

## RESEARCH REPORT

# Functional health literacy and health-promoting behaviour in a national sample of British adults

Christian von Wagner, Katherine Knight, Andrew Steptoe, Jane Wardle

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**Objectives:** To measure the prevalence of limited functional health literacy in the UK, and examine associations with health behaviours and self-rated health.

**Design:** Psychometric testing using a British version of the Test of Functional Health Literacy in Adults (TOFHLA) in a population sample of adults.

**Setting:** UK-wide interview survey (excluding Northern Ireland and the Scottish Isles).

**Participants:** 759 adults (439 women, 320 men) aged 18–90 years (mean age = 47.6 years) selected using random location sampling.

**Main outcome measures:** Functional health literacy, self-rated health, fruit and vegetable consumption, physical exercise and smoking.

**Results:** We found that 11.4% of participants had either marginal or inadequate health literacy. Multivariable logistic regression analysis indicated that the risk of having limitations in health literacy increased with age (adjusted odds ratio 1.04; 95% confidence interval 1.02 to 1.06), being male (odds ratio = 2.04; 95% confidence interval 1.16 to 3.55), low educational attainment (odds ratio = 7.46; 95% confidence interval 3.35 to 16.58) and low income (odds ratio = 5.94; 95% confidence interval 1.87 to 18.89). In a second multivariable logistic regression analysis, every point higher on the health literacy scale increased the likelihood of eating at least five portions of fruit and vegetables a day (odds ratio = 1.02; 95% confidence interval 1.003 to 1.03), being a non-smoker (odds ratio = 1.02; 95% confidence interval 1.0003 to 1.03) and having good self-rated health (odds ratio = 1.02; 95% confidence interval 1.01 to 1.04), independently of age, education, gender, ethnicity and income.

**Conclusions:** The results encourage efforts to monitor health literacy in the British population and examine associations with engagement with preventative health behaviours.

See end of article for authors' affiliations

Correspondence to: Professor Jane Wardle, Department of Epidemiology and Public Health, University College London, 2–16 Torrington Place, London WC1E 6BT, UK;

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## INTRODUCTION

Health literacy denotes a range of skills and resources associated with the ability to process health-related information. It is of major concern to health professionals and public health authorities.<sup>1</sup> A review of 85 studies including data from 31 129 participants revealed that over a quarter had “inadequate” and another fifth “marginal” health literacy.<sup>2</sup> However, most studies have used clinical cohorts, which typically over-represent socially disadvantaged groups, making it difficult to draw inferences about health literacy in the general population. No investigations of functional health literacy have been carried out in the British population.

Health literacy has been investigated principally in the context of acute and chronic health care;<sup>3–5</sup> less is known about associations with health behaviours such as diet, smoking or exercise. Health literacy has been shown to be associated with health status in people with chronic illnesses and the elderly,<sup>6,7</sup> but no research to date has related it to health status in the general population. This study investigated the prevalence of health literacy in a national sample of British adults and examined associations with health behaviours and self-rated health.

## METHODS

### Participants

We studied 759 adults (439 women, 320 men) aged 18–90 years (mean age = 47.6 years; standard deviation (SD) = 18.3). Data collection was carried out by the British Market Research Bureau (BMRB) using a two-stage random location sampling method. Enumeration districts defined by the 2001 census were selected at random, and 83 sample areas were used. These

covered all of the UK except for the Scottish Isles and Northern Ireland. Because this survey ensured complete anonymity of respondents throughout data collection, analysis and reporting, it was exempt from formal ethics committee approval in accordance with guidelines issued by the University College London Research Ethics Committee and the World Health Organization.

### Procedure

Health literacy tests were carried out in respondents' homes. We screened for visual acuity and basic reading ability by asking people to identify a series of characters from three strings of words and numbers (12-point text). Respondents who answered at least three out of four questions correctly proceeded with the functional health literacy assessment.

