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PUBLIC HEALTH & PRIMARY CARE | RESEARCH ARTICLE

Health literacy test for limited literacy populations (HELT-LL): Validation in South Africa

Chipiwa Marimwe¹ and Ros Dowse^{1*}

Abstract: The majority of health literacy measures emanate from high-income countries and are inappropriate for use in limited literacy individuals who are usually excluded from participation in health literacy studies. There is currently no appropriate health literacy measure for the educationally diverse South African population. This study, which reports the validation of the Health Literacy Test for Limited Literacy individuals (HELT-LL), was conducted in primary health-care clinics with 210 isiXhosa-speaking patients with a maximum of 12 years of schooling. The HELT-LL has varied cognitive demands, assesses functional literacy skills as well as local burden of disease knowledge, and also includes self-reported questions. The Multidimensional Screener of Functional Health Literacy (MSFHL) was used as the comparator. Almost a third of the study population (32.4%) had inadequate health literacy, with only a low 17.6% achieving an adequate health literacy rating. The majority of patients (65.9%) with inadequate health literacy had minimal formal schooling of between 0 and 4 years. The HELT-LL score was significantly associated with education ($p < 0.001$), age ($p < 0.001$) and English proficiency ($p < 0.001$). Significant concurrent validity with the MSFHL was established. The HELT-LL is the first general health literacy measure to be developed in South Africa with the aim of enabling the evaluation of health literacy in limited literacy individuals. It was shown to be a valid and reliable measure of health literacy, with good discriminatory ability amongst participants with varying degrees of schooling. It has afforded preliminary insight into the health literacy of the more vulnerable public sector patient population in South Africa.

ABOUT THE AUTHOR

Dr Chipiwa Marimwe holds a PhD in Pharmacy from Rhodes University. Her current research focuses on measures to assess health literacy in limited literacy multilingual public sector patients in South Africa.

PUBLIC INTEREST STATEMENT

Health literacy has been shown to significantly influence health outcomes and patient health. Therefore, it has become increasingly important to identify individuals with limited health literacy. In this paper, we aim to validate a health literacy measure that is contextually and culturally appropriate to measure health literacy in limited literacy multilingual patients in South Africa. There is currently a dearth of health literacy measures which are applicable for use in this demographic and our study makes a significant contribution to knowledge associated with the assessment of health literacy in diverse settings. It also provides valuable South African health literacy data which could inform the development of interventions focusing on improving health literacy and health outcomes.

Subjects: Health & Society; Health Conditions; Public Health Policy and Practice

Keywords: Health literacy; health literacy measure; validation; limited literacy; primary health-care clinics

Health literacy is recognised as a public health issue with increasing evidence showcasing its importance in health, health outcomes and health behaviours. It is associated with knowledge of medical conditions and treatments, the ability to understand health information, adherence to treatment (Noureldin et al., 2012; Speros, 2005) and the use of preventative health-care services (Bennett et al., 1998; Ross, 2007; Scott, Gazmararian, Williams, & Baker, 2002; U.S Department of Health and Human Services, 2010). The growing complexity of the health-care system and the increasing burden of non-communicable diseases demand greater participation in self-care, further underscoring the importance of adequate health literacy (Johnson, 2014; Kickbusch, 2001).

Health literacy is a complex construct that has been described by a wide range of definitions and conceptual models. A high number of health literacy measures have been developed globally and almost all emanate exclusively from high-income countries (HICs). Internationally, the most popular health literacy measures include the TOFHLA (Parker, Baker, Williams, & Nurss, 1995), the REALM (Davis et al., 1993) and the NVS (Weiss et al., 2005). These measures usually have limited application in low- and middle-income countries (LMICs) due to the significantly different structuring of health-care systems, they overlook the extreme discrepancies in educational levels, and they rely too heavily on reading ability and numeracy (Fransen, Van Schaik, Twickler, & Essink-Bot, 2011).

In South Africa, health literacy has not been formally defined as a public policy issue (Pleasant, 2013), with health literacy research being in its infancy. There is no general health literacy measure validated for use in the country. The few papers that have been published describe the inappropriateness of the original Rapid Estimate of Adult Literacy in Medicine (REALM) (Dowse, Lecoko, & Ehlers, 2010; Hunt, Dowse, & La Rose, 2008), as well as the unsuccessful adaptation of that measure for use in a limited literacy population (Dowse et al., 2010; Hunt et al., 2008). A disease-specific measure was developed, based on the revised version of the REALM (REALM-R) (Bass, Wilson, & Griffith, 2003) to assess hypertension health literacy in primary health-care clinics named the Hypertension Health Literacy Assessment Tool (HHLAT) (Mafutha, Mogotlane, De Swardt, & Mafutha, 2017). Despite being reported to be a valid measure for hypertension health literacy, the word recognition test format was shown by Dowse et al. (2010) to have significant limitations in assessing functional health literacy in a limited literacy population. It also fails to address broader definitions of health literacy which is particularly relevant in LMIC populations.

Health care in South Africa is delivered by two distinct systems: the private sector and the public sector. The former is inaccessible to approximately 84% of the population (Council for Medical Schemes, 2016) who are therefore cared for within the public health sector. Many individuals utilising public health-care facilities tend to have low educational levels and low socioeconomic status and constitute the ethnic majority (Brand South Africa, 2012). Limited health literacy is a factor which will continue to compound the vast health inequalities in South Africa; therefore identifying individuals with inadequate health literacy could be a valuable step in mitigating these disparities. The lack of availability of formal national health literacy data is largely due to the absence of an appropriate health literacy measure that can accommodate the unique characteristics of a multicultural, multi-ethnic and multilingual population in which literacy skills of the majority vary widely.

This underscores the importance of developing and validating health literacy tools which take into account the unique features of their population and the multidimensional nature of health literacy (How, 2011). Our study is the first to aim to develop and validate a reliable measure of general health literacy for use in the South African public sector primary care patient population. An initial paper from this study described the first stage of the developmental process of creating

and evaluating an item bank of health literacy questions (Marimwe & Dowse, 2017). The current paper is a continuation of the development process and describes the refinement of the item bank and validation of the Health Literacy Test for Limited Literacy individuals (HELT-LL).

