



## Characteristics of people with low health literacy on coronary heart disease GP registers in South London

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-001503
Article Type:	Research
Date Submitted by the Author:	03-Aug-2012
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<b>Primary Subject Heading</b>:	Public health
Secondary Subject Heading:	General practice / Family practice
Keywords:	Health literacy, Cardiovascular disease, Prevalence

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3 **Characteristics of people with low health literacy on coronary heart**  
4 **disease GP registers in South London**

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40  
41 **Word count: abstract 300 words, main text 1096 words.**  
42

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44  
45 **Study design:** cross-sectional survey  
46

47  
48 **Statements:** The Corresponding Author has the right to grant on behalf of all  
49 authors and does grant on behalf of all authors, an exclusive licence (or non  
50 exclusive for government employees) on a worldwide basis to the BMJ  
51 Publishing Group Ltd to permit this article (if accepted) to be published in BMJ  
52  
53  
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6  
7

8 Competing interests: AT is partly employed by the NIHR Institute of Psychiatry  
9 and South London and Maudsley Foundation Trust Mental Health Biomedical  
10 Research Centre.  
11  
12

13  
14 Funding Statement: this research received no specific funding.  
15  
16  
17

18 Data Sharing Statement: There are no additional unpublished data from this  
19 study  
20  
21

22  
23 All authors have completed the Unified Competing Interest form  
24 **at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf)** (available on request from the  
25 corresponding author) and declare: no support from any organisation for the  
26 submitted work, no financial relationships with any organisations that might  
27 have an interest in the submitted work in the previous three years, no other  
28 relationships or activities that could appear to have influenced the submitted  
29 work.  
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37 GR Led on development of the research idea, contributed to interpretation of  
38 result, and led on writing the paper  
39

40 AM collected research data and contributed to interpretation of results and  
41 writing the paper  
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43 SH collected research data and contributed to interpretation of results and  
44 writing the paper  
45

46 RP led on statistical analysis of the data and interpretation of the results  
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48 AM co-developed the UPBEAT cohort study in which the study is sited,  
49 contributed to the research idea, contributed to interpretation of results and  
50 writing the paper  
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52 AS contributed to the project design, analysis of results and writing the paper  
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54 PW contributed to the research idea, interpretation of the results and writing  
55 the paper  
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5 and writing the paper  
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10 All authors have approved the final version

11 **Abstract (300 words)**

12 *Objective.* To explore characteristics associated with, and prevalence of, low  
13 health literacy in patients recruited to investigate the role of depression in  
14 patients on General Practice (GP) Coronary Heart Disease (CHD) registers  
15 (the Up-Beat UK study).  
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18 *Design.* Cross-sectional cohort. The health literacy measure was the Rapid  
19 Estimate of Health Literacy in Medicine (REALM). Univariable analyses  
20 identified characteristics associated with low health literacy and compared  
21 health service use between health literacy statuses. Those variables where  
22 there was a statistically significant/borderline significant difference between  
23 health literacy statuses were entered into a multivariable model.  
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26 *Setting.* 16 general practices in south London, UK.  
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28 *Participants:* Inclusion: patients >18 years, registered with a GP and on a GP  
29 CHD register. Exclusion: patients temporarily registered.  
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32 *Primary outcome measure:* REALM.  
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34 *Results.* Of the 803 Up-Beat cohort participants, 687 (85.55%) completed the  
35 REALM of whom 92 (13.39%) had low health literacy. A further 28 participants  
36 were excluded from the multivariable analysis due to missing predictor  
37 variable data, leaving a sample of 659. The variables remaining in the final  
38 model were age, gender, ethnicity, IMD score, years of education,  
39 employment; BMI and alcohol intake, and anxiety scores (Hospital Anxiety  
40 and Depression Scale (HADS)). Univariable analysis also showed that people  
41 with low health literacy may have more, and longer, practice nurse  
42 consultations than people with adequate health literacy.  
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45 *Conclusions.* There is a disadvantaged group of people on GP CHD registers  
46 with low health literacy. The multivariable model showed that patients with low  
47 health literacy have significantly higher anxiety levels than people with  
48 adequate health literacy. In addition, the univariable analyses show that such  
49 patients have more, and longer, consultations with practice nurses. We will  
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3 collect 4-year longitudinal cohort data to explore the impact of health literacy  
4 in people on GP CHD registers and the impact of health literacy on health  
5 service use.  
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## 10 11 **Introduction**

12 Health literacy, 'the cognitive and social skills that determine the motivation  
13 and ability of individuals to (access), understand and use information in ways  
14 that promote and maintain good health' (1) is a social determinant of health  
15 (2). Whilst associated with other social determinants e.g. ethnicity, income,  
16 education, and socio-demographic status (SES), it has an independent  
17 association with poorer health (3). There are no data on health literacy levels  
18 in England; however the 2011 national skills survey has shown that 15% of  
19 the adult population (=5 million people) are 'functionally illiterate' (4) (i.e. have  
20 insufficient literacy skills to achieve their potential in life and society (5)). It is  
21 reasonable to assume that a similar proportion also have low health literacy.  
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31 Low health literacy has greatest impact in complex health conditions when  
32 patients have to understand procedures, manage medication, and attend  
33 multiple appointments. US studies have shown that adults with low health  
34 literacy have a higher prevalence of diabetes and heart failure, worse physical  
35 and mental health, and higher all-cause mortality (6). There is little research  
36 on low health literacy and coronary heart disease (CHD), prompting us to  
37 explore this within a longitudinal cohort of patients recruited to investigate the  
38 role of depression in patients on General Practice (GP) CHD registers (7).  
39 This short report presents initial findings on the prevalence and characteristics  
40 of people with CHD and low health literacy.  
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## 49 **Method**

50 The design, recruitment, power calculation, and measures used in the Up-  
51 Beat cohort study were granted ethical approval by the Bexley and Greenwich  
52 Research Ethics Committee (REC Reference: 07/H0809/38) (7). Health  
53 literacy was measured using the Rapid Estimate of Health Literacy in  
54 Medicine (REALM) (8), a 66-item health word pronunciation test highly  
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3 correlated with other measures of health literacy (9, 10) and widely used in  
4 research studies (3). People with a score of < 58 out of the possible 66 are  
5 considered to have low health literacy.  
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10 Study design. A cross-sectional analysis of baseline data from the Up-Beat  
11 UK Cohort Study (7).  
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### 13 14 15 Statistical Analysis

