

- 24 Gay J, Paris V, Devaux M, De Looper M. Mortality Amenable to Health Care in 31 OECD Countries: Estimates and Methodological Issues. OECD Publishing, OECD Health Working Papers, No 55, 2011. Available at: https://www.oecd-ilibrary.org/social-issues-migration-health/mortality-amenable-to-health-care-in-31-oecd-countries_5kgj35f9f8s2-en (16 January 2020, date last accessed).
- 25 Nolte E, McKee M. Measuring the health of nations: updating an earlier analysis. *Health Affairs* 2008;27:58–71.
- 26 Tobias M, Yeh L. How much does health care contribute to health gain and to health inequality? Trends in amenable mortality in New Zealand 1981–2004. *Aust N Z Public Health* 2009;33:70–8.
- 27 AMIEHS. Avoidable Mortality in the European Union: Towards Better Indicators for the Effectiveness of Health Systems, Final Report, 2011. Available at: <http://amiehs.lshtm.ac.uk/publications/reports/AMIEHS%20final%20report%20VOL%20I.pdf> (16 January 2020, date last accessed).
- 28 Global Burden of Disease Study. Healthcare Access and Quality Index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990–2015: a novel analysis from the Global Burden of Disease Study 2015. *Lancet* 2017;390:231–66.
- 29 Mackenbach J, Hoffmann R, Khoshaba B, et al. Using amenable mortality as indicator of healthcare effectiveness in international comparisons—results of a validation study. *J Epidemiol Community Health* 2013;67:139–46.
- 30 Kossarova L, Holland W, Nolte E, McKee M. Measuring ‘Avoidable’ Mortality. Methodological note. Brussels 2009, Directorate-General “Employment, Social Affairs and Equal Opportunities”. Available at: <http://eprints.lse.ac.uk/46390/> (16 January 2020, date last accessed).
- 31 WHO. Mortality Database. Available at: <http://apps.who.int/healthinfo/statistics/mortality/whodpms/> (16 January 2020, date last accessed).
- 32 EUROSTAT. Database. Available at: <https://ec.europa.eu/eurostat/data/database> (16 January 2020, date last accessed).
- 33 FAO. Food Balance Sheets. Available at: <http://www.fao.org/faostat/en/#data/FBS> (16 January 2020, date last accessed).
- 34 Hellenic Statistical Authority. Household Budget Survey (after 2008). Available at: <https://www.statistics.gr/en/statistics/-/publication/SFA05/> (16 January 2020, date last accessed).
- 35 McKee M, Stuckler D. Health effects of the financial crisis: lessons from Greece. *Lancet Public Health* 2016;1:e40–e41. DOI:10.1016/S2468-2667(16)30016-0.
- 36 Gouvalas A, Igoumenidis M, Theodorou M, Athanasakis K. Cost-sharing rates increase during deep recession: preliminary data from Greece. *Int J Health Policy Manag* 2016;5:687–92.
- 37 Nolasco A, Vicent-Castelló E, Pereyra-Zamora P, et al. Mortality due to medical and surgical complications, economic crisis and health spending in Spain, 2002–2013. *Gac Sanit* 2019;33:504–10.
- 38 Alpert H, Vardavas C, Chaloupka F, et al. The recent and projected public health and economic benefits of cigarette taxation in Greece. *Tob Control* 2014;23:452–4.
- 39 Sims M, Maxwell R, Bauld L, Gilmore A. Short term impact of smoke-free legislation in England: retrospective analysis of hospital admissions for myocardial infarction. *BMJ* 2010;340:c2161. DOI:10.1136/bmj.c2161.

.....
The European Journal of Public Health, Vol. 30, No. 5, 866–872

© The Author(s) 2020. Published by Oxford University Press on behalf of the European Public Health Association.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs licence (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial reproduction and distribution of the work, in any medium, provided the original work is not altered or transformed in any way, and that the work is properly cited. For commercial re-use, please contact journals.permissions@oup.com doi:10.1093/eurpub/ckaa064 Advance Access published on 25 April 2020

.....

Impact of low health literacy on healthcare utilization in individuals with cardiovascular disease, chronic obstructive pulmonary disease, diabetes and mental disorders. A Danish population-based 4-year follow-up study

Karina Friis^{1,*}, Marie Hauge Pedersen¹, Anna Aaby², Mathias Lasgaard¹, Helle Terkildsen Maindal²

1 DEFACTUM, Central Denmark Region, 8200 Aarhus N, Denmark

2 Department of Public Health, Section for Health Promotion and Health Services, Aarhus University, Aarhus, Denmark

Correspondence: Karina Friis, DEFACTUM, Central Denmark Region, Olof Palmes Allé 15, 8200 Aarhus N, Denmark, Tel: +45 (0) 78 41 4335, e-mail: karina.friis@stab.rm.dk