1. Method

1.1. Conceptual framework

Two health literacy definitions underpinned the development of the framework for our research. The Institute of Medicine (Nielsen-Bohlman, Panzer, & Kindig, 2004) states that “Health literacy is the degree to which individuals can obtain, process and understand the basic health information and services they need to make appropriate health decisions”. The definition from the World Health Organisation (WHO) in its “Health literacy toolkit for low and middle-income countries” (Dodson, Good, & Osborne, 2015) states that “Health literacy refers to the personal characteristics and social resources needed for individuals and communities to access, understand, appraise and use information and services to make decisions about health”.

The former definition makes reference to traditional functional capabilities; the ability to read, write and perform numerical calculations as the foundation for health literacy skills which individuals should possess in order to be able to operate in a healthy environment. The WHO definition looks beyond the narrow concept of health education and individual functional skills, expanding the focus with a socio-cultural perspective, where health literacy is a personal and community asset, extending into communities and homes.

Categorisation of the health literacy items into domains was informed by Nutbeam (2000). This approach acknowledges different literacies which are not only restricted to basic reading and writing skills but also incorporates a focus on the practical application of these skills in supporting and managing health. The domains include functional/basic, communicative/interactive, and critical health literacy. Functional health literacy highlights basic reading and writing skills which the individual requires to function in everyday situations. Communicative health literacy relates to a combination of advanced cognitive and literacy skill with social skills to obtain information from various forms of communication and apply it to everyday situations. Critical literacy assesses the more advanced social and cognitive skills needed to analyse information and use it in everyday life, with the ultimate goal being self-empowerment.

1.2. Development process of the HELT-LL

Dowse (2016) recommends accounting for limited literacy individuals by developing measures which do not rely solely on cognitive abilities. It was therefore considered important for any proposed health literacy measure to assess traditional functional skills, but to also include questions that cater for our educationally diverse population, many of whom have limited literacy. The initial phase involved the development of an item bank of 30 health literacy questions that were diverse in format and had varying cognitive demands. Question format included self-reported opinion, as well as more challenging ones that directly interrogated existing health-related knowledge, and others that demanded problem-solving skills. Question content ranged from investigating societal influence on health literacy acquisition in order to acknowledge this broader concept of health literacy, a few reflected local disease burden of both communicable and non-communicable diseases, and others addressed medication use, patient-provider communication and the interaction of patients with the healthcare system. All questions were grounded within the context of the South African public healthcare system and the evaluation of these questions in the target population. This developmental and preliminary evaluation process has been described elsewhere (Marimwe & Dowse, 2017).

Individual questions in the Item Bank were evaluated for inclusion in the final measures using a number of approaches. Floor and ceiling effects were taken into consideration as questions exhibiting these effects have very little variability and are considered undesirable for inclusion in a measure (McHorney & Tarlov, 1995). Item response theory was used to determine the difficulty and

discrimination parameters of individual questions. Other psychometric properties assessed percentage of correct responses, the alpha value if an item is deleted, and the item-total correlation (Table 1).

In addition, the decision to include or exclude item bank questions when creating the HELT-LL was based on feedback from a consultant panel of experts that included doctors, nurses and pharmacists, all with extensive experience of working with South African public sector patients, as well as an African language expert. The panel interrogated all 30 questions to identify those suitable for inclusion in the final test. During this process, the following were considered: results from the psychometric analyses, results of questions assessing similar skills or opinions, repetitive questions, possible problems with question content resulting in participant confusion, the need to reword questions to avoid confusion or clarify a focus, and the need to ensure a selection of questions that covered all three health literacy domains.

Time taken for test completion was also considered. The intention was to create a measure that could be applied in either a clinical or a research setting and which could be completed in approximately 5 min. The aim was to include a maximum of 15 questions.

The final version of the HELT-LL consisted of 12 questions. The questions were categorised into the three health literacy domains informed by Nutbeam (2000). The functional health literacy domain contained seven questions of which three assessed basic mathematical skill, one interrogated the ability to read and understand written health information, and three assessed factual disease-related knowledge which reflected local high disease-burden conditions. The communicative health literacy domain included two questions relating to accessing information from different sources, with one reflecting the level of personal empowerment. The three questions in the critical literacy domain assessed the ability to obtain health information in order to make healthy decisions, consider whether information is applicable to them and consider the credibility of the information.

1.3. Study setting

This cross-sectional validation study was conducted in four primary health-care clinics (PHCs) in two small peri-urban towns in the Eastern Cape Province in South Africa. The province, one of nine in the country, has 6.5 million people (Statistics South Africa, 2017) the majority (86.3%) of whom are black African. It is the poorest province and has one of the highest unemployment rates of 32.2% (Statistics South Africa, 2017). In the local population from which the participants were drawn, more than three quarters of the population speak isiXhosa (77.6%) as their first language. Only 19.8% have completed Grade 12, while 10.5% have no formal schooling. (Statistics South Africa, 2011).

1.4. Study design and participants

A convenience sampling technique was adopted for this study. Theoretically, a sample size of 120 participants was required to support a ratio of 10 subjects per item for the measure to be validated (Hair & Anderson, 1998; Nunnally, 1978). The final number of 210 participants was almost double the required sample size and was used to increase the power of the test (Kwan, Zumbo, Kelly, Hayes, & Fraser, 2006; Williams, Baker, Parker, & Nurss, 1998).

All participants had to be above the age of 18 years, speak isiXhosa as their home language, have a maximum of 12 years of schooling and attend public sector health-care facilities. Exclusion criteria included evidence of cognitive, hearing or visual impairment (informally assessed through initial conversation with the participants). The participants were stratified equally into four educational groups; 0–Grade 4, Grade 5–7, Grade 8–10 and Grade 11–12.