16 In order to identify the factors to be entered into the multivariable regression  
17 model, the characteristics of those with low health literacy were compared to  
18 those with adequate health literacy using  $\chi^2$  tests (categorical variables) and t-  
19 tests (continuous variables). Those characteristics where there was a  
20 statistically significant ( $p < 0.05$ ) or borderline significant difference between  
21 people with low and adequate health literacy were entered into a multivariable  
22 model; logistic regression was used to model predictors of low health literacy.  
23 The fit for the model was assessed by the C statistic (ROC curve) and the  
24 Hosmer-Lemeshow goodness of fit  $\chi^2$  test.  
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33 Analyses were performed using Stata version 11.2.  
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### 36 **Results**

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39 Cohort characteristics are detailed elsewhere (7). Cohort recruitment and a  
40 study flow diagram are shown in figure 1.  
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45 *Figure about here.*  
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48 The results of the univariable and multivariable analyses are shown in table 1.  
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Table: Characteristics by Health Literacy

		Health Literacy		Univariable analysis N=687	Multivariable analysis N=659
		Adequate	Low		
		N (%)	N (%)		
Total		595 (86.61)	92 (13.39)		
				<b>P-value <sup>(1)</sup></b>	<b>Adjusted odds of having low health literacy (p-values)</b>
<b>Socio-demographic characteristics</b>					
Gender	Male	409 (68.74)	75 (81.52)	0.012	0.36 (<0.001)
	Female	186 (31.26)	17 (18.48)		
Ethnicity	White	536 (90.08)	69 (75.00)	<0.001	3.33 (<0.001)
	Other	59 (9.92)	23 (25.00)		
Age, Mean (SD)	Years	71.13 (10.40)	68.62 (12.09)	0.061 <sup>(2)</sup>	1.00 (0.933)
Index of Multiple Deprivation score, Mean (SD)	Range 0-100	18.37 (13.75)	25.10 (13.59)	<0.001	1.02 (0.056)
Time in education, Mean (SD)	Years	11.99 (3.37)	10.90 (2.57)	<0.001 <sup>(2)</sup>	0.83 (<0.001)
Employment status	Unemployed/student	14 (2.36)	10 (10.99)	<0.001	0.063
	Paid employment	120 (20.24)	15 (16.48)		
	Retired/Housewife	459 (77.40)	66 (72.53)		
<b>Lifestyle Characteristics</b>					
Alcohol intake (Units)	Doesn't drink	139 (23.40)	41 (45.05)	<0.001	<0.001
	1-10 units	297 (50.00)	36 (39.56)		
	11-20 units	89 (14.98)	7 (7.69)		
	Greater than 21 units	69 (11.62)	7 (7.69)		
BMI	Underweight/Normal	147 (25.34)	13 (14.29)	0.035	0.033
	Overweight	257 (44.31)	41 (45.05)		
	Obese	176 (30.34)	37 (40.66)		
<b>Mental Health</b>					
Depression score, Mean (SD)		2.93 (3.21)	4.07 (3.55)	0.002	
Anxiety score, Mean (SD)		4.47 (4.23)	6.16 (4.96)	0.002 <sup>(2)</sup>	1.06 (0.035)
<b>Health utilisation in the 6 months prior to baseline</b>					
Number of practice nurse visits, Mean (SD)		0.92 (1.89)	1.21 (2.01)	0.044 <sup>(3)</sup>	
Duration of practice nurse visit, Mean (SD)		5.06 (7.08)	6.79 (8.41)	0.034 <sup>(3)</sup>	
All other service use variables <sup>(4)</sup>				0.191 <sup>(5)</sup> - 0.990 <sup>(6)</sup>	
<sup>1</sup> P-value from t-test for continuous variables and chi-squared tests for categorical variables					
<sup>2</sup> Unequal variances t-test used					
<sup>3</sup> Wilcoxon rank sum test					



<sup>4</sup> Number of Accident and Emergency visits, Day hospital and in-patient admissions (days), outpatient visits, GP visits (number, duration), district nurse visits (number, duration), other medical visits (number, duration), other care based visits (number, duration), informal care visits number).

<sup>5</sup> Number of Accident and Emergency visits

<sup>6</sup> Number (days) in-patient visits

Of the 803 cohort participants 687 (85.55%) completed the REALM questionnaire. The 116 non-responders were excluded from the analyses. Non-responders lived in more socio-economically deprived areas and had received fewer years of education than those who completed the REALM. There was no difference in ethnicity (responders vs non-responders).

Of the 687 participants who completed the REALM, 92 (13.39%) had low health literacy. For the multivariable analysis a further 28 patients were excluded due to missing predictor variable data, leaving a total sample of 659.

The variables remaining in the final model were age, gender, ethnicity (white versus other), IMD score, years of education, employment; BMI and alcohol intake, and anxiety scores (Hospital Anxiety and Depression Scale (HADS)) (11). There was a 6% increase in the odds of low health literacy for every single unit increase in the anxiety score on HADS (range 0-21).

The association between health literacy and IMD scores and employment were borderline significant. There was no significant difference in age.

Service use analysis (univariable only) showed that people with low health literacy had significantly more, and longer, GP practice nurse consultations than people with adequate health literacy, but other service use showed no differences between groups.

## Discussion

### *Key findings*

This study confirms that the characteristics of patients with low health literacy on UK GP CHD registers are similar to those seen in other long-term conditions in studies undertaken in other industrialised countries (i.e.,



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3 membership of a minority ethnic group, socio-economic deprivation, fewer  
4 years in education, and lower income (6)). The prevalence of low health  
5 literacy is close to that predicted from national general literacy levels (4).  
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10 In addition people on GP CHD registers who have higher anxiety levels are  
11 more likely to have low health literacy than people with lower anxiety levels.  
12 This persists in the multivariable model, indicating an association over and  
13 above that already known to exist between anxiety and low socio-economic  
14 status (12, 13). This may reflect the findings of Ussher et al that CHD patients  
15 with low health literacy have increased difficulty understanding information,  
16 less knowledge of heart problems, and increased discomfort about asking for  
17 explanations (14). The finding in the univariable analysis that patients with low  
18 health literacy had more contact with practice nurses but not with other health  
19 services requires further investigation.  
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### 27 28 *Study limitations*

29 As a cross-sectional study this project cannot demonstrate causality or the  
30 impact of low health literacy over time.  
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34 Our findings may underestimate of the true picture; the 14.45% of participants  
35 who declined to do the REALM share the characteristics of people with low  
36 health literacy and may have declined because of reading difficulties.  
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40 Our findings of more frequent, and longer, GP practice nurse consultations  
41 should be interpreted with caution, as this was found during univariable  
42 analysis with no other factors controlled for; no service use data were entered  
43 into the multivariable model. The above preliminary finding thus requires more  
44 detailed health economic analysis and interpretation.  
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50 Finally, the REALM, although highly correlated with tests of functional health  
51 and general literacy, is not itself a test of functional skills but of pronunciation.  
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### 55 56 *Summary*