Background: Previous research from the USA has shown that low health literacy is associated with higher hospitalization rates and higher rates of emergency service use. However, studies in a European context using more comprehensive health literacy definitions are lacking. The aim was to study the impact of low health literacy on healthcare utilization in a Danish context. **Methods:** In this prospective cohort study, baseline survey data from 2013 were derived from a large Danish health and morbidity survey and merged with individual-level longitudinal register data for a 4-year follow-up period. The study included people in the general population ($n = 29\,473$) and subgroups of people with four different chronic conditions: cardiovascular disease (CVD) ($n = 2389$), chronic obstructive pulmonary disease (COPD) ($n = 1214$), diabetes ($n = 1685$) and mental disorders ($n = 1577$). **Results:** In the general population, low health literacy predicted slightly more visits to the general practitioner and admissions to hospital and longer hospitalization periods at 4 years of follow-up, whereas low health literacy did not predict planned outpatient visits or emergency room visits. In people with CVD, low health literacy predicted more days with emergency room visits. In people with mental disorders, difficulties in actively engaging with healthcare providers were associated with a higher number of hospital admission days. No significant association between health literacy and healthcare utilization was found for diabetes or COPD. **Conclusions:** Even though Denmark has a universal healthcare system the level of health literacy affects healthcare use in the general population and in people with CVD and mental disorders.

.....

Introduction

Health literacy is defined as the personal characteristics and social resources needed for people to access, understand, appraise and use information and services to make decisions about health.¹ Thus, health literacy refers to the set of skills that people need to navigate a complex healthcare system.

A growing body of literature has explored the association between health literacy and healthcare utilization.^{2–14} Low health literacy is associated with underutilization of preventive healthcare services^{15,16} and increased rates of hospitalization^{2,6,12,17} and rates of emergency service use.^{3,5–8,12,17} This indicates that navigating the healthcare system is unequal and more expensive for people with low health literacy levels than for people with higher health literacy levels. Most studies on the association between health literacy and healthcare utilization are based on data from the USA.^{2,3,5,7,8,10} However, differences between the European and the US healthcare systems are outspoken, and findings from the US studies can, therefore, hardly be extrapolated to a European context. In many European countries, including Denmark, healthcare is universal and all citizens have free and equal access to healthcare. It is, however, unclear if low health literacy also has adverse effects on healthcare service utilization in countries with such universal healthcare.

The tools most often used to measure health literacy in relation to healthcare utilization are performance-based, covering basic reading and numeracy skills.¹⁸ Self-reported health literacy measures and measures covering abilities to actively engage with healthcare providers have only been used only a few times.^{6,11,13} Therefore, it is important to gain more insight into the relationship between these health literacy competences and health outcomes as these measures aim to capture a person's confidence, social resources, skills and perceived ability to navigate the healthcare system.

A recent study showed that people with chronic conditions such as cardiovascular disease (CVD), chronic obstructive pulmonary disease (COPD), diabetes and mental disorders reported more difficulties than the general population in understanding health information and actively engaging with healthcare providers.¹⁹ In Denmark, CVD is one of the leading causes of death and mental disorders, chronic respiratory diseases and diabetes are also major sources of ill health.²⁰ Furthermore, people with these chronic conditions account for many outpatient treatments and hospital admissions and therefore place a significant burden on national healthcare resources and health professionals' workload. Hence, it is relevant to study the impact of low health literacy on healthcare utilization in populations with these chronic conditions.

The aim of this study was to analyze the impact of two aspects of self-reported health literacy—the ability to understand information about health and the ability to engage actively with healthcare providers—on healthcare utilization in a universal healthcare system during a 4-year period. The study explores the association between health literacy and healthcare utilization in the general population and in people with four different chronic conditions (CVD, COPD, diabetes and mental disorders).

Methods

Setting and survey data

The baseline survey data for this cohort study were derived from a large Danish health and morbidity survey entitled 'How Are You?' from 2013. Denmark is divided into five geographic and administrative regions. This study was conducted in the Central Denmark Region where approximately one-fifth of the Danish population lives.

A random sample of 46 354 people (25+ years) living in the Central Denmark Region were invited to participate in the survey. The sample was drawn from the Danish Civil Registration System as per 1 January 2013 using the unique personal identification number assigned to all

Danish citizens. In total, 29 473 people (63%) participated in the study by answering the questionnaire online or in paper.