1.5. Questionnaire

The Multidimensional Screener of Functional Health Literacy (MSFHL) was developed in Brazil, and is based on demographic characteristics, simple questions about literacy habits, and ratings of perceived difficulties with reading and writing (Apolinario, Mansur, Carthery-Goulart, Brucki, & Nitrini, 2014). It

Table 1. Selection criteria for questions from the item bank (☐ indicates a result within the acceptable range)

Questions	% Correct ¹	Item Difficulty ²	Item Discrimination ³	Alpha if item deleted ⁴
1. Community-based health talks offered	-	-	-	✓
2. Community support available when sick with TB	-	-	-	✓
3. Family support available after an operation	-	-	-	✓
4. Asking the doctor for information about health problems	✓	✓	✓	✓
5. Asking the doctor questions during consultation	✓	✓	✓	✓
6. Sceptical about health information from friends and neighbours	✓	✓	✓	✓
7. Ability to use the internet to find health information	✓	-	✓	✓
8. Ability to access transport to the clinic	✓	✓	-	-
9. Ability to deal with stressful situations	✓	✓	-	-
10. Understand instructions to take medication	-	-	-	✓
11. No difficulty understanding written information	✓	✓	✓	✓
12. No help needed when reading written health materials	✓	✓	✓	✓
13. Date of clinic return visit 2 weeks after 7 March	✓	✓	✓	✓
14. 4 out of 20 people may get a cold; give the percentage (%) chance	-	-	-	✓
15. One tablet to be taken three times a day. If the first tablet is at 7 am, give the time of the next dose	-	-	-	✓
16. Indicate 2 ml on a graduated syringe	✓	-	✓	✓
17. Choice of healthy meal option	-	-	-	✓
18. Not acceptable for HCPs to discuss your health with other patients	-	-	-	✓
19. Distrust of quality of internet-based information	-	-	✓	✓
20. State normal body temperature	-	-	✓	✓
21. Explain what diabetes is	-	-	-	✓
22. Comparative risk for thin or overweight person of developing diabetes	✓	-	✓	✓
23. Identify blood pressure reading closest to normal	✓	-	-	✓

(Continued)

Table 1. (Continued)

Questions	% Correct ¹	Item Difficulty ²	Item Discrimination ³	Alpha if item deleted ⁴
24. State if HIV/AIDS can be cured	✓	-	✓	✓
25. State if TB is transmitted by using the same toilet as a TB patient	✓	-	✓	✓
26. Comparative risk of getting TB if person has HIV/AIDS	✓	✓	✓	✓
27. Making time to exercise at least three times a week	✓	✓	-	✓
28. Need to finish the course of antibiotics	-	-	-	✓
29. Concurrent use of herbal/traditional medicine with prescribed medicine	-	-	-	-
30. Safety of herbal/traditional medicines	✓	-	-	✓

¹Acceptable range for % correct: 20%-80%.

²Acceptable range for item difficulty (Dif): 0.25-0.75.

³Acceptable range for item discrimination (Dis): ≥ 0.3 .

⁴Acceptable range for alpha when item deleted: ≤ 0.666 .

Highlighted questions indicate questions included in the HELT-LL.

was used as the comparator as it was also developed and validated in an LMIC. The measure was modified to ensure local applicability (Marimwe & Dowse, 2017).

Data collected for our study included demographic and socioeconomic data, and health literacy data from the HELT-LL and the modified MSFHL. Both the HELT-LL and the MSFHL were translated into isiXhosa by an African language specialist, and back-translated by a different language expert fluent in both English and isiXhosa. The isiXhosa versions of the measures were used by the interpreter during the interview.

1.6. Recruitment and interview process

To assist with communicating between the researcher (CM) and participants, an interpreter fluent in both English and isiXhosa was trained by the researcher to assist with all interviews. Between August and September 2017, the interpreter and the researcher (CM) approached potential participants at the clinics and provided a brief explanation of the study and procedures. Before the interviews, participants were assessed for eligibility criteria and written consent was obtained. The questionnaire was then administered via a face-to-face interview with the aid of the trained interpreter who had been instructed to read the translated Xhosa version of each question to the participant, to accurately report the responses provided, and to attempt to avoid additional explanation. At the conclusion of the interview, all participants were remunerated for their input and time with a R50 (\$3.60) gift voucher from a local supermarket.

The study was approved by the Faculty of Pharmacy Ethics Committee (PHARM-2017-03) and the Eastern Cape Department of Health (EC_2015RP40_351). Permission to work in the clinics was granted by the Makana District Health Coordinators.

1.7. Statistical analysis

The responses to the questions in the HELT-LL were in the form of either a 3-point Likert Scale or a correct/incorrect response. For the Likert Scale questions, two marks were assigned to the most favourable response indicating satisfactory health literacy, one mark to the next favourable response, and zero to the least favourable response. For questions requiring a specific answer, two marks were allocated for the correct answer, and zero for incorrect answers. The maximum score for the 12-question HELT-LL was 24.

Frequency data were generated. The mean and standard deviation for the HELT-LL and the MSFHL scores were calculated. HELT-LL categories were defined as inadequate (0–10), marginal (11–20) or adequate (21–24). The choice of cut-off points for each HL category was informed by checking cut-off points for a number of other health literacy tests. Although some HL measures present data in only two categories (adequate and inadequate), we considered it essential to allow for additional differentiation within our population, in which only a predicted minority were likely to achieve “adequate” health literacy status. As such, three HL categories are presented in order to provide further insight into those who did not achieve adequate HL status.

The association of selected demographic and socioeconomic variables with the HELT-LL score was computed using one-way ANOVA. Correlations between the HELT-LL and the MSFHL scores were determined using Pearson’s correlation test. The criteria for interpreting the correlation were as follows: 0.0–0.25 weak correlation, 0.26–0.50 moderate correlation, 0.51–0.75 strong correlation, and >0.75 very strong correlation (Godwin, Pike, Bethune, & Kirby, 2013).

To assess reliability, internal consistency of items within the HELT-LL was assessed by Cronbach’s alpha coefficient. A Cronbach’s alpha value of greater than 0.60 was considered to be acceptable to establish internal consistency (Nunnally, 1978). The reliability of the HELT-LL was also evaluated through the test-retest approach, which was re-administered to 40 participants 2 weeks after initial administration. Pearson’s correlation was used to determine the relationship

between each item at the two phases. All analyses were performed with SPSS Version 25. Statistical significance was set at $p < 0.05$.

2. Results

2.1. Demographic and socioeconomic characteristics

Demographic and socioeconomic characteristics of the 210 participants are presented in Table 2. The majority of participants were female (85.2%), the mean age was 42.9 ± 14.4 years, and approximately 40% had only a primary school education.