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3 Our findings indicate that there is a disadvantaged group of people on GP  
4 CHD registers who have low health literacy in addition to other socio-  
5 demographic barriers to health. A new finding is that these people have  
6 significantly higher anxiety levels than people with adequate health literacy.  
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### 10 11 *Next steps*

12 Our possible finding that people on GP CHD registers with lower health  
13 literacy consulted practice nurses more frequently will inform future Up-Beat  
14 pilot interventions (7) and our longitudinal cohort data will enable us to explore  
15 the impact of low health literacy on patients on GP CHD registers, and on  
16 their health service use.  
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### 22 **Acknowledgements**

23 Many thanks to the 16 South London practices who participated in the  
24 UPBEAT-UK study.  
25  
26  
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28

29 This report/article presents independent research commissioned by the  
30 National Institute for Health Research (NIHR) under its Programme Grants for  
31 Applied Research scheme (RP-PG-0606-1048). The views expressed in this  
32 publication are those of the author(s) and not necessarily those of the NHS,  
33 the NIHR or the Department of Health.  
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39 AT is partly employed by the NIHR Institute of Psychiatry and South London  
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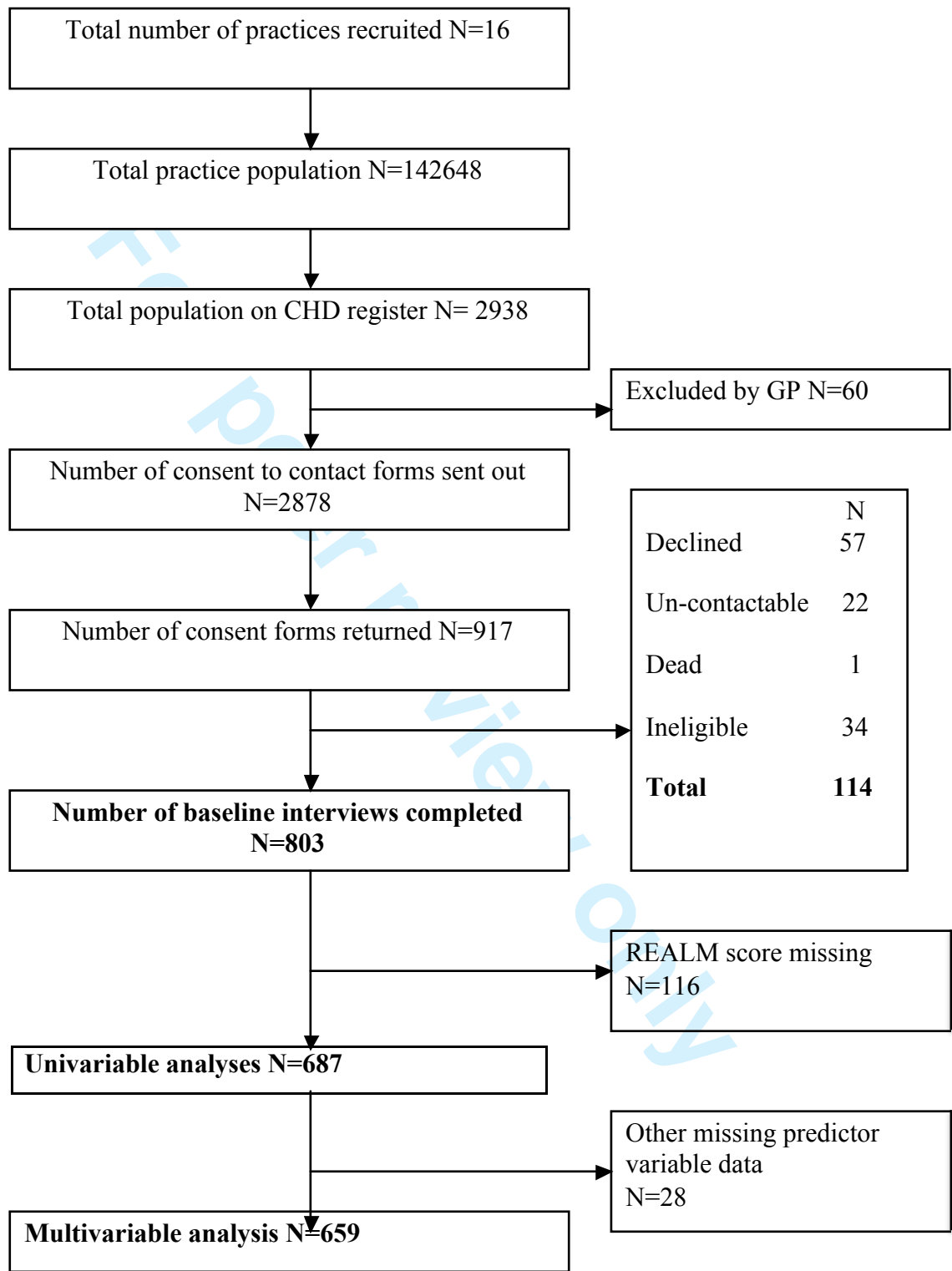
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**Exploring indicators of low health literacy in a cohort with symptomatic Coronary Heart Disease**

**Figure: Study recruitment: Consort diagram**





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Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2012-001503.R1
Article Type:	Research
Date Submitted by the Author:	19-Oct-2012
Complete List of Authors:	Rowlands, Gillian; London South Bank University, Institute of Primary Care and Public Health Mehay, Anita; Institute of Psychiatry, Section of Primary Care Mental Health Hampshire, Sally; Institute of Psychiatry, Section of Primary Care Mental Health Phillips, Rachel; Institute of Psychiatry, Section of Primary Care Mental Health Williams, Paul; Institute of Psychiatry, Section of Primary Care Mental Health Mann, Anthony; Institute of Psychiatry, Health Service and Population Research Steptoe, Andrew; University College London, UCL Institute of Epidemiology and Health Care Walters, Paul; Institute of Psychiatry, Section of Primary Care Mental Health Tylee, Andre; Institute of Psychiatry
<b>Primary Subject Heading</b>:	Public health
Secondary Subject Heading:	General practice / Family practice, Cardiovascular medicine, Sociology, Mental health
Keywords:	Health literacy, Cardiovascular disease, Prevalence

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33 **Word count: abstract 300 words, main text 1303 words.**  
34  
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40 **Study design:** cross-sectional survey  
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44 **Statements:** The Corresponding Author has the right to grant on behalf of all  
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6 Competing interests: AT is partly employed by the NIHR Institute of Psychiatry  
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12 All authors have completed the Unified Competing Interest form  
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14 corresponding author) and declare: no support from any organisation for the  
15 submitted work, no financial relationships with any organisations that might  
16 have an interest in the submitted work in the previous three years, no other  
17 relationships or activities that could appear to have influenced the submitted  
18 work.  
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24 **Contributions:**