We assessed health literacy with a modified version of the Test of Functional Health Literacy in Adults (TOFHLA), a widely used psychometric test developed in the USA.<sup>8</sup> The TOFHLA uses materials that patients might encounter in the health care setting and consists of numeracy and reading comprehension sections. The test was modified for the UK population following a series of pilot studies conducted at University College London and a London-based pharmacy. The final version was sent for scrutiny to the team who developed the TOFHLA and then piloted in door-to-door interviews in west London. Interviewers were trained in the administration of visual prompt cards, timing and computer-assisted data entry. Those taking part in the pilot for the national survey received a 30-min training session. Those involved in the main part of the survey were given a 20-min instructional video and a hard copy of the interviewer instructions, and conducted at

least one practice interview before collecting data for the main study.

*Numeracy* was tested by assessing the participant's ability to understand and act on numerical directions of the sort that might be given by a health care provider or pharmacist. The section contains 10 scenarios based on real-life situations and was presented through a series of prompt cards. The tasks involved included reading information on appointment slips, following directions to take medication, using information on time intervals to plan when to take medicines, and calculating eligibility for financial aid. Scenarios varied in their level of difficulty. For the adapted version of the TOFHLA, the physical layout of prompts matched UK conventions for information on prescription medication. In the final item in the original TOFHLA, respondents have to decide on their eligibility for financial aid for health care. It was not possible to identify a match in terms of difficulty for a UK situation, so we kept the original and advised respondents that this item was hypothetical. There were a total of 17 questions, but respondents were stopped when they reached the time limit of 10 min. Weighted scores ranged from 0 to 50, representing the number of correctly answered items within the allocated time period.

*Reading comprehension* was tested after the respondent had completed the numeracy section or reached the time limit. It comprised a 50-item test using the modified Cloze procedure,<sup>9</sup> to measure the ability to read and understand three prose passages. In the original TOFHLA, passages are selected from instructions preparing for an upper gastrointestinal examination, patients' rights and responsibilities in Medicaid and a standard hospital informed consent. The readability of the passages on the Gunning Fog Index (GFI)<sup>10</sup> was grade 4.3, 10.4 and 19.5 respectively. For the British version, a passage on eligibility for exemption from prescription charges replaced the Medicaid passage (GFI grade 13). Time on this task was restricted to 12 min and participants obtained a score of 0–50 according to the number of correct answers within the time.

The sum of the two sections yields the TOFHLA score, which ranges from 0 to 100. Scores are classified and interpreted as follows: 0–59, inadequate functional health literacy; 60–74, marginal health literacy; and 75–100, adequate functional health literacy.<sup>8</sup> All participants, irrespective of their eligibility to take the TOFHLA, answered a series of questions on demographic characteristics, self-rated health,<sup>12</sup> smoking status, exercise and consumption of fruit and vegetables. Participants were asked to rate their general health as excellent, very good, good, fair or poor. Smoking status was assessed with a "yes" or "no" question (Do you smoke at all?). Participants also indicated whether or not they had undertaken any form of physical exercise within the last 7 days, and how many servings of fruit and vegetables they consume on a typical day.

### Statistical analysis

We used SPSS v13 for data analysis. Multivariable logistic regression analysis was used to determine the associations between demographic variables (age, education, gender, ethnicity and income) and functional health literacy. For this analysis, the inadequate and marginal categories were combined into one denoting limited functional health literacy. Odds ratios (ORs) for limited health literacy with 95% confidence intervals (CIs) adjusted for all other variables are presented. In a second multivariable logistic regression analysis, health literacy scores (ranging from 0 to 100) were entered together with age, education, ethnic background, speaking English as the first language and personal income, to determine the associations between health literacy and health behaviours and self-rated health.<sup>11</sup> With a sample of over 750 participants, we had > 85% power to detect differences of 10% or more in the

rates of fruit and vegetable intake, smoking and regular physical activity between adequate and poor health literacy groups. This estimation was based on existing surveys in the US documenting the prevalence of poor health literacy.<sup>1</sup>

For health behaviours daily consumption of fruit and vegetables was recoded to derive a dichotomous variable categorising participants according to whether or not they followed recommendations to eat at least five portions of fruit and vegetables a day. Self-rated health was recoded into two groups – good, very good or excellent and poor or fair – to estimate the odds of good health.