Over three quarters (76.7%) of the participants reported being able to listen, speak and read English, while 14.3% were unable to communicate in English. Seventy per cent were unemployed,

Table 2. Participant demographic and socioeconomic characteristics (n = 210)

Demographics	Total n (%)
Gender	
Male	31 (14.8)
Female	179 (85.2)
Age (years)	
18–29	44 (21.0)
30–44	70 (33.3)
45–59	68 (32.4)
≥60	28 (13.3)
Education	
Grade 0–4	41 (19.5)
Grade 5–7	45 (21.4)
Grade 8–10	57 (27.2)
Grade 11–12	67 (31.9)
Self-reported English literacy	
No understanding	17 (8.1)
Verbal understanding but unable to respond	13 (6.2)
Verbal understanding and able to respond	19 (9.0)
Verbal understanding, able to respond and read	161 (76.7)
Employed	
Yes	63 (30.0)
No	147 (70.0)
Type of employment	
Not employed	147 (70.0)
Predominantly manual	60 (28.6)
Predominantly non-manual	3 (1.4)
Recipient of social grant	
Yes	121 (57.6)
No	89 (42.4)
Income¹	
< R2000	37 (17.6)
R2000—R5000	21 (10.0)
> R5000	5 (2.4)
N/A	147 (70.0)
Number living in the house	
1–5	167 (79.5)
6–10	41 (19.5)
> 10	2 (1.0)
Use of technology	
Have a computer	10 (4.8)
Can look for health information on computer	53 (25.2)
Have a mobile phone	165 (78.6)
Can look for health information on mobile phone	28 (13.3)

¹One US dollar ~ 14.5 South African Rands.

and more than half (57.6%) received government grants, with the most commonly received grants being child support (35.2%) and older person (12.4%) grants. Although possession of a computer was low (4.8%), a majority (78.6%) had a mobile phone, although many were not smartphones. In order to access health-related information, only 25% stated being able to use a computer, and a much lower 13.3% a mobile phone.

2.2. HELT-LL results

Table 3 presents responses to individual questions that were correct or reflected higher health literacy. The mean percentage total score for the HELT-LL was $52.8 \pm 18.4\%$, and the average time taken to administer the test was 3.6 ± 0.9 min.

3. Functional health literacy

Two numeracy questions (Q1, Q2) were amongst the three most poorly answered. The ability to read written health information was clearly difficult for most participants (Q3), with only 40% reporting being able to do so without assistance. Whole number identification was good, with the majority (Q4; 86.7%) being able to identify the 2 ml mark on a graduated syringe. Three of the questions interrogating knowledge relating to local disease burden were based on hypertension, HIV/AIDS and TB. Less than half identified the correct blood pressure reading from three options (Q5; 48.6%), under two-thirds (Q6; 61.4%) knew that TB was not transmitted by sharing a toilet with someone who had TB, and 44% thought that HIV/AIDS could be cured (Q7).

4. Communicative health literacy

Q8 highlights the extent of patient disempowerment in the public health sector, with less than a quarter (23.8%) indicating ever asking HCPs for information. However, just over half (Q9; 52.4%) of the participants preferred to source health information from the clinic as opposed to asking friends and neighbours.

5. Critical health literacy

Unlike individuals in developed countries where use of the internet is endemic, only a third (Q10; 32.4%) of our participants reported knowing how to look for health information on the internet. Just over a third (Q11; 34.8%) knew that information from the internet could not always be trusted. Question 12 addressed the locally important issue of traditional medicine use, with 84.3% correctly reporting that herbal/traditional medicines were not always safe to use.

5.1. Association between HELT-LL score and demographic variables

Table 4 shows that significant correlations with the HELT-LL score were established for age ($p < 0.001$), education ($p < 0.001$), and English proficiency ($p < 0.001$). Younger individuals performed better than older individuals, and Tukey post-hoc analyses showed significant reductions in the mean scores between the 30–44 year versus 45–60 year age group ($p < 0.001$), and between the 45–60 year and >60 year age groups ($p = 0.023$).

Tukey post-hoc analysis of education and the HELT-LL score indicated significant differences ($p < 0.001$) in the mean scores between all educational groups apart from between the Grade 0–4 and Grade 5–7-year categories ($p = 0.849$).

The influence of English proficiency on total score was also significant; individuals who had the highest level of self-reported English literacy had almost double the mean score of those having no understanding of the English language. Tukey post-hoc analysis showed that those with the highest English literacy (understand, respond and read) had a significantly higher score compared to all three lower categories of English literacy ($p < 0.001$ for all three).

Employment, higher income and the ability to look for health information, using either a computer or a mobile phone, also significantly and positively influenced the health literacy score, with a significance of $p < 0.001$ for all.

Table 3. Correct responses or responses reflecting higher health literacy (n = 210)

Health literacy domain and individual questions	Score (%)
Functional health literacy	
1. If you go to the clinic on the 7 th March and you are asked to return to the clinic 2 weeks later, what will the date be?	61 (29.0)
2. You are told to take one tablet three times a day, every 8 h. If you take your first tablet each day at 7 am, when should you take the next one?	42 (20.0)
3. How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor/nurse/pharmacist? (example of package insert shown)	87 (41.4)
4. You are told to give a child 2 ml of a liquid medicine. On the syringe, please show me where you will fill the syringe up to. (image of syringe shown)	182 (86.7)
5. Which of the three blood pressure readings is closest to a normal blood pressure reading? (3 options shown)	102 (48.6)
6. Can you get TB if you use the same toilet as someone with TB?	129 (61.4)
7. Can HIV/AIDS be cured?	118 (56.2)
Communicative/interactive health literacy	
8. If you don't understand what the nurse/doctor/pharmacist says, do you usually ask them to give you more information and explain things to you?	50 (23.8)
9. If you are worried about a health problem, do you usually ask your friends and neighbours first for information and advice before going to the clinic?	110 (52.4)
Critical health literacy	
10. Do you know how to use a computer or cellphone to answer your health-related questions?	68 (32.4)
11. Do you think that health information from the internet on your cellphone or computer is always good information that you can trust?	73 (34.8)
12. Herbal/traditional medicines are natural and are from plants. Are they always safe to take?	177 (84.3)
Total mean score = 52.8 ± 18.4%	
Average time = 3.6 ± 0.9 min	