25 GR Led on development of the research idea, contributed to interpretation of  
26 result, and led on writing the paper  
27

28 AM collected research data and contributed to interpretation of results and  
29 writing the paper  
30

31 SH collected research data and contributed to interpretation of results and  
32 writing the paper  
33

34 RP led on statistical analysis of the data and interpretation of the results  
35

36 PW conducted additional statistical analysis and contributed to the paper  
37

38 AM co-developed the UPBEAT cohort study in which the study is sited,  
39 contributed to the research idea, contributed to interpretation of results and  
40 writing the paper  
41

42 AS contributed to the project design, analysis of results and writing the paper  
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44 PW contributed to the research idea, interpretation of the results and writing  
45 the paper  
46

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49 and writing the paper.  
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55 All authors have approved the final version  
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**Abstract (299 words)**

*Objective.* To explore characteristics associated with, and prevalence of, low health literacy in patients recruited to investigate the role of depression in patients on General Practice (GP) Coronary Heart Disease (CHD) registers (the Up-Beat UK study).

*Design.* Cross-sectional cohort. The health literacy measure was the Rapid Estimate of Health Literacy in Medicine (REALM). Univariable analyses identified characteristics associated with low health literacy and compared health service use between health literacy statuses. Those variables where there was a statistically significant/borderline significant difference between health literacy statuses were entered into a multivariable model.

*Setting.* 16 general practices in south London, UK.

*Participants:* Inclusion: patients >18 years, registered with a GP and on a GP CHD register. Exclusion: patients temporarily registered.

*Primary outcome measure:* REALM.

*Results.* Of the 803 Up-Beat cohort participants, 687 (85.55%) completed the REALM of whom 106 (15.43%) had low health literacy. Twenty-eight participants could not be included in the multivariable analysis due to missing predictor variable data, leaving a sample of 659. The variables remaining in the final model were age, gender, ethnicity, IMD score, years of education, employment; BMI and alcohol intake, and anxiety scores (Hospital Anxiety and Depression Scale (HADS)). Univariable analysis also showed that people with low health literacy may have more, and longer, practice nurse consultations than people with adequate health literacy.

*Conclusions.* There is a disadvantaged group of people on GP CHD registers with low health literacy. The multivariable model showed that patients with low health literacy have significantly higher anxiety levels than people with adequate health literacy. In addition, the univariable analyses show that such patients have more, and longer, consultations with practice nurses. We will collect 4-year longitudinal cohort data to explore the impact of health literacy in people on GP CHD registers and the impact of health literacy on health service use.

## Article summary

### Article focus

- Identifying the prevalence and characteristics of people with CHD and low health literacy on coronary heart disease GP registers in South London, UK

### Key Messages

- The characteristics of patients with low health literacy on UK GP CHD registers are similar to those seen in other long-term conditions in studies undertaken in other industrialised countries
- The prevalence of low health literacy to be close to that predicted from national general literacy levels at 15%
- People on GP CHD registers who have higher anxiety levels are more likely to have low health literacy than people with lower anxiety levels

### Strengths

- The data were collected within a prospective cohort study
- There were a wide range of sociodemographic data collected enabling characteristics of patients with low health literacy to be described
- The simultaneous collection of psychological and service use data enabled these to be compared between patients with low and adequate health literacy

### Limitations

- As a cross-sectional study this project cannot demonstrate causality or the impact of low health literacy over time.
- The findings may underestimate of the true picture; the participants who declined to do the REALM may have declined because of reading difficulties.
- Our findings of more frequent, and longer, GP practice nurse consultations should be interpreted with caution; the above preliminary finding requires more detailed health economic analysis and interpretation
- The REALM, although highly correlated with tests of functional health and general literacy, is not itself a test of functional skills but of pronunciation

## Introduction

Health literacy, 'the cognitive and social skills that determine the motivation and ability of individuals to (access), understand and use information in ways that promote and maintain good health' (1) is a social determinant of health (2). Whilst associated with other social determinants e.g. ethnicity, income, education, and socio-demographic status (SES), it has an independent association with poor health (3). International comparisons of health literacy levels are hampered by differing national definitions; however it is clear that health literacy is an important issue in many industrialised nations. The proportion of the population thought to be disadvantaged through low health literacy ranges from 19% in the US (4) to 55% in Canada (5). A recent survey of health literacy in Europe, where a common definition of health literacy was adopted, shows a range of health literacy skills between nations, with the proportion of the population having suboptimal health literacy skills ranging from 27.3% in the Netherlands to 61.4% in Bulgaria (6). There are no data on health literacy levels in England; however the 2011 national skills survey has shown that 15% of the adult population (=5 million people) are 'functionally illiterate' (7) (i.e. have insufficient literacy skills to achieve their potential in life and society (8)). It is reasonable to assume that a similar proportion also have low health literacy.

Low health literacy has greatest impact in complex health conditions when patients have to understand procedures, manage medication, and attend multiple appointments. US studies have shown that adults with low health literacy have a higher prevalence of diabetes and heart failure, worse physical and mental health, and higher all-cause mortality (9). There is little research on low health literacy and coronary heart disease (CHD), prompting us to explore this within a longitudinal cohort of patients recruited to investigate the role of depression in patients on General Practice (GP) CHD registers (10). This short report presents initial findings on the prevalence and characteristics of people with CHD and low health literacy.

## Method

The design, recruitment, power calculation, and measures used in the Up-

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2  
3 Beat cohort study are described elsewhere (10). The study was granted  
4 ethical approval by the Bexley and Greenwich Research Ethics Committee  
5 (REC Reference: 07/H0809/38) (10). Health literacy was measured using the  
6 Rapid Estimate of Health Literacy in Medicine (REALM) (11), a 66-item health  
7 word pronunciation test highly correlated with other measures of health  
8 literacy (12, 13) and widely used in research studies (3). The version of the  
9 REALM validated for use in the UK was used. This groups people into 'low'  
10 and 'adequate' health literacy with people with a score of < 59 out of the  
11 possible 66 being considered to have low health literacy (14).  
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20 Study design. A cross-sectional analysis of baseline data from the Up-Beat  
21 UK Cohort Study (10).  
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### 24 Statistical Analysis

25 Initial exploratory univariable analysis was undertaken to identify factors  
26 independently associated with low health literacy using  $\chi^2$  tests (categorical  
27 variables) and t-tests (continuous variables). Multivariable regression analysis  
28 was then undertaken to identify those factors that remained significant when  
29 all those identified in the univariable analysis were considered together.  
30 Those characteristics where there was a statistically significant ( $p < 0.05$ ) or  
31 borderline significant difference between people with low and adequate health  
32 literacy were entered into the multivariable model; logistic regression was  
33 used to model predictors of low health literacy. The fit for the model was  
34 assessed by the C statistic (ROC curve) and the Hosmer-Lemeshow  
35 goodness of fit  $\chi^2$  test.  
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46 Analyses were performed using Stata version 11.2.  
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48

### 49 **Results**

50 Cohort characteristics are detailed elsewhere (10). Cohort recruitment and a  
51 study flow diagram are shown in figure 1.  
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58 *Figure about here.*  
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The results of the univariable and multivariable analyses are shown in table 1.