Health literacy

To study the impact of health literacy on healthcare utilization, two subscales from the nine-subscale Health Literacy Questionnaire (HLQ)²¹ were included: 'Understanding health information well enough to know what to do' and 'Actively engaging with healthcare providers'. The HLQ was developed using a validity-driven approach including in-depth grounded consultations, psychometric analyses and cognitive interviews. The HLQ has previously been translated and validated for use in a Danish context.²² The two subscales were selected because they cover two distinct and central dimensions of health literacy providing valuable insight into the health literacy challenges of individuals with chronic diseases. Also, we found that the two subscales were the best suited to be included in a population-based survey where not all respondents have had much contact with the healthcare system. Each scale included five items allowing participants to indicate their response on a four-point Likert scale: 1 = very difficult, 2 = difficult, 3 = easy and 4 = very easy. The total scale scores were calculated as the mean of the five-item scores and then standardized to range between 1 (lowest ability) and 4 (highest ability) to ensure consistency with the response options. If responses to more than two items were missing on either scale for any respondent, the scale score for that person was coded as missing. Each scale was coded into a binary variable (score ≤ 2) to identify respondents who found it very difficult or difficult to understand health information or to engage actively with healthcare providers.

Chronic conditions

Information about CVD, COPD, diabetes and mental disorders was self-reported. Respondents were asked if they had the specific condition or had suffered from the condition previously. To ensure that our populations reflected active COPD, diabetes and mental disorders, we included only those who reported the condition at present. In relation to CVD, we included both those who answered that they had myocardial infarction, angina pectoris and stroke now and those who reported previous disease.

Follow-up data and outcome measures

All outcome measures derived from registry data. We used the unique personal identification number to link all survey respondents with individual-level longitudinal register data for a 4-year period—from the beginning of 2014 to the end of 2017. Data were collected from the Danish National Health Service Register²³ and the Danish National Patient Register.²⁴

We included five indicators of healthcare utilization. (i) 'Number of weeks with one or more visits at a general practitioner'. For each individual, we retrieved information about the total number of weeks in which at least one physical consultation, e-mail consultation or telephone consultation at a general practitioner had taken place. (ii) 'Number of days with planned outpatient visits' and (iii) 'Number of days with emergency room visits'. These two outcome measures include all unique days with outpatient visits at a somatic hospital—both public and private. Information about hospital admissions was also divided into two variables: (iv) 'At least one hospital admission' and (v) 'Number of hospital admission days'. These two outcome measures included all unique days with hospital admission at a somatic hospital—both public and private. For all outcome measures, number of visits was summarized for all four follow-up years.

Confounders

We included the following baseline variables as confounders: gender (registry data), age (registry data), educational level (survey), ethnic

background (registry data), cohabitation status (survey) and multimorbidity (survey). Furthermore, death during the follow-up period (registry data) was included as a confounder. We categorized self-reported educational level as low (1–10 years of education), medium (11–14 years of education) or high (≥ 15 years of education). In relation to ethnic background, a person was defined as Danish if he/she or at least one parent had Danish citizenship. Cohabitation status was categorized as living with a partner or not. Multimorbidity was categorized as having 0, 1, 2, 3 or 4+ (additional) chronic conditions (i.e. asthma, allergy, diabetes, hypertension, CVD, COPD, osteoarthritis, rheumatoid arthritis, osteoporosis, cancer, migraine or recurrent headaches, mental disorders, slipped discs or other back injuries, cataract or tinnitus) at baseline.

Ethics

There is no formal agency for ethical approval of questionnaire-based survey studies in Denmark. The study was approved by the Danish Data Protection Agency. Information about the survey was provided to potential participants, and the participants' voluntary completion and return of the survey questionnaires constituted implied consent.

Statistical data analysis

Statistics Denmark used the personal identification number to link respondents and non-respondents to Danish administrative registers. A weight was constructed to account for differences in selection probabilities and response rates using a model-based calibration approach.²⁵ Data were weighted to represent the population in the Central Denmark Region.

To examine if the two health literacy variables predicted the four-count variables (weeks with contact with the general practitioner, days with planned outpatient visits, days with emergency room visits and hospital admission days), we used negative binomial regression analyses. The method was used because data were over-dispersed (i.e. the conditional variance exceeded the conditional mean). Unadjusted and adjusted incidence-rate ratios (IRRs) with 95% CIs were produced.

To examine if the two low health literacy variables predicted admission to hospital during the follow-up period, logistic regression models were used with the outcome measure as the dependent variable. Unadjusted and adjusted odds ratio (ORs) with 95% CIs were produced.

All regression models were conducted at the general population level and for each of the four selected chronic condition groups.

Table 1. Participant characteristics in the general population in the Central Denmark Region and by chronic condition group