### RESULTS

From the original sample of 759 participants, 40 did not pass the visual acuity test and were therefore not eligible for health literacy assessment. Non-eligible participants were older (mean = 55.8 years; SD = 19.5) than eligible participants (mean = 47.2 years; SD = 18.3), more likely to have no formal education (62% vs. 29%,  $p < 0.001$ ) and more likely not to have English as their first language (17% vs. 4%,  $p < 0.01$ ).

Table 1 shows the distribution of demographic variables. The distribution was reasonably representative of the UK population for age and ethnicity but differed with regard to gender and education. The sample contained more women (58%) than is representative of the general UK population (51%). It also had more participants without formal qualification (29%) than the general population (21%).<sup>13</sup>

Of the 719 eligible participants, 41 (5.7%) were classified as having inadequate health literacy and 41 (5.7%) as having marginal health literacy.

### Demographic variables and functional health literacy

Table 1 shows the distribution of health literacy by socio-demographic factors, and table 2 summarises the results of the regression analyses predicting limited health literacy.

Older participants were more likely to have limited health literacy (OR = 1.04; 95% CI 1.02 to 1.06). As can be seen in table 1, only 5.7% of respondents aged 18–44 years were classified as marginal or inadequate in functional health literacy, compared with 30% of those aged 65 and over. Participants without formal education were more likely to have limited health literacy (OR = 7.46; 95% CI 3.36 to 16.58); approximately 30% of participants with no formal qualifications scored within the range of marginal or inadequate functional health literacy, compared with just under 3% of participants with the highest level of education. Men were more likely than women to fall into the limited literacy category (OR = 2.04; 95% CI 1.16 to 3.55), as were respondents with a personal income of less than £10 000 (OR = 4.02; 95% CI 1.42 to 13.29) and those who refused or were unable to state their annual personal income (OR = 5.94; 95% CI 1.87 to 18.89).

### Health literacy, health behaviours and self-rated health

Table 3 shows health behaviour and self-rated health in relation to health literacy categories. We also used health literacy scores (0–100) in multivariable logistic regression models to determine the association between health literacy and health behaviours and self-rated health (see table 4). Every point higher on the health literacy scale was associated with a greater likelihood of eating at least five servings of fruit and vegetables a day (OR = 1.02; 95% CI 1.003 to 1.03). Individuals with higher health literacy scores were also more likely to be non-smokers (OR = 1.02; 95% CI 1.0003 to 1.03). A greater proportion of participants in the adequate health literacy group exercised at least once a week, but this association was not significant after adjusting for age, education, gender, ethnicity and income (table 4).

**Table 1** Relationship between functional health literacy and demographic characteristics (mean and standard deviation or number with percentages in brackets)

Demographic variable	Per cent	Functional health literacy		
		Adequate (n = 637)	Marginal (n = 41)	Inadequate (n = 41)
Means (SD) age in years		45.2 (17.2)	60.2 (20.9)	63.9 (19.5)
Gender				
Female	58.0	373 (89.9)	20 (4.8)	22 (5.3)
Male	42.0	264 (86.8)	21 (6.9)	19 (6.3)
Ethnicity				
White	93.6	598 (88.9)	39 (5.8)	36 (5.3)
Non-white	6.4	39 (84.8)	2 (4.3)	5 (10.9)
Language				
English is first language	95.5	611 (88.9)	40 (5.8)	36 (5.2)
English not first language	4.5	26 (81.3)	1 (3.1)	5 (15.6)
Education completed*				
A-level or university	46.0	321 (97.3)	5 (1.5)	4 (1.2)
GCSE or trade apprenticeship	5.3	167 (91.8)	10 (5.5)	5 (2.7)
No formal qualifications	28.7	148 (71.8)	26 (12.6)	32 (15.5)
Annual personal income				
More than £20 000	15.3	168 (97.7)	3 (1.7)	1 (.6)
£10 000–£19 999	34.6	176 (93.6)	8 (4.3)	4 (2.1)
Up to £9999	26.1	210 (84.3)	23 (9.2)	16 (6.4)
Don't know or refused	23.9	83 (75.5)	7 (6.4)	20 (18.2)

\*Numbers do not add up to the total due to missing data.