**Table: Characteristics by Health Literacy**

		Health Literacy		Univariable analysis	Multivariable analysis
		Adequate	Low		
		N (%)	N (%)		
Total		581 (84.57)	106 (15.43)	N=687	N=659
				<b>P-value <sup>(1)</sup></b>	<b>Adjusted odds of having low health literacy (p-values)</b>
<b>Socio-demographic characteristics</b>					
Gender	Male	397 (68.33)	87 (82.08)	0.004	0.32 (<0.001)
	Female	184 (31.67)	19 (17.92)		
Ethnicity	White	524 (90.19)	81 (76.42)	<0.001	3.12 (<0.001)
	Other	57 (9.81)	25 (23.58)		
Age, Mean (SD)	Years	71.14 (10.41)	68.92 (11.84)	0.049	1.00 (0.873)
Index of Multiple Deprivation score, Mean (SD)	Range 0-100	18.34 (13.84)	24.37 (13.24)	<0.001	1.02 (0.072)
Time in education, Mean (SD)	Years	12.01 (3.40)	10.92 (2.46)	<0.001 <sup>(2)</sup>	0.84 (0.001)
Employment status	Unemployed/student	14 (2.42)	10 (9.52)	0.001	0.138
	Paid employment	117 (20.21)	18 (17.14)		
	Retired/Housewife	448 (77.37)	77 (73.33)		
<b>Lifestyle Characteristics</b>					
Alcohol intake (Units)	Doesn't drink	136 (23.45)	44 (41.90)	0.001	0.002
	1-10 units	289 (49.83)	44 (41.90)		
	11-20 units	87 (15.00)	9 (8.57)		
	Greater than 21 units	68 (11.72)	8 (7.62)		
BMI	Underweight/Normal	145 (25.62)	15 (14.29)	0.024	0.027
	Overweight	250 (44.17)	48 (45.71)		
	Obese	171 (30.21)	42 (40.00)		
<b>Mental Health</b>					
Depression score, Mean (SD)		2.86 (3.14)	4.28 (3.76)	<0.001 <sup>(2)</sup>	
Anxiety score, Mean (SD)		4.39 (4.13)	6.35 (5.18)	<0.001 <sup>(2)</sup>	1.08 (0.002)
<b>Health utilisation in the 6 months prior to baseline</b>					
Number of practice nurse visits, Mean (SD)		0.89 (1.85)	1.33 (2.21)	0.008 <sup>(3)</sup>	
Duration of practice nurse visit, Mean (SD)		4.98 (7.05)	6.98 (8.30)	0.008 <sup>(3)</sup>	
All other service use variables <sup>(4)</sup>				0.120 <sup>(5)</sup>	0.793 <sup>(6)</sup>
<sup>1</sup> P-value from t-test for continuous variables and chi-squared tests for categorical variables					
<sup>2</sup> Unequal variances t-test used					
<sup>3</sup> Wilcoxon rank sum test					
<sup>4</sup> Number of Accident and Emergency visits, Day hospital and in-patient admissions (days), outpatient visits, GP visits (number, duration), district nurse visits (number, duration), other medical visits (number, duration), other care based visits (number, duration), informal care visits number.					
<sup>5</sup> Number of Accident and Emergency visits					
<sup>6</sup> Other care based visits (duration)					



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4 Of the 803 cohort participants 687 (85.55%) completed the REALM  
5 questionnaire. The 116 non-responders were excluded from the analyses.  
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7 Non-responders lived in more socio-economically deprived areas and had  
8 received fewer years of education than those who completed the REALM.  
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10 There was no difference in ethnicity (responders vs. non-responders).  
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14 Of the 687 participants who completed the REALM, 106 (15.43%) had low  
15 health literacy. For the multivariable analysis 28 patients could not be included  
16 due to missing predictor variable data, leaving a total sample of 659.  
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20 Exploratory univariable analyses showed that people with low health literacy  
21 were more likely to be male, from a non-white ethnic group, live in a more  
22 deprived area, have spent fewer years in education, and were less likely to be  
23 employed. Age was borderline significant with people with low health literacy  
24 being slightly younger than people with adequate health literacy (difference in  
25 mean age between groups 2.22 years).  
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32 The variables remaining in the final multivariable model were age, gender,  
33 ethnicity (white versus other), IMD score, years of education, employment;  
34 BMI and alcohol intake, and anxiety scores (Hospital Anxiety and Depression  
35 Scale (HADS)) (15). There was an 8% increase in the odds of low health  
36 literacy for every single unit increase in the anxiety score on HADS (range 0-  
37 21).  
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44 Service use analysis (univariable only) showed that people with low health  
45 literacy had significantly more, and longer, GP practice nurse consultations  
46 than people with adequate health literacy, but other service use showed no  
47 differences between groups.  
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## 51 **Discussion**

### 52 *Key findings*

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54 This study confirms that the characteristics of patients with low health literacy  
55 on UK GP CHD registers are similar to those seen in other long-term  
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3 conditions in studies undertaken in other industrialised countries (i.e.,  
4 membership of a minority ethnic group, socio-economic deprivation, fewer  
5 years in education, and lower income (9)). In contrast to other studies (3-6),  
6 the patients with low health literacy in our study were slightly younger than the  
7 patients with adequate health literacy, although the difference between groups  
8 was small and should be interpreted with caution. We found the prevalence  
9 of low health literacy to be close to that predicted from national general  
10 literacy levels (7).  
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18 In addition people on GP CHD registers who have higher anxiety levels are  
19 more likely to have low health literacy than people with lower anxiety levels.  
20 This persists in the multivariable model, indicating an association over and  
21 above that already known to exist between anxiety and low socio-economic  
22 status (16, 17). This may reflect the findings of Ussher et al that CHD patients  
23 with low health literacy have increased difficulty understanding information,  
24 less knowledge of heart problems, and increased discomfort about asking for  
25 explanations (18). The finding in the univariable analysis that patients with low  
26 health literacy had more contact with practice nurses but not with other health  
27 services requires further investigation.  
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### 36 *Study limitations*