	General population		CVD		COPD		Diabetes		Mental disorders	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
	<i>n</i> = 29 473		<i>n</i> = 2389 (7.5%)		<i>n</i> = 1214 (3.9%)		<i>n</i> = 1685 (5.5%)		<i>n</i> = 1577 (6.4%)	
Gender										
Men	14 025	49.4	1471	58.8	630	49.2	954	54.9	618	41.3
Women	15 448	50.6	918	41.2	584	50.8	731	45.1	959	58.7
Level of education										
Low (1–10 years)	5507	18.6	736	33.7	440	37.6	529	34.1	389	25.9
Medium (11–14 years)	14 718	50.2	1147	49.1	571	49.1	790	48.9	731	47.0
High (≥ 15 years)	8319	31.2	409	17.2	160	13.3	282	17.1	407	27.1
Cohabitation status										
Lives with partner/spouse	22 176	69.7	1654	61.5	762	54.1	1170	61.6	575	47.2
Does not live with partner/spouse	6657	30.3	690	38.5	424	45.9	479	38.4	982	52.8
Ethnic background										
Danish	28 400	93.6	2318	95.0	1197	98.0	1633	95.0	1452	89.3
Not Danish	1073	6.4	71	5.0	17	2.0	52	5.0	125	10.7
Number of (additional) chronic conditions										
0	10 310	37.4	443	18.7	130	10.6	213	12.8	354	23.5
1	8244	28.4	595	23.9	241	18.3	445	25.7	396	26.3
2	5218	17.0	535	22.1	268	22.8	405	22.1	310	18.0
3	2755	8.8	364	14.3	222	17.5	297	18.1	223	13.8
4+	2444	8.3	452	20.9	353	30.9	325	21.2	294	18.4
Health literacy										
Easy to understand information about health	26 475	95.8	2012	90.9	1031	90.4	1446	90.7	1354	88.1
Difficult to understand information about health (mean = 3.09, SD = 0.55)	1037	4.2	181	9.1	94	9.6	121	9.3	165	11.9
Easy to actively engage with healthcare providers	25 748	93.1	1980	88.9	1000	86.9	1438	90.7	1257	82.3
Difficult to actively engage with healthcare providers (mean = 3.07, SD = 0.59)	1801	6.9	217	11.1	126	13.1	133	9.3	263	17.7
	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)	
Age	52.1 (16.3)		65.7 (14.0)		66.1 (12.2)		63.6 (13.4)		48.2 (14.7)	
Healthcare use during follow-up (2014–17)										
General practitioner (weeks)	25.4 (22.1)		41.1 (28.0)		42.5 (29.1)		44.9 (27.2)		39.8 (26.9)	
Planned outpatient visits (days)	6.0 (9.0)		8.7 (10.9)		10.0 (11.2)		9.2 (12.0)		7.6 (9.9)	
Emergency room visits (days)	0.4 (0.9)		0.7 (1.4)		0.7 (1.3)		0.6 (1.2)		0.5 (1.1)	
Hospital admission (days)	3.1 (11.5)		7.8 (17.1)		9.8 (19.7)		7.7 (19.1)		4.3 (15.8)	

CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease.

Table 2. Impact of difficulties in understanding information about health and in actively engaging with healthcare providers on visits to the general practitioner during the period from 2014 to 2017 in the general population and by chronic condition group

	Weeks at general practitioner	
	Unadjusted IRR (95% CI)	Adjusted IRR ^a (95% CI)
General population (<i>n</i> = 29 473)		
Difficult to understand information about health ^b	1.37 (1.29–1.45)	1.16 (1.09–1.23)
Difficult to actively engage with healthcare providers ^c	1.22 (1.16–1.28)	1.07 (1.02–1.11)
CVD (<i>n</i> = 2389)		
Difficult to understand information about health ^b	1.22 (1.08–1.38)	1.21 (1.07–1.37)
Difficult to actively engage with healthcare providers ^c	1.10 (0.97–1.26)	1.06 (0.94–1.21)
COPD (<i>n</i> = 1214)		
Difficult to understand information about health ^b	1.11 (0.93–1.32)	0.98 (0.84–1.16)
Difficult to actively engage with healthcare providers ^c	1.19 (1.02–1.38)	1.04 (0.90–1.20)
Diabetes (<i>n</i> = 1685)		
Difficult to understand information about health ^b	1.04 (0.90–1.20)	1.06 (0.93–1.20)
Difficult to actively engage with healthcare providers ^c	1.03 (0.88–1.19)	0.96 (0.84–1.09)
Mental disorder (<i>n</i> = 1577)		
Difficult to understand information about health ^b	1.07 (0.93–1.23)	1.06 (0.93–1.21)
Difficult to actively engage with healthcare providers ^c	1.01 (0.90–1.12)	0.96 (0.87–1.06)

CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease.

a: Adjusted for gender, age, educational level, ethnic background, cohabitation status and multimorbidity at baseline and for mortality during follow-up.

b: Reference group—easy to understand information about health.

c: Reference group—easy to actively engage with healthcare providers.

