Int J Public Health (2018) 63:213–222
https://doi.org/10.1007/s00038-017-1037-7

ORIGINAL ARTICLE

Association between literacy and self-rated poor health in 33 high- and upper middle-income countries

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Received: 5 April 2017 / Revised: 13 September 2017 / Accepted: 16 September 2017 / Published online: 30 September 2017

Abstract
Objectives To assess the relationship between general literacy proficiency and self-rated poor health by analyzing data from the Programme for the International Assessment of Adult Competencies, an international survey conducted from 2011 to 2015 in 33 high- and upper middle-income countries and national sub-regions.
Methods Logistic regression was used to model general literacy proficiency as a predictor of self-rated poor health.
Results Data from 167,062 adults aged 25–65 years were analyzed. The mean overall prevalence of self-rated poor health was 24%. The odds ratio of self-rated poor health for those in the lowest level of general literacy proficiency compared to those in the highest level was 2.5 (95% CI 2.2–3.0) in the unadjusted model, and 1.9 (95% CI 1.6–2.2) in the adjusted model. This association was robust over time and across countries. General literacy proficiency attenuated 22% of the effect of self-education on self-rated poor health, in addition to a substantial independent effect of its own.
Conclusions Our study provides robust and generalizable evidence that general literacy proficiency is independently associated with self-rated poor health. These results offer a potential modifiable target for policy interventions to reduce educational inequities in health.

Keywords Literacy · Educational attainment · Self-rated poor health · Socioeconomic status · OECD · Programme for the International Assessment of Adult Competencies

Introduction

Disparities in health are closely associated with disparities in educational attainment (Conti et al. 2010). Individuals with less education are less likely to engage in health-promoting behaviors, are disadvantaged in the timeliness of diagnosis for a chronic disease, are less effective in managing the illness, have worse health outcomes and ultimately a lower life expectancy (Cutler and Lleras-Muney 2006) This association is consistent and robust across a variety of contexts and health outcomes, although it is challenging to conclusively establish the causality. A vigorous debate exists around the plausibility of reverse causation, and the potential for unmeasured confounding by factors such as income, individual ability, genetic potential or parental socioeconomic status (SES) (Chatterji 2014). Moreover, even if an assumption of causality is made, it is difficult to argue that the health gap can be closed by merely focusing on greater equity in the tally of years of schooling completed or degrees achieved, with disregard to the role of factors such as quality of education, skill domains, subsequent life experiences and social context that may cause individuals to differentially accrue and retain the health benefits of equivalent education. A deeper

Electronic supplementary material The online version of this article (doi:10.1007/s00038-017-1037-7) contains supplementary material, which is available to authorized users.

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understanding of the factors that drive the education–health association will enable the design of pragmatic and efficient policy solutions to reduce education-related disparities in health.

The literature emerging from the 1990s onward has linked low levels of general literacy proficiency to poorer health outcomes, including health-related knowledge, intermediate disease markers, morbidity, general health status and use of health resources (Dewalt et al. 2004). In parallel, a relatively broader concept of 'health literacy' has been linked to the use of emergency health services, hospitalization, interpretation of health communication, appropriate taking of medications and mortality in the elderly (Berkman et al. 2011). The expectation that individuals will become partners in the management of their own health and bear a major responsibility for adopting health-promoting behaviors has increased in parallel with the growth in life expectancy and associated chronic health conditions (Bauer et al. 2014). Treatment of a chronic condition often entails that individuals communicate with health-care providers and understand complex probabilistic concepts such as risk factors, learn to self-monitor parameters such as blood pressure, comply meticulously with long-term courses of drug regimens for multiple morbidities, navigate digital texts, interpret information on food and drug labels and connect with support networks of friends and peer patients through social media. With rapidly evolving health-promoting technology products, individuals need to adapt to become perennial learners. As such, strong general literacy and numeracy proficiency have become pre-conditions for the development of health literacy. It is therefore plausible that general literacy proficiency may be causally associated with health, either independently or as a mediator of the education–health association, even after accounting for confounding by parental and self-educational attainment ('educational attainment' is hereafter referred to as 'education').

To evaluate what is already known about this association, we conducted a literature review (Electronic Supplementary Material (ESM) 1) and found the following gaps in knowledge. First, there seems to be no consensus around what constitutes general literacy proficiency or a gold standard to measure it, and a vast majority of studies measure only the ability to read with different tools. Second, studies differ in the choice of confounding variables and outcomes, making it difficult to compare estimates across regions and times. Third, only about a quarter of the studies come from nationally representative study populations and most are conducted in select groups such as patient populations, minorities and the elderly, thus restricting the generalizability of the findings. Fourth, a majority of the studies come from the USA and may not be generalizable to countries that differ in social or macroeconomic context.