Table 4. Association between mean HELT-LL score and selected variables

Variable	Mean % HELT-LL score ± SD	p value
Age (years)		<0.001
18–29	60.8 ± 23.9	
30–44	59.6 ± 28.6	
45–59	47.1 ± 38.0	
≥60	36.7 ± 38.6	
Education		<0.001
Grade 0–4	39.2 ± 39.2	
Grade 5–7	42.1 ± 40.6	
Grade 8–10	55.8 ± 23.9	
Grade 11–12	64.6 ± 20.6	
Self-reported English literacy		<0.001
No understanding	29.6 ± 42.2	
Verbal understanding but unable to respond	34.6 ± 44.6	
Verbal understanding and able to respond	39.6 ± 43.2	
Verbal understanding, able to respond and read	57.9 ± 24.5	

5.2. Health literacy categories

The 210 participants were classified into three health literacy categories for both the HELT-LL and the comparator, the MSFHL (Figure 1). The HELT-LL categorised only 17.6% as having adequate health literacy. For participants classified as having inadequate health literacy, almost two-thirds (65.9%) had 0–4 years of education, just under three quarters (71.4%) were over the age of 60 years, and 88.2% reported no understanding of the English language. The category with the highest proportion of participants was the marginal health literacy category.

In contrast to the HELT-LL, the MSFHL categorised the highest proportion of the study population (over double that of the HELT-LL) as having adequate health literacy (41.4%). Inadequate health literacy numbers were similar to the HELT-LL, and marginal health literacy numbers were much higher for the HELT-LL.

5.3. Validation results of the HELT-LL

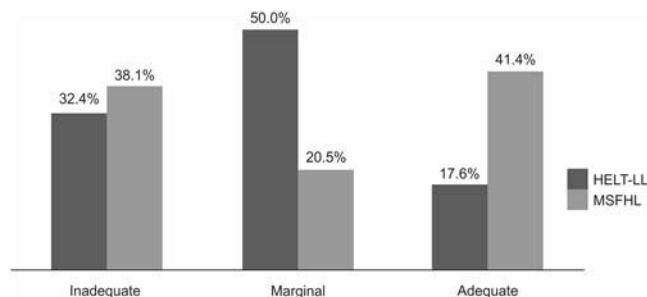
5.3.1. Validity

Content and face validity of all items in the original item bank were established in the earlier stages of development and have been reported elsewhere (Marimwe & Dowse, 2017). Concurrent validity, as shown by the correlation between the HELT-LL and MSFHL scores, indicated a strong and significant correlation ($r = .685, p < 0.001$).

5.3.2. Reliability

Cronbach’s alpha which is used to assess internal consistency was 0.6 for the HELT-LL, a value considered to be within the acceptable range (Nunnally, 1978). Test-retest reliability was evaluated

Figure 1. Comparison of health literacy categories in the HELT-LL and MSFHL tests.



by determining Pearson's correlation coefficient between baseline and follow-up scores. The mean total scores at baseline (13.4 ± 3.8) and follow-up (13.3 ± 3.5) indicated a strong and significant correlation ($r = .927$, $p < 0.001$).

6. Discussion

This is the first paper to report the development and validation of a measure designed to enable the assessment of health literacy in individuals with limited literacy in South Africa. The HELT-LL was shown to be an appropriate, reliable and valid measure which successfully allowed for the differentiation of health literacy levels in a population who have varying exposure to formal schooling. All those with any form of tertiary education were excluded. This is significant as many published health literacy studies automatically exclude individuals with lower levels of education, as well as those unable to read. However, despite a prevalence of questions that were either self-reported or had a lower cognitive demand, less than 20% of the study population successfully achieved adequate literacy status. Good correlation between scores of the HELT-LL and its comparator, the MSFHL, indicated good validity of the measure. Internal consistency was found to be within the acceptable minimum value, and the highly significant correlation of the test-retest results indicates excellent reliability of the measure and its stability over multiple administration times.

The HELT-LL aimed to encompass a broader socio-cultural perspective of health literacy that extends beyond the individual and the clinical encounter, to homes and communities (Center for Health Literacy Promotion, 2009). As well as interrogating individual health literacy skills (reading, numeracy), it expands the focus to the broader social skills for dealing with and acting on health information that can influence health literacy (Jordan, Osborne, & Buchbinder, 2011; Nutbeam, 2000; Peerson & Saunders, 2009). In these often tight-knit communities, the opinions and support of families and the local community play an important role in influencing attitudes to various health conditions and their treatment, are a commonly cited source of health information and tend to participate in decision-making about health concerns.

Health literacy has many determinants, with the most commonly reported being education, age and English proficiency (Dewalt, Berkman, & Sheridan, 2004; Pandit et al., 2009; Sun et al., 2013). It is well established that education is a key determinant of health (Baker, Leon, Smith Greenaway, Collins, & Movit, 2011). Numerous studies have identified significant correlations of health literacy with education, a finding which our results endorse (Cho, Lee, Arozullah, & Crittenden, 2008; Cordasco, Homeier, Franco, Wang, & Sarkisian, 2012; Dewalt et al., 2004; Ganzer, Insel, & Ritter, 2012; Kickbusch, 2001; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005; Stuebing, 1997; Sun et al., 2013; Wolf, Feinglass, Thompson, & Baker, 2010). A significant effect of education was noted on the HELT-LL scores for the educational groupings, but what was particularly noteworthy was the importance of any senior school education, as no significant difference was noted between the two junior school groups (0–7 years). However, any exposure to education beyond seven years resulted in a significant increase in health literacy. The largest difference in score was noted between the two senior school groups, indicating the importance of those last two years of schooling (11–12 years) in developing health literacy skills.

An important aim driving this research project was to develop a measure that had the ability to differentiate health literacy status within a school-only educated population possessing varying literacy skills, particularly amongst those with a greater degree of limited literacy. To our knowledge, this has not been a stated aim of any previous studies in which a new health literacy measure was developed. The discriminatory properties of the HELT-LL were evident in its ability to show a significant difference in the mean score of senior versus primary school groupings, as well as between the two senior school groups. Widespread prevalence of limited health literacy was found, with almost a third having inadequate health literacy, and only 17.6% being considered to have adequate health literacy skills. This is in contrast to the MSFHL which classified a high 41.1% as having adequate health literacy. Greater insight into the health literacy status of lower

literacy patients can inform the degree of support these patients require in treating and self-managing their health conditions.