Higher health literacy was associated with good self-rated health, independently of age, gender, ethnicity, language and education (OR = 1.02; 95% CI 1.01 to 1.04). Table 3 shows that 51% of individuals in the “inadequate” compared with 83% of those in the “adequate” health literacy category reported being in good health.

## DISCUSSION

### Principal findings

More than 1 in 10 (11.4%) of the eligible respondents in this study were assessed as limited in functional health literacy. Limitations in health literacy were associated with older age, lower level of education, being male and having a lower income. Health literacy was associated with higher fruit and vegetable consumption, being a non-smoker and good self-rated health after controlling for demographic factors.

### Strengths and limitations

To our knowledge this is the first study of health literacy outside the US which is not limited to a specific patient cohort or segment of society. In contrast to a majority of larger scale cross-sectional surveys, we used the full rather than the short TOFHLA (S-TOFHLA) as the basis for our modifications and

conducted testing face-to-face rather than in a group setting. We are therefore confident that we retained the quality of the original instrument as a measure of functional health literacy. Despite the focus of the TOFHLA on the comprehension of material related to acute health care, this survey found significant associations between health literacy and health promotion.

The recruitment strategy employed in the study did not allow us to monitor response rates, and the demographic distribution of respondents was slightly different from the UK adult population. The predominance of women might have led to an underestimation of the true extent of limited health literacy, given the association between gender and health literacy. On the other hand, the above average number of participants without formal education is likely to overestimate its prevalence. The cross-sectional nature of the study prevents us from reaching conclusions about the nature of the reported associations. Given the exploratory nature of this survey, the assessment of health behaviours and self-rated health was deliberately broad and we were able to gather only self-report data. This limits the clinical significance of our findings.

The relatively low prevalence of adequate health literacy compared with previous studies in the US constituted the greatest challenge of this study. It meant that we had to take the unusual step of using health literacy scores rather than categories in the second part of the analysis, which examined associations between health literacy and health behaviours. The relatively good levels of health literacy in Britain documented in this study highlight the importance of conducting health literacy research outside the US, and using general population samples. The potential pitfalls of using findings from previous health literacy research based on clinical populations to estimate health literacy at the general population level has become apparent in this study and should be considered in future research. In fact, the results of this study are broadly comparable with recently published figures from the latest National Assessment of Adult Literacy (NAAL), which for the first time used a health literacy component.<sup>12</sup> Future research studying the association between health literacy and health behaviour will benefit from being able to adjust their numbers in response to surveys using nationally representative samples.

**Table 2** Predicting limitations in functional health literacy

	Odds of limited health literacy (95% confidence interval)
Age	1.04 (1.02 to 1.06)***
Male	2.04 (1.17 to 3.55)*
Non-white ethnic background	2.06 (0.07 to 7.80)
English not the first language	3.33 (0.80 to 13.83)
Education	
A-level or university	1.00
GCSE or trade apprenticeship	2.84 (1.16 to 6.97)*
No formal qualifications	7.46 (3.36 to 16.58)***
Annual personal income	
More than £20 000	1.00
£10 000–£19 999	1.42 (0.42 to 4.75)
£0 to £9999	4.02 (1.42 to 13.29)**
Don't know or refused	5.94 (1.87 to 18.89)**

\*\*\*p < 0.001; \*\*p < 0.01; \*p < 0.05.

**Table 3** Health behaviour and self-rated health by health literacy category (number with percentages in brackets)

	Functional health literacy		
	Adequate (n = 637)	Marginal (n = 41)	Inadequate (n = 41)
Eating fruit and vegetables			
More than five a day	302 (47.4)	16 (39.0)	12 (29.3)
Less than five a day	335 (52.6)	25 (61.0)	29 (70.7)
Any exercise in the last 7 days*			
Yes	233 (36.6)	8 (19.5)	9 (22.0)
No	403 (63.4)	33 (80.5)	32 (78.0)
Smoking status			
Yes	189 (29.7)	13 (32.5)	12 (29.3)
No	448 (70.3)	27 (67.5)	29 (70.7)
Self-reported health			
Excellent to good	529 (83.0)	32 (78.0)	21 (51.2)
Fair to poor	108 (17.0)	9 (22.0)	20 (48.8)

\*Numbers do not add up to the total due to missing data.