To address these gaps, we analyzed data from an international survey of adults in 33 high- and upper middle-income countries/national sub-regions to assess the relationship between general literacy proficiency and health status.

Methods

Data sources

We analyzed data from the Programme for the International Assessment of Adult Competencies (PIAAC), (Schleicher 2008), an international survey of about 250,000 adults (16–65 years) conducted by the Organization for Economic Cooperation and Development (OECD) from 2011 to 2015 in the following 33 high- and upper middle-income countries/national sub-regions: Australia, Austria, Belgium (Flanders), Canada, Chile, the Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Lithuania, The Netherlands, New Zealand, Norway, Poland, the Russian Federation, Singapore, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, the UK (England and Northern Ireland) and the USA. Details about the design and implementation of the survey have been published elsewhere (OECD 2013).

For comparison across time, we also analyzed data on Australia, Canada, Italy, Norway, the Netherlands, New Zealand and the USA from the Adult Literacy and Life-skills (ALL) survey, (Satherley et al. 2008) an international survey of about 30,000 adults (16–65 years) conducted between 2003 and 2008.

Study population, and sample size

The survey population was representative of the civilian, non-institutionalized population aged 16–65 years residing in each country at the time of data collection irrespective of nationality, citizenship or language status. Sample sizes were determined primarily based on the number of cognitive domains assessed and the number of languages in which the survey was administered. For our analysis, we excluded participants whose age was less than 25 years at the time of taking the survey (Fig. 1).

Data collection

The PIAAC survey was conducted in the official language of each participating country. It was administered under the

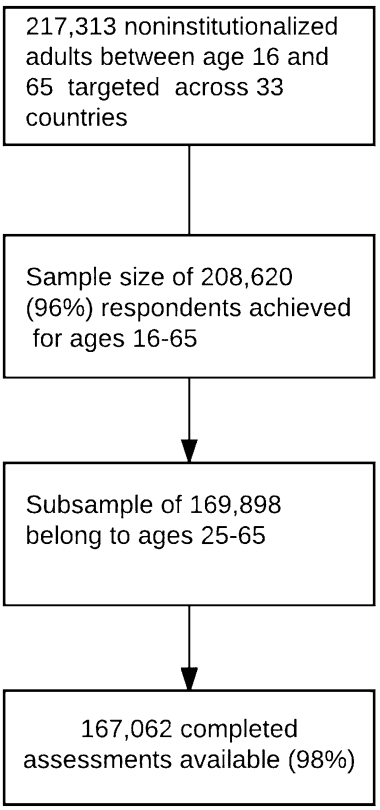

Fig. 1 Participant selection in the Programme for the International Assessment of Adult Competencies survey of 33 high- and upper middle-income countries and national sub-regions

supervision of trained interviewers in the respondent's home, or at a mutually agreed upon location. A background questionnaire was administered in computer-aided personal interview format (CAPI) by the interviewer. This was followed by the general literacy, numeracy and problem-solving skills assessment which was administered either on a laptop computer or as a pencil and paper test, depending on the computer skills of the respondent.

Measurements

Outcome: self-rated poor health

Self-rated health was measured in PIAAC through the following question: "in general, you say your health is:" to which respondents could answer using a five-point scale ranging from "excellent", "very good", "good", "fair" to "poor". We recoded the self-rated health variable and in all our models used a dichotomous indicator taking value 1 when individuals reported to be in fair or poor health and 0 otherwise. Self-rated health is an important predictor of mortality, (Idler and Benyamini 1997) and of the onset of disability and stress levels (Farmer and Ferraro 1997). Self-rated health measures have high levels of validity and consistency, and the relationship between self-rated health and mortality does not vary by socioeconomic group. Small differences can be observed, however, by gender and ethnic group (Franks et al. 2003; van Doorslaer and Gerdtham 2003).