Table 3. Impact of difficulties in understanding information about health and in actively engaging with healthcare providers on planned and emergency outpatient visits from 2014 to 2017 in the general population and by chronic condition group

	Days with planned outpatient visits		Days with emergency room visits	
	Unadjusted IRR (95% CI)	Adjusted IRR ^a (95% CI)	Unadjusted IRR (95% CI)	Adjusted IRR ^a (95% CI)
General population (<i>n</i> = 29 473)				
Difficult to understand information about health ^b	1.10 (1.00–1.21)	0.98 (0.88–1.09)	1.71 (1.40–2.08)	1.22 (0.99–1.50)
Difficult to actively engage with healthcare providers ^c	1.16 (1.08–1.25)	1.06 (0.98–1.15)	1.22 (1.03–1.44)	0.97 (0.82–1.15)
CVD (<i>n</i> = 2389)				
Difficult to understand information about health ^b	1.05 (0.85–1.30)	1.12 (0.90–1.40)	2.37 (1.54–3.65)	1.77 (1.19–2.65)
Difficult to actively engage with healthcare providers ^c	1.12 (0.94–1.34)	1.08 (0.88–1.33)	1.91 (1.25–2.92)	1.50 (1.02–2.19)
COPD (<i>n</i> = 1214)				
Difficult to understand information about health ^b	0.82 (0.62–1.10)	0.82 (0.62–1.09)	1.47 (0.88–2.44)	1.11 (0.75–1.66)
Difficult to actively engage with healthcare providers ^c	1.18 (0.96–1.46)	1.25 (0.97–1.62)	1.61 (1.08–2.40)	1.23 (0.86–1.75)
Diabetes (<i>n</i> = 1685)				
Difficult to understand information about health ^b	1.00 (0.77–1.30)	1.04 (0.79–1.36)	1.22 (0.65–2.27)	1.07 (0.63–1.83)
Difficult to actively engage with healthcare providers ^c	1.00 (0.78–1.28)	0.95 (0.75–1.20)	0.98 (0.53–1.81)	0.85 (0.53–1.38)
Mental disorder (<i>n</i> = 1577)				
Difficult to understand information about health ^b	1.14 (0.97–1.39)	1.18 (0.93–1.50)	1.67 (1.14–2.45)	1.26 (0.86–1.85)
Difficult to actively engage with healthcare providers ^c	1.17 (0.97–1.39)	1.20 (0.98–1.47)	1.21 (0.85–1.72)	0.94 (0.69–1.28)

CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease.

a: Adjusted for gender, age, educational level, ethnic background, cohabitation status and multimorbidity at baseline and for mortality during follow-up.

b: Reference group—easy to understand information about health.

c: Reference group—easy to actively engage with healthcare providers.

Significance was set at $P < 0.05$, and STATA version 15 was used to analyze data.

Results

Descriptive statistics

The mean age of the general population was 52.1 (SD 16.3) years. In total, 2389 (7.5% of the study population) had CVD, 1214 (3.9%) had COPD, 1685 (5.5%) had diabetes and 1577 (6.4%) had a mental disorder at baseline (table 1). The mean age was lowest among

people with mental disorders (48.2 years) and ranged from 63.6 to 66.1 years in the three other chronic condition groups. In all four chronic condition groups, the percentage with a low level of education was markedly higher than in the general population. The vast majority of individuals with one of the four chronic conditions also had other chronic conditions. Especially, people with COPD had multiple chronic conditions. In the general population, 4.2% found it difficult to understand information about health and 6.9% found it difficult to engage actively with healthcare providers. The two percentages were higher in each of the four chronic condition groups than in the general population.

Table 4. Impact of difficulties in understanding information about health and in actively engaging with healthcare providers on hospital admissions from 2014 to 2017 in the general population and by chronic condition group

	At least one hospital admission		Hospital admission days	
	Unadjusted OR (95% CI)	Adjusted OR ^a (95% CI)	Unadjusted IRR (95% CI)	Adjusted IRR ^a (95% CI)
General population (n = 29 473)				
Difficult to understand information about health ^b	1.83 (1.57–2.12)	1.31 (1.11–1.56)	1.87 (1.46–2.41)	1.42 (1.01–2.01)
Difficult to actively engage with healthcare providers ^c	1.44 (1.28–1.62)	1.21 (1.06–1.38)	1.42 (1.15–1.76)	1.48 (1.10–1.98)
CVD (n = 2389)				
Difficult to understand information about health ^b	2.07 (1.42–3.02)	1.89 (1.25–2.86)	1.70 (1.23–2.34)	1.60 (1.07–2.41)
Difficult to actively engage with healthcare providers ^c	1.34 (0.96–1.88)	1.30 (0.90–1.89)	1.35 (0.97–1.89)	1.55 (1.02–2.37)
COPD (n = 1214)				
Difficult to understand information about health ^b	1.22 (0.74–2.02)	0.97 (0.58–1.61)	1.21 (0.75–1.95)	1.04 (0.61–1.77)
Difficult to actively engage with healthcare providers ^c	1.69 (1.08–2.63)	1.51 (0.91–2.52)	1.03 (0.68–1.55)	1.11 (0.69–1.79)
Diabetes (n = 1685)				
Difficult to understand information about health ^b	1.30 (0.84–2.02)	1.19 (0.73–1.93)	1.17 (0.72–1.88)	0.74 (0.44–1.24)
Difficult to actively engage with healthcare providers ^c	0.91 (0.60–1.38)	0.86 (0.55–1.34)	0.97 (0.61–1.53)	0.87 (0.56–1.36)
Mental disorder (n = 1577)				
Difficult to understand information about health ^b	1.42 (0.97–2.07)	1.29 (0.85–1.97)	2.22 (1.09–4.52)	2.05 (0.99–4.23)
Difficult to actively engage with healthcare providers ^c	1.45 (1.06–1.98)	1.32 (0.94–1.84)	1.82 (0.98–3.39)	1.68 (1.01–2.79)

CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease.

a: Adjusted for gender, age, educational level, ethnic background, cohabitation status and multimorbidity at baseline and for mortality during follow-up.

b: Reference group—easy to understand information about health.

c: Reference group—easy to actively engage with healthcare providers.

Visits to a general practitioner

The adjusted analysis showed that people in the general population who found it difficult to understand information about health and/or to engage actively with healthcare providers had slightly more visits to the general practitioner during the follow-up period than those who did not have these difficulties (IRR 1.16 and 1.07, respectively; [table 2](#)). People with CVD who found it difficult to understand information about health had slightly more visits to the general practitioner than those with CVD who did not have these difficulties (IRR 1.21). The two scales did not predict visits to the general practitioner for people with COPD, diabetes or mental disorders.

Planned outpatient and emergency room visits

The two health literacy scales were not associated with the number of days with planned outpatient visits when this number was adjusted for covariates, either in the general population or in any of the chronic condition groups ([table 3](#)). In the general population, the health literacy scales did not predict the number of days with emergency room visits. However, people with CVD who found it difficult to understand information about health and/or to engage actively with healthcare providers had more days with emergency room visits than those who did not have these difficulties (IRR 1.77 and 1.50, respectively). No significant results were found for any of the other chronic conditions.

Hospital admission and number of hospital admission days

In the general population, difficulties in understanding information about health and in actively engaging with healthcare providers increased the odds of being admitted to hospital (OR 1.31 and 1.21, respectively) and was associated with more hospital admission days (IRR 1.42 and 1.48, respectively; [table 4](#)).

In people with CVD, difficulties in understanding information about health increased the odds of having had at least one hospital admission (OR 1.89) and more hospital admission days (IRR 1.60) compared with those who did not have these difficulties.

Furthermore, people with CVD who found it difficult to engage actively with healthcare providers had more hospital admission days (IRR 1.55) than those who did not have this difficulty. Finally, in people with mental disorders, difficulties in actively engaging with healthcare providers increased the number of hospital admission days (IRR 1.68), whereas no differences in hospital admissions were seen for people with COPD and diabetes.

Discussion

Our study showed that in the general population, difficulties in understanding information about health and in actively engaging with healthcare providers predicted higher odds for being hospitalized (at least once) and for having longer hospital admission periods. However, these dimensions of health literacy did not predict the number of planned outpatient or emergency room visits in the general population and predicted only slightly more visits to the general practitioner.

In line with our study, several previous studies have concluded that people with low health literacy have higher hospitalization rates.⁶ The mechanisms whereby low health literacy leads to higher hospitalization rates are only partially understood. People with low health literacy have a poorer self-care behaviour.^{26,27} This is critical since proper, long-term self-care behaviour is important to avoid hospitalizations and other adverse health outcomes in most chronic conditions. Higher hospitalization rates among people with low health literacy may also be a result of poor patient–clinician interaction. For instance, people with low health literacy may be reluctant to seek preventive healthcare or to participate in shared decision-making, thereby increasing the risk of poor health outcomes.^{15,28} In our study, people with difficulties in understanding information about health and in actively engaging with healthcare providers only had slightly more visits to the general practitioner than those with high health literacy, and no differences were found in relation to the use of planned outpatient services. This was unexpected as people with low health literacy more frequently suffer from more chronic conditions than those with high health literacy. This may indicate that the higher odds for being hospitalized among people with low health literacy are associated with underuse of general

practitioner and outpatient services, resulting in a more inappropriate use of the healthcare system. For many years, it has been a public health goal in Denmark to reduce health inequalities through prevention and health promotion directed towards vulnerable groups.²⁹ Our study indicates, however, that even though Denmark is a country with a universal healthcare system where citizens are eligible to receive free medical treatment, people with low health literacy are more frequently admitted to hospital and have longer hospitalization periods than people with high health literacy.

To the best of our knowledge, this is the first study to investigate associations between dimensions of health literacy and healthcare utilization in people with various chronic conditions. We found that the association largely depends on the condition in question. In people with CVD, we found that, contrary to the other chronic conditions analyzed here, difficulties in understanding information about health and in actively engaging with healthcare providers predicted more visits at the general practitioner, more days with emergency room visits, more admissions to hospital and longer hospital admissions. This may reflect that management of CVD is particularly complex and challenges the patients' self-management skills more than does other conditions. Hence, people with CVD may encounter more difficulties in avoiding adverse health outcomes than people with other chronic conditions. Several other studies of patients with heart conditions have shown that health literacy is a predictor of poor health outcomes.^{2,30–34} This may indicate that whereas people with high health literacy would handle an acute health problem without assistance from the emergency care system, people with low health literacy may be more inclined to believe that immediate medical care is required.