In South Africa, English is the first language of only 8.2% of the population (Statistics South Africa, 2011). In our study, English literacy was found to have a significant influence on the health literacy score, and a high proportion of those unable to understand English were found within the inadequate HELT-LL health literacy category. The mean HELT-LL score increased by 94.0% from those who were unable to understand any English, to those who could speak and read English. The language policy of the National Department of Health states that English is to be used for international, governmental and electronic communication (National Department of Health, 2015). However, all 11 official languages are to be used for health-related public hearings, meetings, road shows and educational material. Limited English proficiency is a key barrier to health-care, often associated with poorer health status in individuals of different racial or ethnic groups (Jacobs, Karavolos, Rathouz, Ferris, & Powell, 2005).

It is important to note the significance of possessing English reading skills; our study indicated a major upward shift in health literacy (46.2% increase in HELT-LL score) from those participants reporting only being able to understand but not read English. Nurses working in primary care clinics generally speak the local language, so communication problems due to language barriers are unlikely for study participants. It should also be recalled that the HELT-LL was translated into isiXhosa, the first language of the participants, and that all questions and responses were verbal, ensuring that participants were able to understand question content. The combination of poor English literacy and limited health literacy renders individuals vulnerable, placing them at a higher risk of poor health status, disease management and health outcomes (E. J. Kim, Kim, Paasche-Orlow, Rose, & Hanchate, 2017; Sentell & Braun, 2012).

Numeracy is one domain of the general construct of health literacy and these skills have been associated with a range of health-related outcomes such as medication management (Lokker et al., 2009), self-management of chronic conditions such as diabetes (Osborn, Cavanaugh, Wallston, & Rothman, 2010) and asthma (Apter et al., 2006), and the ability to interpret risk information (Gardner, McMillan, Raynor, Woolf, & Knapp, 2011; Gurmankin, Baron, & Armstrong, 2004), amongst others. Most of our participants were unable to process simple arithmetic instructions based on numbers reflecting dates for a follow-up appointment after 2 weeks, and the time at which the next dose should be taken, given a dosing interval of 8 h. This inability to perform basic numeric tasks required to function in the healthcare environment has been reported previously (Bosworth, 2010).

The extended length of some health literacy measures, and the time taken for administration has been highlighted as one of the reasons for infrequent assessment of health literacy (Cawthon, Mion, Willens, Roumie, & Kripalani, 2014; Johnson & Weiss, 2008), whereas shorter measures have been found to be more feasible in a clinical setting (Bann, McCormack, Berkman, & Squiers, 2012). Through refining the item bank of questions from 30 to 12, the short administration time of the HELT-LL of less than 4 min allows for application in time-constrained clinical settings as well as being a useful rapid research measure.

There are limitations to this study. Participants were recruited through convenience sampling from primary health clinics in two small semi-rural towns in one of the nine provinces of South Africa. Assessment of health literacy was conducted in the locally prevalent language of isiXhosa, so all participants were drawn from only 1 of the 11 official language groups. All participants were from a low socioeconomic background. Study findings are therefore not necessarily representative of all ethnic and socioeconomic groups within South Africa.

Further research should investigate health literacy using the HELT-LL in the broader public sector patient population in South Africa to include different language and cultural groupings. It should

also be investigated for its applicability in patients able to access private healthcare, as the private and public health-care populations differ significantly in terms of sociodemographic and socio-economic characteristics.

7. Conclusion

The HELT-LL is the first general health literacy measure to be developed and validated in South Africa with the aim of enabling the evaluation of health literacy in limited literacy individuals. This measure fills an important gap in addressing a limitation of most current measures, i.e. the exclusion of populations with limited literacy. It addresses a broader understanding of health literacy, includes a range of questions formats, is not overly cognitively demanding, and was shown to be a valid and reliable measure of health literacy with a good discriminatory ability amongst participants with varying degrees of schooling. It has afforded preliminary insight into the health literacy of the more vulnerable public sector patient population in South Africa, with only 17.6% being shown to have adequate health literacy. The short administration time allows for the possibility of its use in clinical settings, and it offers researchers a validated test that is easy to administer. This study has addressed international calls encouraging health literacy research from LMICs, and it contributes to the sparse health literacy data generated from sub-Saharan Africa.

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References

- Apolinario, D., Mansur, L. L., Carthery-Goulart, M. T., Brucki, S. M. D., & Nitrini, R. (2014). Detecting limited health literacy in Brazil: Development of a multidimensional screening tool. *Health Promotion International*, 29(1), 5–14. doi:10.1093/heapro/dat074
- Apter, A. J., Cheng, J., Small, D., Bennett, I. M., Albert, C., Fein, D. G., ... Van Horne, S. (2006). Asthma numeracy skill and health literacy. *Journal of Asthma*, 43(9), 705–710. doi:10.1080/02770900600925585
- Baker, D. P., Leon, J., Smith Greenaway, E. G., Collins, J., & Movit, M. (2011). The education effect on population health: A reassessment. *Population and Development Review*, 37(2), 307–332. doi:10.1111/padr.2011.37.issue-2
- Bann, C. M., McCormack, L. A., Berkman, N. D., & Squiers, L. B. (2012). The health literacy skills instrument: A 10-item short form. *Journal of Health Communication*, 17(sup3), 191–202. doi:10.1080/10810730.2012.718042
- Bass, P. F., Wilson, J. F., & Griffith, C. H. (2003). A shortened instrument for literacy screening. *Journal of General Internal Medicine*, 18(12), 1036–1038. doi:10.1111/j.1525-1497.2003.10651.x
- Bennett, C. L., Ferreira, M. R., Davis, T. C., Kaplan, J., Weinberger, M., Kuzel, T., ... Sartor, O. (1998). Relation between literacy, race, and stage of presentation among low-income patients with prostate cancer. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*, 16(9), 3101–3104. doi:10.1200/JCO.1998.16.9.3101
- Bosworth, H. B. (2010). Challenges and strategies to improve patient health literacy and competencies. *Patient Intelligence*, (1), 19–25. doi:10.2147/PI
- Brand South Africa. (2012). Healthcare in South Africa. Retrieved from <https://www.brandsouthafrica.com/south-africa-fast-facts/health-facts/health-care-in-south-africa>
- Cawthon, C., Mion, L. C., Willens, D. E., Roumie, C. L., & Kripalani, S. (2014). Implementing routine health literacy assessment in hospital and primary care patients. *Joint Commission Journal on Quality and Patient Safety*, 40(2), 68–76. doi:10.1016/S1553-7250(14)40008-4
- Center for Health Literacy Promotion. (2009). Home visits using reflective approach improve functional health literacy among low-income pregnant women and new parents. Retrieved from <https://www.healthliteracypromotion.com/default.html>
- Cho, Y. I., Lee, S.-Y. D., Arozullah, A. M., & Crittenden, K. S. (2008). Effects of health literacy on health status and health service utilization amongst the elderly. *Social Science & Medicine*, 66(8), 1809–1816. doi:10.1016/j.socscimed.2008.01.003
- Cordasco, K. M., Homeier, D. C., Franco, I., Wang, P.-C., & Sarkisian, C. A. (2012). Health literacy screening of geriatric monolingual Spanish-speaking patients using single-item literacy screening questions and education. *Health Education Journal*, 71(5), 597–605. doi:10.1177/0017896911411764
- Council for Medical Schemes. (2016). Council for medical schemes: Annual report 2016/2017. Retrieved from <http://www.medicalschemes.com/files/AnnualReports/CMS AnnualReport2015-2016.pdf>