37 As a cross-sectional study this project cannot demonstrate causality or the  
38 impact of low health literacy over time.  
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43 Our findings may underestimate of the true picture; the 14.45% of participants  
44 who declined to do the REALM share the characteristics of people with low  
45 health literacy and may have declined because of reading difficulties.  
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49 Our findings of more frequent, and longer, GP practice nurse consultations  
50 should be interpreted with caution, as this was found during univariable  
51 analysis with no other factors controlled for; no service use data were entered  
52 into the multivariable model. The above preliminary finding thus requires more  
53 detailed health economic analysis and interpretation.  
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3 Finally, the REALM, although highly correlated with tests of functional health  
4 and general literacy, is not itself a test of functional skills but of pronunciation.  
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### 7 8 *Summary*

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10 Our findings indicate that there is a disadvantaged group of people on GP  
11 CHD registers who have low health literacy in addition to other socio-  
12 demographic barriers to health. A new finding is that these people have  
13 significantly higher anxiety levels than people with adequate health literacy.  
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### 16 17 *Next steps*

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19 Our possible finding that people on GP CHD registers with lower health  
20 literacy consulted practice nurses more frequently will inform future Up-Beat  
21 pilot interventions (10) and our longitudinal cohort data will enable us to  
22 explore the impact of low health literacy on patients on GP CHD registers, and  
23 on their health service use.  
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### 29 30 **Acknowledgements**

31 Many thanks to the 16 South London practices who participated in the  
32 UPBEAT-UK study.  
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36 This report/article presents independent research commissioned by the  
37 National Institute for Health Research (NIHR) under its Programme Grants for  
38 Applied Research scheme (RP-PG-0606-1048). The views expressed in this  
39 publication are those of the author(s) and not necessarily those of the NHS,  
40 the NIHR or the Department of Health.  
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46 AT is partly employed by the NIHR Institute of Psychiatry and South London  
47 and Maudsley Foundation Trust Mental Health Biomedical Research Centre.  
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### 50 51 **Data Sharing Statement**

52 There are no additional unpublished data from this study.  
53

### 54 55 **Funding**

56 None  
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3 **Characteristics of people with low health literacy on coronary heart**  
4 **disease GP registers in South London**

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6 **Lead, corresponding author and paper guarantor**

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40 **Word count: abstract 300 words, main text 1303 words.**

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43 **Study design:** cross-sectional survey

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46 **Statements:** The Corresponding Author has the right to grant on behalf of all  
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6 Competing interests: AT is partly employed by the NIHR Institute of Psychiatry  
7 and South London and Maudsley Foundation Trust Mental Health Biomedical  
8 Research Centre.  
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12 All authors have completed the Unified Competing Interest form  
13 **at**[www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the  
14 corresponding author) and declare: no support from any organisation for the  
15 submitted work, no financial relationships with any organisations that might  
16 have an interest in the submitted work in the previous three years, no other  
17 relationships or activities that could appear to have influenced the submitted  
18 work.  
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24 **Contributions:**

25 GR Led on development of the research idea, contributed to interpretation of  
26 result, and led on writing the paper  
27

28 AM collected research data and contributed to interpretation of results and  
29 writing the paper  
30

31 SH collected research data and contributed to interpretation of results and  
32 writing the paper  
33

34 RP led on statistical analysis of the data and interpretation of the results  
35

36 PW conducted additional statistical analysis and contributed to the paper  
37

38 AM co-developed the UPBEAT cohort study in which the study is sited,  
39 contributed to the research idea, contributed to interpretation of results and  
40 writing the paper  
41

42 AS contributed to the project design, analysis of results and writing the paper  
43

44 PW contributed to the research idea, interpretation of the results and writing  
45 the paper  
46

47 AT led on the development of the UPBEAT cohort study in which the study is  
48 sited, contributed to the research idea, contributed to interpretation of results  
49 and writing the paper.  
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55 All authors have approved the final version  
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**Abstract (299 words)**

*Objective.* To explore characteristics associated with, and prevalence of, low health literacy in patients recruited to investigate the role of depression in patients on General Practice (GP) Coronary Heart Disease (CHD) registers (the Up-Beat UK study).

*Design.* Cross-sectional cohort. The health literacy measure was the Rapid Estimate of Health Literacy in Medicine (REALM). Univariable analyses identified characteristics associated with low health literacy and compared health service use between health literacy statuses. Those variables where there was a statistically significant/borderline significant difference between health literacy statuses were entered into a multivariable model.

*Setting.* 16 general practices in south London, UK.

*Participants:* Inclusion: patients >18 years, registered with a GP and on a GP CHD register. Exclusion: patients temporarily registered.

*Primary outcome measure:* REALM.

*Results.* Of the 803 Up-Beat cohort participants, 687 (85.55%) completed the REALM of whom 106 (15.43%) had low health literacy. **Twenty-eight participants could not be included in the multivariable analysis due to missing predictor variable data, leaving a sample of 659.** The variables remaining in the final model were age, gender, ethnicity, IMD score, years of education, employment; BMI and alcohol intake, and anxiety scores (Hospital Anxiety and Depression Scale (HADS)). Univariable analysis also showed that people with low health literacy may have more, and longer, practice nurse consultations than people with adequate health literacy.

*Conclusions.* There is a disadvantaged group of people on GP CHD registers with low health literacy. The multivariable model showed that patients with low health literacy have significantly higher anxiety levels than people with adequate health literacy. In addition, the univariable analyses show that such patients have more, and longer, consultations with practice nurses. We will collect 4-year longitudinal cohort data to explore the impact of health literacy in people on GP CHD registers and the impact of health literacy on health service use.