Likewise, our study showed that for people with mental disorders who had difficulties in actively engaging with healthcare providers, the number of hospitalization days in a somatic department rose. Several studies have found that people with mental disorders are more frequently hospitalized for somatic conditions than people without those disorders, which is most likely associated with a number of causes, including behavioural and lifestyle factors, access to and quality of healthcare and social determinants of health.^{35–37} Our study shows that difficulties in actively engaging with healthcare providers may also contribute to the explanation.

Finally, in people with diabetes and COPD, difficulties in understanding information about health and in actively engaging with healthcare providers did not predict any type of healthcare utilization. This finding could indicate that individuals find these long-term conditions—compared with individuals with CDV—find it less complex to navigate the healthcare system. However, more studies are needed to study the association between health literacy and healthcare utilization in individuals with diabetes and COPD to determine why the association does not exist in these long-term condition groups.

Our study has some limitations. The ability and motivation to fill out a long health survey represent a health literacy competency in itself; thus, the most vulnerable groups may not have participated in the study. The study is also limited by including only two dimensions of health literacy. As this study is based on data from a general health and morbidity study covering a wide range of topics there was no room for adding the full relatively extensive HLQ questionnaire without compromising the response rate for the survey. Thus, the study suffers from construct underrepresentation. Finally, it should be noted that there may be some imprecision and bias associated with using self-report measures of chronic conditions.

One major strength of this study is the use of data from a large, population-based survey with a high response rate that were merged with quality register data regarding the healthcare outcome measures. The large data set made it possible to stratify the analyses on various chronic conditions.

To conclude, our study showed that even though Denmark has a universal healthcare system where citizens are eligible to receive free medical treatment, the health literacy level affects healthcare use in the general population as well as in people with CVD and mental disorders.

Funding

This study was funded by the Karen Elise Jensen Foundation.

Conflicts of interest: None declared.

Key points

- Low health literacy predicted more visits to the general practitioner and longer hospitalization periods.
- In people with cardiovascular disease (CVD), low health literacy predicted more emergency room visits.
- Even though Denmark has a universal healthcare system where citizens are eligible to receive free medical treatment, the health literacy level affects healthcare use in the general population as well as in people with CVD and mental disorders.
- This study serves as a reminder to healthcare providers to adopt and implement communication techniques that are feasible and effective for patients with low health literacy.

References

- 1 Dodson S, Good S, Osborne R. *Health Literacy Toolkit for Low and Middle-Income Countries: A Series of Information Sheets to Empower Communities and Strengthen Health Systems*. New Delhi: World Health Organization, Regional Office for South-East Asia, 2015.
- 2 Wu JR, Holmes GM, DeWalt DA, et al. Low literacy is associated with increased risk of hospitalization and death among individuals with heart failure. *J Gen Intern Med* 2013;28:1174–80.
- 3 Griffey RT, Kennedy SK, McGowan L, et al. Is low health literacy associated with increased emergency department utilization and recidivism? *Acad Emerg Med* 2014; 21:1109–15.
- 4 Kim YS, Khatiwoda P, Park BH, Lee HY. Health literacy and its link to healthcare service utilization among older adults in Korea. *Soc Work Public Health* 2016;31: 467–73.
- 5 Rasu RS, Bawa WA, Suminski R, Snella K, et al. Health literacy impact on national healthcare utilization and expenditure. *Int J Health Policy Manag* 2015;4: 747–55.
- 6 Vandenbosch J, Van den Broucke S, Vancorenland S, et al. Health literacy and the use of healthcare services in Belgium. *J Epidemiol Community Health* 2016;70: 1032–8.
- 7 Baker DW, Gazmararian JA, Williams MV, et al. Health literacy and use of outpatient physician services by Medicare managed care enrollees. *J Gen Intern Med* 2004;19:215–20.
- 8 Schumacher JR, Hall AG, Davis TC, et al. Potentially preventable use of emergency services: the role of low health literacy. *Med Care* 2013;51:654–8.
- 9 Lee SY, Tsai TI, Tsai YW, Kuo KN. Health literacy, health status, and healthcare utilization of Taiwanese adults: results from a national survey. *BMC Public Health* 2010;10:614.
- 10 Balakrishnan MP, Herndon JB, Zhang J, et al. The Association of health literacy with preventable emergency department visits: a cross-sectional study. *Acad Emerg Med* 2017;24:1042–50.
- 11 Franzen J, Mantwill S, Rapold R, Schulz PJ. The relationship between functional health literacy and the use of the health system by diabetics in Switzerland. *Eur J Public Health* 2014;24:997–1003.

