends on the goals and purpose for use. Such instruments may minimize performance pressure and embarrassment, although the subject's test experience was also outside the scope of the present article. In many research contexts, performance-based tools are more appropriate. When possible, use of comprehensive measures to gain in-depth comparative knowledge regarding the dimensions of health literacy or across multiple measures to allow comparison across instruments is particularly useful to the field. Repeated measures are also recommended to support validity and a knowledge base in longitudinal research. It is our hope that this inventory and review of health literacy measurements can improve health literacy measurement selection in policy, research and quality improvement projects.

Conclusion

A plethora of health literacy measures exist but they vary in the dimensions they measure and the level of psychometric rigor to exhibit various aspects of validity. Health literacy measures currently available demonstrate few modes of administration and vary in the time and resources needed to use them. On the basis of these findings we conclude the field still lacks in a single rigorously validated health literacy measure that addresses the full range of dimensions which represent this complex construct.

The ongoing development of instruments suggests that there is still a need for comprehensive measurement across diverse populations. This review provides evidence that comprehensive validated measurements for diverse populations are needed. Multiple dimensions that figure prominently in conceptual models are rarely measured in existing tools. This has severely narrowed the field of health literacy. In addition, fundamental limitations in validation procedures are common. This threatens the appropriateness of general use for multiple tools.

This inventory provides information to enable decision makers and health professionals in research, policy, and practice to select the most appropriate tool available. Although we hope the tables in this article will help numerous health and public health investigators and practitioners, new tools and validation papers

will continue to emerge. Although this article presents a much-needed comprehensive review of health literacy measurements, because of the ongoing evolution of the field, this article is already dated. As such, our inventory exhibits the need for an ongoing publically accessible compendium of health literacy tools and validation data with expert critical appraisal to serve as a public resource. To support clarity and accuracy authors can explicitly report measure characteristics, strengths, weaknesses and dimensions, along with their validation efforts. This will create continuity and a standardized approach to reporting that will help advance the science of health literacy measurement.

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