### Future policy and research

Assessment tools in health literacy have had a strong focus on clinical behaviours.<sup>1</sup> This emphasis on clinical settings and contexts is reflected particularly in the TOFHLA, currently the most prominent and ecologically valid assessment tool. Most of the scenarios use materials directly relevant to acute health care (e.g. appointment slips, medical instructions and consent forms). The results of the present study have shown that disparities in health literacy also apply to health behaviours outside clinical settings. The broader scope of health literacy should therefore be reflected in its assessment. Another shortcoming of current health literacy assessments is that they are comparatively unchallenging. This is particularly true if examining health literacy in the general population. One promising recent development is the Newest Vital Sign (NVS) test, a screening tool for limited health literacy that tests the ability to read, comprehend and manipulate nutritional information. In contrast to the TOFHLA, the NVS does not have a ceiling effect and therefore provides better discrimination among individuals across the upper part of the distribution of literacy skills.<sup>13</sup>

It is important to learn more about the relationship between health literacy, general literacy and intellectual ability.<sup>14</sup> Research into the causes of limited health literacy has been

### What this study adds

- Around 11% of adults in this British population survey have marginal or inadequate health literacy.
- Limited health literacy is associated with older age, lower educational attainment, lower income and being male.
- Limited health literacy is associated with fewer healthy lifestyle behaviours and worse self-rated health.

### Policy implications

- Assessment of health literacy needs to be adapted to reflect literacy levels in the general population and become more relevant to the cognitive demands of modern health care systems.
- Health literacy research and interventions need to move beyond clinical context and address the consequences for health-related choices in everyday life.
- Understanding the causes of limited health literacy is essential for the development of effective interventions.

neglected in favour of studies of its role in health care. Given the relative novelty of this construct, it has been valuable to raise awareness of limited health literacy by demonstrating the adverse consequences of not being able to read and understand health information. Health literacy research should progress from describing to understanding these relationships in more detail and use this knowledge to inform policy-makers, health care professionals and the education sector about how to develop effective interventions. Our results suggest that health literacy may play an important role in health promotion. Efforts to increase people's ability not only to read, but also to engage with, health education materials<sup>15</sup> will be important in addressing disparities in lifestyle-related health behaviours.

In conclusion, these results provide evidence that limitations in functional health literacy are widespread in Britain and

**Table 4** Factors associated with health behaviours and self-reported health, odds ratios (ORs) and 95% confidence intervals (CIs)

	Eating five a day		Exercise in last 7 days		Not smoking		Good health	
	OR (CI 95%)	p Value	OR (CI 95%)	p Value	OR (CI 95%)	p Value	OR (95% CI)	p Value
Health literacy scores (0–100)	1.02 (1.003 to 1.03)	0.016	1.00 (0.98 to 1.02)	0.88	1.02 (1.0003 to 1.03)	0.046	1.02 (1.001 to 1.04)	0.011
Age	1.02 (1.01 to 1.03)	0.002	0.98 (0.97 to 0.99)	0.000	1.04 (1.03 to 1.05)	0.000	0.98 (0.97 to 0.99)	0.002
Male	0.42 (0.30 to 0.59)	0.000	1.97 (1.40 to 2.75)	0.000	0.68 (0.47 to 0.97)	0.033	0.95 (0.62 to 1.44)	0.79
Non-white background	0.46 (0.21 to 0.99)	0.046	0.81 (0.39 to 1.68)	0.57	2.40 (0.95 to 6.01)	0.06	1.62 (0.48 to 5.48)	0.44
English not the first language	0.82 (0.34 to 2.01)	0.67	1.08 (0.45 to 2.58)	0.86	0.45 (0.14 to 1.39)	0.16	0.40 (0.08 to 2.04)	0.27
Education								
A-level and higher qualifications	1.00	0.022	1.00	0.003	1.00	0.001	1.00	0.20
GCSE and trade apprenticeship	0.74 (0.50 to 1.09)	0.13	0.68 (0.45 to 1.02)	0.06	0.66 (0.43 to 1.01)	0.06	0.64 (0.38 to 1.07)	0.09
No formal qualifications	0.56 (0.36 to 0.85)	0.007	0.45 (0.28 to 0.72)	0.001	0.42 (0.26 to 0.68)	0.000	0.70 (0.42 to 1.19)	.19
Annual personal income								
£20 000 or more	1.00	0.020	1.00	0.024	1.00	0.07	1.00	0.011
£10 000–£19 999	0.49 (0.32 to 0.77)	0.27	0.51 (0.32 to 0.80)	0.003	0.88 (0.53 to 1.45)	0.60	0.46 (0.22 to 0.94)	0.033
£0 to £9999	0.66 (0.42 to 1.02)	0.06	0.62 (0.40 to 0.97)	0.034	0.62 (0.38 to 1.01)	0.05	0.32 (0.16 to 0.63)	0.001
Don't know or refused	0.74 (0.43 to 1.26)	0.002	0.60 (0.34 to 1.05)	0.07	1.18 (0.63 to 2.20)	0.60	0.341 (0.16 to 0.74)	0.006