## Article summary

### Article focus

- Identifying the prevalence and characteristics of people with CHD and low health literacy on coronary heart disease GP registers in South London, UK

### Key Messages

- The characteristics of patients with low health literacy on UK GP CHD registers are similar to those seen in other long-term conditions in studies undertaken in other industrialised countries
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### Strengths

- The data were collected within a prospective cohort study
- There were a wide range of sociodemographic data collected enabling characteristics of patients with low health literacy to be described
- The simultaneous collection of psychological and service use data enabled these to be compared between patients with low and adequate health literacy

### Limitations

- As a cross-sectional study this project cannot demonstrate causality or the impact of low health literacy over time.
- The findings may underestimate of the true picture; the participants who declined to do the REALM may have declined because of reading difficulties.
- Our findings of more frequent, and longer, GP practice nurse consultations should be interpreted with caution; the above preliminary finding requires more detailed health economic analysis and interpretation
- The REALM, although highly correlated with tests of functional health and general literacy, is not itself a test of functional skills but of pronunciation

## Introduction

Health literacy, 'the cognitive and social skills that determine the motivation and ability of individuals to (access), understand and use information in ways that promote and maintain good health' (1) is a social determinant of health (2). Whilst associated with other social determinants e.g. ethnicity, income, education, and socio-demographic status (SES), it has an independent association with poor health (3). **International comparisons of health literacy levels are hampered by differing national definitions; however it is clear that health literacy is an important issue in many industrialised nations. The proportion of the population thought to be disadvantaged through low health literacy ranges from 19% in the US (4) to 55% in Canada (5). A recent survey of health literacy in Europe, where a common definition of health literacy was adopted, shows a range of health literacy skills between nations, with the proportion of the population having suboptimal health literacy skills ranging from 27.3% in the Netherlands to 61.4% in Bulgaria (6).** There are no data on health literacy levels in England; however the 2011 national skills survey has shown that 15% of the adult population (=5 million people) are 'functionally illiterate' (7) (i.e. have insufficient literacy skills to achieve their potential in life and society (8)). It is reasonable to assume that a similar proportion also have low health literacy.

Low health literacy has greatest impact in complex health conditions when patients have to understand procedures, manage medication, and attend multiple appointments. US studies have shown that adults with low health literacy have a higher prevalence of diabetes and heart failure, worse physical and mental health, and higher all-cause mortality (9). There is little research on low health literacy and coronary heart disease (CHD), prompting us to explore this within a longitudinal cohort of patients recruited to investigate the role of depression in patients on General Practice (GP) CHD registers (10). This short report presents initial findings on the prevalence and characteristics of people with CHD and low health literacy.

## Method

The design, recruitment, power calculation, and measures used in the Up-

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11 **possible 66 being considered to have low health literacy (14).**

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20 Study design. A cross-sectional analysis of baseline data from the Up-Beat  
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### 22 23 24 Statistical Analysis

25 **Initial exploratory univariable analysis was undertaken to identify factors**  
26 **independently associated with low health literacy using  $\chi^2$  tests (categorical**  
27 **variables) and t-tests (continuous variables). Multivariable regression analysis**  
28 **was then undertaken to identify those factors that remained significant when**  
29 **all those identified in the univariable analysis were considered together.**  
30 Those characteristics where there was a statistically significant ( $p < 0.05$ ) or  
31 borderline significant difference between people with low and adequate health  
32 literacy were entered into the multivariable model; logistic regression was  
33 used to model predictors of low health literacy. The fit for the model was  
34 assessed by the C statistic (ROC curve) and the Hosmer-Lemeshow  
35 goodness of fit  $\chi^2$  test.

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46 Analyses were performed using Stata version 11.2.

### 47 48 49 **Results**

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53 Cohort characteristics are detailed elsewhere (10). Cohort recruitment and a  
54 study flow diagram are shown in figure 1.

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58 *Figure about here.*

The results of the univariable and multivariable analyses are shown in table 1.

**Table: Characteristics by Health Literacy**

		Health Literacy		Univariable analysis	Multivariable analysis
		Adequate	Low		
		N (%)	N (%)	N=687	N=659
Total		581 (84.57)	106 (15.43)		
				P-value <sup>(1)</sup>	Adjusted odds of having low health literacy (p-values)
<b>Socio-demographic characteristics</b>					
Gender	Male	397 (68.33)	87 (82.08)	0.004	0.32 (<0.001)
	Female	184 (31.67)	19 (17.92)		
Ethnicity	White	524 (90.19)	81 (76.42)	<0.001	3.12 (<0.001)
	Other	57 (9.81)	25 (23.58)		
Age, Mean (SD)	Years	71.14 (10.41)	68.92 (11.84)	0.049	1.00 (0.873)
Index of Multiple Deprivation score, Mean (SD)	Range 0-100	18.34 (13.84)	24.37 (13.24)	<0.001	1.02 (0.072)
Time in education, Mean (SD)	Years	12.01 (3.40)	10.92 (2.46)	<0.001 <sup>(2)</sup>	0.84 (0.001)
Employment status	Unemployed/student	14 (2.42)	10 (9.52)	0.001	0.138
	Paid employment	117 (20.21)	18 (17.14)		
	Retired/Housewife	448 (77.37)	77 (73.33)		
<b>Lifestyle Characteristics</b>					
Alcohol intake (Units)	Doesn't drink	136 (23.45)	44 (41.90)	0.001	0.002
	1-10 units	289 (49.83)	44 (41.90)		
	11-20 units	87 (15.00)	9 (8.57)		
	Greater than 21units	68 (11.72)	8 (7.62)		
BMI	Underweight/Normal	145 (25.62)	15 (14.29)	0.024	0.027
	Overweight	250 (44.17)	48 (45.71)		
	Obese	171 (30.21)	42 (40.00)		
<b>Mental Health</b>					
Depression score, Mean (SD)		2.86 (3.14)	4.28 (3.76)	<0.001 <sup>(2)</sup>	
Anxiety score, Mean (SD)		4.39 (4.13)	6.35 (5.18)	<0.001 <sup>(2)</sup>	1.08 (0.002)
<b>Health utilisation in the 6 months prior to baseline</b>					
Number of practice nurse visits, Mean (SD)		0.89 (1.85)	1.33 (2.21)	0.008 <sup>(3)</sup>	
Duration of practice nurse visit, Mean (SD)		4.98 (7.05)	6.98 (8.30)	0.008 <sup>(3)</sup>	
All other service use variables <sup>(4)</sup>				0.120 <sup>(5)</sup> - 0.793 <sup>(6)</sup>	
<sup>1</sup> P-value from t-test for continuous variables and chi-squared tests for categorical variables					
<sup>2</sup> Unequal variances t-test used					
<sup>3</sup> Wilcoxon rank sum test					
<sup>4</sup> Number of Accident and Emergency visits, Day hospital and in-patient admissions (days), outpatient visits, GP visits (number, duration), district nurse visits (number, duration), other medical visits (number, duration), other care based visits (number, duration), informal care visits number).					
<sup>5</sup> Number of Accident and Emergency visits					
<sup>6</sup> Other care based visits (duration)					