- <http://www.medicalschemes.com/files/AnnualReports/CMSAnnualReport2015-2016.pdf>
- Davis, T. C., Long, S. W., Jackson, R. H., Mayeaux, E. J., George, R. B., Murphy, P. W., & Crouch, M. A. (1993). Rapid estimate of adult literacy in medicine: A shortened screening instrument. *Family Medicine*, 25(6), 391–395.
- Dewalt, D. A., Berkman, N. D., & Sheridan, S. (2004). Literacy and health outcomes: A systematic review of the literature. *Journal of General Internal Medicine*, 19(12), 1228–1239. doi:10.1111/j.1525-1497.2004.40153.x
- Dodson, S., Good, S., & Osborne, R. (2015). Health literacy toolkit for low and middle-income countries: A series of information sheets to empower communities and strengthen health systems. Retrieved from <http://dro.deakin.edu.au/view/DU:30074618>
- Dowse, R. (2016). The limitations of current health literacy measures for use in developing countries. *Journal of Communication in Healthcare*, 9(1), 4–6. doi:10.1080/17538068.2016.1147742
- Dowse, R., Lecoko, L., & Ehlers, M. S. (2010). Applicability of the REALM health literacy test to an English second-language South African population. *Pharmacy World & Science*, 32(4), 464–471. doi:10.1007/s11096-010-9392-y
- Fransen, M. P., Van Schaik, T. M., Twickler, T. B., & Essink-Bot, M. L. (2011). Applicability of internationally available health literacy measures in the Netherlands. *Journal of Health Communication*, 16(sup3), 134–149. doi:10.1080/10810730.2011.551998
- Ganzer, C. A., Insel, K. C., & Ritter, L. S. (2012). Associations between working memory, health literacy, and recall of the signs of stroke among older adults. *Journal of Neuroscience Nursing*, 44(5), 236–243. doi:10.1097/JNN.0b013e3182666231
- Gardner, P. H., McMillan, B., Raynor, D. K., Woolf, E., & Knapp, P. (2011). The effect of numeracy on the comprehension of information about medicines in users of a patient information website. *Patient Education and Counseling*, 83(3), 398–403. doi:10.1016/j.pec.2011.05.006
- Godwin, M., Pike, A., Bethune, C., & Kirby, A. (2013). Concurrent and convergent validity of the simple lifestyle indicator questionnaire. *ISRN Family Medicine*. doi:10.5402/2013/529645
- Gurmankin, A. D., Baron, J., & Armstrong, K. (2004). Intended message versus message received in hypothetical physician risk communications: Exploring the gap. *Risk Analysis*, 24(5), 1337–1347. doi:10.1111/risk.2004.24.issue-5
- Hair, J., & Anderson, R. (1998). *Multivariate data analysis*. New Jersey: Prentice-Hall.
- How, C. H. (2011). A review of health literacy: Problem, tools and interventions. *Proceedings of Singapore Healthcare*, 20(2), 119–125. doi:10.1177/201010581102000209
- Hunt, S., Dowse, R., & La Rose, C. (2008). Health literacy assessment: Relexicalising a US test for a South African population. *Southern African Linguistics and Applied Language Studies*, 26(2), 267–281. doi:10.2989/SALALS.2008.26.2.7.571
- Jacobs, E. A., Karavolos, K., Rathouz, P. J., Ferris, T. G., & Powell, L. H. (2005). Limited English proficiency and breast and cervical cancer screening in a multiethnic population. *American Journal of Public Health*, 95(8), 1410–1416. doi:10.2105/AJPH.2004.045799
- Johnson. (2014). Health literacy, does it make a difference? *Australian Journal of Advanced Nursing*, 31(3), 39–45.
- Johnson, K., & Weiss, B. D. (2008). How long does it take to assess literacy skills in clinical practice? *Journal of the American Board of Family Medicine*, 21(3), 211–214. doi:10.3122/jabfm.2008.03.070217
- Jordan, J. E., Osborne, R. H., & Buchbinder, R. (2011). Critical appraisal of health literacy indices revealed variable underlying constructs, narrow content and psychometric weaknesses. *Journal of Clinical Epidemiology*, 64(4), 366–379. doi:10.1016/j.jclinepi.2010.04.005
- Kickbusch, I. S. (2001). Health literacy: Addressing the health and education divide. *Health Promotion International*, 16(3), 289–297. doi:10.1093/heapro/16.3.289
- Kim, E. J., Kim, T., Paasche-Orlow, M. K., Rose, A. J., & Hanchate, A. D. (2017). Disparities in hypertension associated with limited english proficiency. *Journal of General Internal Medicine*, 32(6), 632–639. doi:10.1007/s11606-016-3934-5
- Kwan, B., Zumbo, B., Kelly, K., Hayes, M., & Fraser, S. (2006). The development and validation of measures of “health literacy” in different populations. Retrieved from <http://blogs.ubc.ca/frankish/files/2010/12/HLit-final-report-2006-11-24.pdf>
- Lokker, N., Sanders, L., Perrin, E. M., Kumar, D., Finkle, J., Franco, V., ... Rothman, R. L. (2009). Parental misinterpretations of over-the-counter pediatric cough and cold medication labels. *PEDIATRICS*, 123(6), 1464–1471. doi:10.1542/peds.2008-0854
- Mafutha, N. G., Mogotlane, S., De Swardt, H. C., & Mafutha, N. (2017). Development of a hypertension health literacy assessment tool for use in primary healthcare clinics in South Africa, Gauteng. *African Journal of Primary Health Care & Family Medicine*, 9(1), 2071–2936. doi:10.4102/phcfm.v9i1.1305
- Marimwe, C., & Dowse, R. (2017). Development of an item bank of health literacy questions appropriate for limited literacy public sector patients in South Africa. *Journal of Communication in Healthcare*, 10(4), 273–284. doi:10.1080/17538068.2017.1380577
- McHorney, C. A., & Tarlov, A. R. (1995). Individual-patient monitoring in clinical practice: Are available health status surveys adequate? *Quality of Life Research*, 4(4), 293–307. doi:10.1007/BF01593882
- National Department of Health. (2015). South Africa: National department of health: Language policy. Retrieved from [file:///C:/Users/New/Downloads/ndoh_languagepolicyenglish\(2\).pdf](file:///C:/Users/New/Downloads/ndoh_languagepolicyenglish(2).pdf)
- Nielsen-Bohlman, L., Panzer, A., & Kindig, D. (Eds.). (2004). *Health Literacy: A prescription to end confusion*. Washington, D.C: National Academies Press.
- Noureldin, M., Plake, K. S., Morrow, D. G., Tu, W., Wu, J., & Murray, M. D. (2012). Effect of health literacy on drug adherence in patients with heart failure. *Pharmacotherapy: the Journal of Human Pharmacology and Drug Therapy*, 32(9), 819–826. doi:10.1002/(ISSN)1875-9114
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International*, 15(3), 259–267. doi:10.1093/heapro/15.3.259
- Osborn, C. Y., Cavanaugh, K., Wallston, K. A., & Rothman, R. L. (2010). Self-efficacy links health literacy and numeracy to glycemic control. *Journal of Health Communication*, 15(sup2), 146–158. doi:10.1080/10810730.2010.499980
- Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T., & Rudd, R. R. (2005). The