encourage an extension of health literacy assessments beyond health care to health promotion.

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## Authors' affiliations

**Christian von Wagner, Katherine Knight, Andrew Steptoe and Jane Wardle**, Cancer Research UK Health Behaviour Unit, Department of Epidemiology and Public Health, University College London, Gower Street, London WC1E 6BT, UK

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## REFERENCE

- 1 **Institute of Medicine**. *Health literacy: a prescription to end confusion*. Washington, DC: National Academic Press, 2004.
- 2 **Paasche-Orlow MK**, Parker RM, Gazmararian JA, et al. The prevalence of limited health literacy. *J Gen Intern Med* 2005;**20**:175–84.
- 3 **Williams MV**, Parker RM, Baker DW, et al. Inadequate functional health literacy among patients at two public hospitals. *JAMA* 1995;**274**:1677–82.
- 4 **Baker DW**, Parker RM, Williams MV, et al. The health care experience of patients with low literacy. *Arch Fam Med* 1996;**5**:329–34.
- 5 **Gazmararian JA**, Baker DW, Williams MV, et al. Health literacy among Medicare enrollees in a managed care organization. *JAMA* 1999;**281**:545–51.
- 6 **Baker DW**, Gazmararian JA, Sudano J, et al. The association between age and health literacy among elderly persons. *J Gerontol B Psychol Sci Soc Sci* 2000;**55**:S368–74.
- 7 **Kalichman SC**, Rompa D. Functional health literacy is associated with health status and health-related knowledge in people living with HIV-AIDS. *J Acquir Immune Defic Syndr*, 2000;**25**:337–44.
- 8 **Nursrs JR**, Parker RM, Baker DW. *TOFHLA: test of functional health literacy in adults*, 2nd edn. Snow Camp, NC: Peppercorn Books and Press, 2001.
- 9 **Taylor W**. Cloze procedure: a new tool for measuring readability. *Journalism Q* 1953;**30**:415–33.
- 10 **Laubach R**, Koschnick K. *Using readability formulas for easy adult materials*. Syracuse, NY: New Readers Press, 1977.
- 11 **Prescott-Clarke P**, Primatesta P. *Health survey for England*. London: HMSO, 1994.
- 12 **Kutner M**, Greenberg E, Jin Y, et al. *The health literacy of America's adults: results from the 2003 National Assessment of Adult Literacy (NCES 2006-483)*. Washington, DC: National Center for Education Statistics, US Department of Education, 2006.
- 13 **Weiss BD**, Mays MZ, Martz W, et al. Quick assessment of literacy in primary care: the Newest Vital Sign. *Ann Fam Med* 2005;**3**:514–22.
- 14 **Gottfredson LS**. Intelligence: Is it the epidemiologists' elusive "Fundamental cause" of social class inequalities in health? *J Pers Soc Psychol* 2004;**86**:174–99.
- 15 **Department for Education and Skills, Department of Health**. *Skilled for health update*. London: Department for Education and Skills, Department of Health, 2004.