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4 Of the 803 cohort participants 687 (85.55%) completed the REALM  
5 questionnaire. The 116 non-responders were excluded from the analyses.  
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7 Non-responders lived in more socio-economically deprived areas and had  
8 received fewer years of education than those who completed the REALM.  
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10 There was no difference in ethnicity (responders vs. non-responders).  
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14 Of the 687 participants who completed the REALM, 106 (15.43%) had low  
15 health literacy. For the multivariable analysis 28 patients could not be included  
16 due to missing predictor variable data, leaving a total sample of 659.  
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20 Exploratory univariable analyses showed that people with low health literacy  
21 were more likely to be male, from a non-white ethnic group, live in a more  
22 deprived area, have spent fewer years in education, and were less likely to be  
23 employed. Age was borderline significant with people with low health literacy  
24 being slightly younger than people with adequate health literacy (difference in  
25 mean age between groups 2.22 years).  
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30 The variables remaining in the final multivariable model were age, gender,  
31 ethnicity (white versus other), IMD score, years of education, employment;  
32 BMI and alcohol intake, and anxiety scores (Hospital Anxiety and Depression  
33 Scale (HADS)) (15). There was an 8% increase in the odds of low health  
34 literacy for every single unit increase in the anxiety score on HADS (range 0-  
35 21).  
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39 Service use analysis (univariable only) showed that people with low health  
40 literacy had significantly more, and longer, GP practice nurse consultations  
41 than people with adequate health literacy, but other service use showed no  
42 differences between groups.  
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## 51 Discussion

### 52 Key findings

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54 This study confirms that the characteristics of patients with low health literacy  
55 on UK GP CHD registers are similar to those seen in other long-term  
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3 conditions in studies undertaken in other industrialised countries (i.e.,  
4 membership of a minority ethnic group, socio-economic deprivation, fewer  
5 years in education, and lower income (9)). In contrast to other studies (3-6),  
6 the patients with low health literacy in our study were slightly younger than the  
7 patients with adequate health literacy, although the difference between groups  
8 was small and should be interpreted with caution. We found the prevalence  
9 of low health literacy to be close to that predicted from national general  
10 literacy levels (7).

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18 In addition people on GP CHD registers who have higher anxiety levels are  
19 more likely to have low health literacy than people with lower anxiety levels.  
20 This persists in the multivariable model, indicating an association over and  
21 above that already known to exist between anxiety and low socio-economic  
22 status (16, 17). This may reflect the findings of Ussher et al that CHD patients  
23 with low health literacy have increased difficulty understanding information,  
24 less knowledge of heart problems, and increased discomfort about asking for  
25 explanations (18). The finding in the univariable analysis that patients with low  
26 health literacy had more contact with practice nurses but not with other health  
27 services requires further investigation.

### 28 29 30 31 32 33 34 35 36 *Study limitations*

37 As a cross-sectional study this project cannot demonstrate causality or the  
38 impact of low health literacy over time.

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43 Our findings may underestimate of the true picture; the 14.45% of participants  
44 who declined to do the REALM share the characteristics of people with low  
45 health literacy and may have declined because of reading difficulties.

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50 Our findings of more frequent, and longer, GP practice nurse consultations  
51 should be interpreted with caution, as this was found during univariable  
52 analysis with no other factors controlled for; no service use data were entered  
53 into the multivariable model. The above preliminary finding thus requires more  
54 detailed health economic analysis and interpretation.  
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3 Finally, the REALM, although highly correlated with tests of functional health  
4 and general literacy, is not itself a test of functional skills but of pronunciation.  
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### 8 *Summary*

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10 Our findings indicate that there is a disadvantaged group of people on GP  
11 CHD registers who have low health literacy in addition to other socio-  
12 demographic barriers to health. A new finding is that these people have  
13 significantly higher anxiety levels than people with adequate health literacy.  
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### 17 *Next steps*

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19 Our possible finding that people on GP CHD registers with lower health  
20 literacy consulted practice nurses more frequently will inform future Up-Beat  
21 pilot interventions (10) and our longitudinal cohort data will enable us to  
22 explore the impact of low health literacy on patients on GP CHD registers, and  
23 on their health service use.  
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### 29 **Acknowledgements**

30  
31 Many thanks to the 16 South London practices who participated in the  
32 UPBEAT-UK study.  
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36  
37 This report/article presents independent research commissioned by the  
38 National Institute for Health Research (NIHR) under its Programme Grants for  
39 Applied Research scheme (RP-PG-0606-1048). The views expressed in this  
40 publication are those of the author(s) and not necessarily those of the NHS,  
41 the NIHR or the Department of Health.  
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46 AT is partly employed by the NIHR Institute of Psychiatry and South London  
47 and Maudsley Foundation Trust Mental Health Biomedical Research Centre.  
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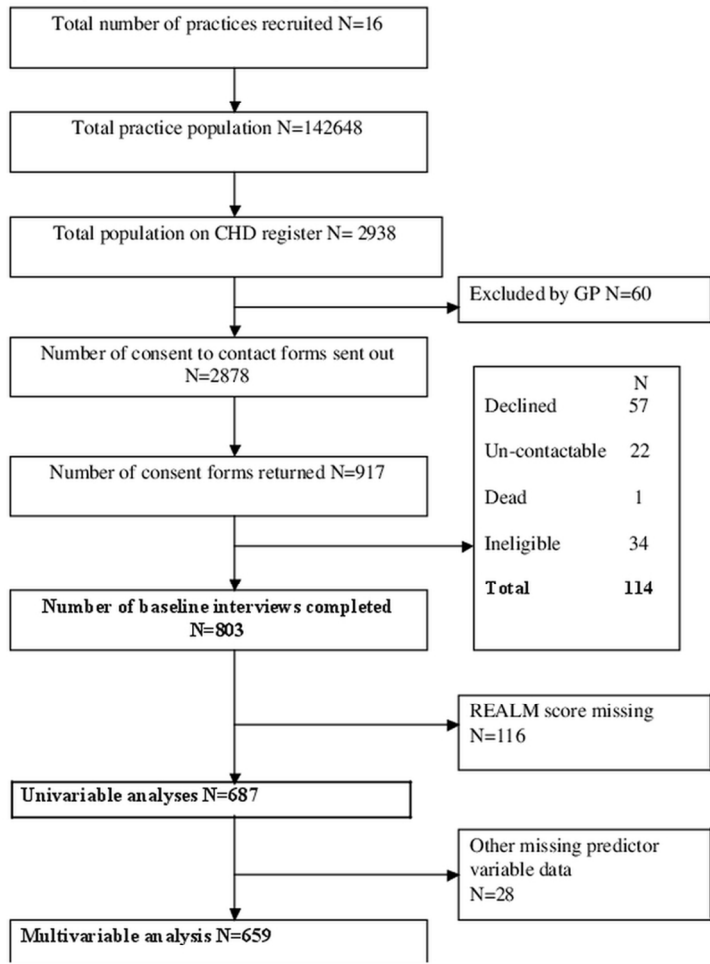
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Exploring indicators of low health literacy in a cohort with symptomatic Coronary Heart Disease

Figure: Study recruitment: Consort diagram



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