- prevalence of limited health literacy. *Journal of General Internal Medicine*, 20(2), 175–184. doi:10.1111/j.1525-1497.2005.40245.x
- Pandit, A. U., Tang, J. W., Bailey, S. C., Davis, T. C., Bocchini, M. V., Persell, S. D., ... Wolf, M. S. (2009). Education, literacy, and health: Mediating effects on hypertension knowledge and control. *Patient Education and Counseling*, 75(3), 381–385. doi:10.1016/j.pec.2009.04.006
- Parker, R. M., Baker, D. W., Williams, M. V., & Nurss, J. R. (1995). The test of functional health literacy in adults: A new instrument for measuring patients' literacy skills. *Journal of General Internal Medicine*, 10(10), 537–541. doi:10.1007/BF02640361
- Peerson, A., & Saunders, M. (2009). Health literacy revisited: What do we mean and why does it matter? *Health Promotion International*, 24(3), 285–296. doi:10.1093/heapro/dap014
- Pleasant, A. (2013). Health literacy around the world: Part 1 health literacy efforts outside of the United States. Retrieved from <https://www.nap.edu/download/18325>
- Ross, J. (2007). Health literacy and its influence on patient safety. *Journal of PeriAnesthesia Nursing*, 22(3), 220–222. doi:10.1016/j.jopan.2007.03.005
- Scott, T. L., Gazmararian, J. A., Williams, M. V., & Baker, D. W. (2002). Health literacy and preventive healthcare use among medicare enrollees in a managed care organization. *Medical Care*, 40(5), 395–404. doi:10.1097/00005650-200205000-00005
- Sentell, T., & Braun, K. L. (2012). Low health literacy, limited English proficiency, and health status in Asians, Latinos, and other racial/ethnic groups in California. *Journal of Health Communication*, 17(sup3), 82–99. doi:10.1080/10810730.2012.712621
- Speros, C. (2005). Health literacy: Concept analysis. *Journal of Advanced Nursing*, 50(6), 633–640. doi:10.1111/jan.2005.50.issue-6
- Statistics South Africa. (2017). Quarterly labour force survey. Retrieved from <http://www.statssa.gov.za/publications/P0211/P02111stQuarter2017.pdf>
- Statistics South Africa. (2011). Census 2011 provincial profile: Eastern Cape. Retrieved from <http://www.statssa.gov.za/publications/Report-03-01-71/Report-03-01-712011.pdf>
- Statistics South Africa. (2011). Provincial profile: Eastern Cape. Retrieved from <http://www.statssa.gov.za/publications/Report-03-01-71/Report-03-01-712011.pdf>
- Stuebing, K. W. (1997). Maternal schooling and comprehension of child health information in urban Zambia: Is literacy a missing link in the maternal schooling-child health relationship? *Health Transition Review : the Cultural, Social, and Behavioural Determinants of Health*, 7(2), 151–171.
- Sun, X., Shi, Y., Zeng, Q., Wang, Y., Du, W., Wei, N., ... Chang, C. (2013). Determinants of health literacy and health behavior regarding infectious respiratory diseases: A pathway model. *BMC Public Health*, 13(1), 261. doi:10.1186/1471-2458-13-261
- U.S Department of Health and Human Services. (2010). Quick guide to health literacy. Retrieved from <https://health.gov/communication/literacy/quickguide/quickguide.pdf>
- Weiss, B. D., Mays, M. Z., Martz, W., Castro, K. M., DeWalt, D. A., Pignone, M. P., ... Hale, F. A. (2005). Quick assessment of literacy in primary care: The newest vital sign. *The Annals of Family Medicine*, 3(6), 514–522. doi:10.1370/afm.405
- Williams, M. V., Baker, D. W., Parker, R. M., & Nurss, J. R. (1998). Relationship of functional health literacy to patients' knowledge of their chronic disease. A study of patients with hypertension and diabetes. *Archives of Internal Medicine*, 158(2), 166–172.
- Wolf, M. S., Feinglass, J., Thompson, J., & Baker, D. W. (2010). In search of 'low health literacy': Threshold vs. gradient effect of literacy on health status and mortality. *Social Science & Medicine*, 70(9), 1335–1341. doi:10.1016/j.socscimed.2009.12.013



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