- 12 Marrie RA, Salter A, Tyry T, et al. Health literacy association with health behaviors and health care utilization in multiple sclerosis: a cross-sectional study. *Interact J Med Res* 2014;3:e3.
- 13 Berens EM, Vogt D, Ganahl K, et al. Health literacy and health service use in Germany. *Health Lit Res Pract* 2018;2:e115–22.
- 14 Cho YI, Lee SY, Arozullah AM, Crittenden KS. Effects of health literacy on health status and health service utilization amongst the elderly. *Soc Sci Med* 2008;66:1809–16.
- 15 White S, Chen J, Atchison R. Relationship of preventive health practices and health literacy: a national study. *Am J Health Behav* 2008;32:227–42.
- 16 Oldach BR, Katz ML. Health literacy and cancer screening: a systematic review. *Patient Educ Couns* 2014;94:149–57.
- 17 Hardie NA, Kyanko K, Busch S, et al. Health literacy and health care spending and utilization in a consumer-driven health plan. *J Health Commun* 2011;16:308–21.
- 18 Kiechle ES, Bailey SC, Hedlund LA, et al. Different measures, different outcomes? A systematic review of performance-based versus self-reported measures of health literacy and numeracy. *J Gen Intern Med* 2015;30:1538–46.
- 19 Friis K, Lasgaard M, Osborne RH, Maingal HT. Gaps in understanding health and engagement with healthcare providers across common long-term conditions: a population survey of health literacy in 29,473 Danish citizens. *BMJ Open* 2016;6:e009627.
- 20 OECD/European Observatory on Health Systems and Policies. *Denmark: Country Health Profile 2017, State of Health in the EU*. Brussels: OECD Publishing, Paris/European Observatory on Health Systems and Policies, 2017.
- 21 Osborne RH, Batterham RW, Elsworth GR et al. The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ). *BMC Public Health* 2013;13:658.
- 22 Maingal HT, Kayser L, Norgaard O, et al. Cultural adaptation and validation of the Health Literacy Questionnaire (HLQ): robust nine-dimension Danish language confirmatory factor model. *Springerplus* 2016;5:1232.
- 23 Andersen JS, Olivarius Nde FF, Krasnik A. The Danish National Health Service Register. *Scand J Public Health* 2011;39:34–7.
- 24 Lynge E, FAU SJ, Rebolj, M. The Danish National Patient Register. *Scand J Public Health* 2011;39:30–3.
- 25 Särndal C, Lundström S. *Estimation in Surveys with Nonresponse*. New York: Wiley, 2005.
- 26 Aaby A, Friis K, Christensen B, et al. Health literacy is associated with health behaviour and self-reported health: a large population-based study in individuals with cardiovascular disease. *Eur J Prev Cardiol* 2017;24:1880–8.
- 27 Friis K, Vind BD, Simmons RK, Maingal HT. The relationship between health literacy and health behaviour in people with diabetes: a Danish population-based study. *J Diabetes Res* 2016;2016:1–7.
- 28 von Wagner C, Steptoe A, Wolf MS, Wardle J. Health literacy and health actions: a review and a framework from health psychology. *Health Educ Behav* 2009;36:860–77.
- 29 Diderichsen F, Andersen I, Manuel C, et al.; Working Group of Danish Review on Social Determinants of Health. Health inequality—determinants and policies. *Scand J Public Health* 2012;40:12–105.
- 30 Fabbri M, Yost K, Finney Rutten LJ, et al. Health literacy and outcomes in patients with heart failure: a prospective community study. *Mayo Clin Proc* 2018;93:9–15.
- 31 Bailey SC, Fang G, Annis IE, et al. Health literacy and 30-day hospital readmission after acute myocardial infarction. *BMJ Open* 2015;5:e006975.
- 32 Peterson PN, Shetterly SM, Clarke CL, et al. Health literacy and outcomes among patients with heart failure. *JAMA* 2011;305:1695–701.
- 33 McNaughton CD, Cawthon C, Kripalani S, et al. Health literacy and mortality: a cohort study of patients hospitalized for acute heart failure. *J Am Heart Assoc* 2015;4:doi:10.1161/JAHA.115.001799.
- 34 Moser DK, Robinson S, Biddle MJ, et al. Health literacy predicts morbidity and mortality in rural patients with heart failure. *J Card Fail* 2015;21:612–8.
- 35 Barber S, Thornicroft G. Reducing the mortality gap in people with severe mental disorders: the role of lifestyle psychosocial interventions. *Front Psychiatry* 2018;9:463.
- 36 Zolnieriek CD. Non-psychiatric hospitalization of people with mental illness: systematic review. *J Adv Nurs* 2009;65:1570–83.
- 37 Walker ER, McGee RE, Druss BG. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. *JAMA Psychiatry* 2015;72:334–41.