Primary independent variable: general literacy proficiency

General literacy is defined in PIAAC as: "understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (OECD 2013). The general literacy assessment was designed to assess three broad cognitive strategies considered necessary to achieve a full understanding of text (a) accessing and identifying information in a text, (b) integrating and relating parts of one or more texts to each other and (c) drawing upon knowledge, ideas or values external to the text to evaluate aspects such as accuracy, reliability and timeliness of the text. In this regard, the construct of general literacy was broader than what would fall within the scope of 'reading ability', which can be narrowly understood as 'decoding' written text. One unique feature of the assessment of general literacy in PIAAC is that it assessed adults' ability to read digital texts (e.g., texts containing hypertext and navigation features such as scrolling or clicking on links) as well as traditional print-based texts. Secondly, given that the context in which reading takes place may influence the motivation to read and the manner of interpretation, materials for the general literacy assessment were drawn from a wide range of contexts. The tasks varied in difficulty based on (a) the transparency of information in the text as it related to the presented question, (b) degree of complexity required in making inferences, (c) semantic and syntactic complexity, (d) amount of information needed to complete the task, (e) amount of competing but potentially relevant information that the reader has to sift through to access information needed to complete the task and (f) degree to which the reader has to independently construct relationships among different parts of the text to make the required conclusion. Respondents with very low general literacy skills bypassed the full general literacy assessment and went directly to a test of reading components and were evaluated on the knowledge of vocabulary, ability to process meaning at the level of the sentence and fluency in reading passages of text. The assessment had no time limit.

The test design for PIAAC was based on a variant of matrix sampling (using different sets of items, multistage adaptive testing and different assessment modes), where each respondent was administered a subset of items from the total item pool (OECD 2013). This was because the study aims to represent at the population level, and not individual level, the level of proficiency and the

relationship between proficiency and a set of outcomes. General literacy proficiency scores are considered to be on a continuum of ability representing the mastery of tasks of increased complexity. The scores are represented on a 500-point scale and were calculated based on item response theory (IRT) models: individuals' response patterns to specific questions in their assessment were used to impute plausible value scores of achievement in the complete assessment. At each point on the continuous general literacy proficiency scale, an individual has 67% chance of completing items located at that point. The continuous scale was then divided by PIAAC into six levels of proficiency (Supp. Table 1 in ESM 2). We recoded these general literacy proficiency levels into a categorical variable taking values 1, 2, 3 and 4, respectively, for general literacy proficiency level 1 and below, level 2, level 3 and levels 4 and 5 (referred to as "level 4/5" hereon).

Considerable effort was expended to make the content of the assessment equivalent in difficulty in each of the 27 language versions and to standardize implementation procedures across countries. Scoring systems were rigorously evaluated for within and cross-country reliability.

Secondary independent variables

The PIAAC background questionnaire collected information on respondents' (self) and their parent/guardian's (both father and mother) highest level of completed educational attainment (referred to as "parental education" hereon) (OECD 2013). To derive a cross-country comparable measure of education, PIAAC mapped individual responses on national qualifications onto the International Standard Classification of Education (ISCED) system (UNESCO 2013). For the purpose of this analysis, parental education was recoded into a dichotomous variable taking value 1 for parental education level of tertiary or higher degree, and 0 otherwise. Self-education was recoded into a categorical variable taking values 1, 2 and 3 for lower secondary degree at most, upper secondary degree and tertiary or higher degree, respectively.

Covariates

Detailed information on covariates (age, gender, foreign born or not, employment status and absolute income) was also collected through the PIAAC background questionnaire. For the purpose of this analysis, employment status (employed at the time of survey: yes/no) and country of birth (born in the country where survey was administered: yes/no) were additionally considered.

Statistical analysis

Descriptive statistics for the outcome (self-rated poor health) and key independent variables (general literacy proficiency categories: levels 1 and below, 2, 3 and 4/5; self-education categories: lower secondary degree at most, upper secondary degree and tertiary or higher degree; parental education categories: upper secondary degree at most and tertiary or higher degree) were calculated as percentages, by country. The variation of self-rated poor health across levels of the independent variables and co-variation of the independent variables was assessed by preparing a contingency table (Table 1).

We used logistic regression to model parental education, self-education and general literacy proficiency as predictors of self-rated poor health. All models were controlled for age, gender, employment status, income and country of birth. To establish a baseline, we initially modeled each of these independent variables separately, without adjusting for the others and reported the minimally adjusted odds ratio (OR) with 95% confidence intervals (CI) as Models 1, 2 and 3 (Table 2). We then modeled self-education and general literacy proficiency, respectively, in Models 4 and 5, while adjusting for confounding by parental education. Finally, we modeled general literacy proficiency as a predictor of self-rated poor health while adjusting for both parental education and self-education (Model 6) to assess the relative importance of general literacy proficiency with regard to the latter. We also tested for interaction between self-education and general literacy proficiency in the adjusted model, but these were not significant and hence were not included in the results.

We first conducted the above analysis on the PIAAC data (2012–2015), and then repeated the same on ALL data (2003–2008) to assess the robustness of the adjusted associations over time (Model 6). This analysis was restricted to the subset of seven countries that took part in both surveys. We also repeated these analyses by age and self-education categories to assess the relative importance of each predictor across age groups, across time and self-education categories.

To assess the extent to which the association between self-education and self-rated poor health is explained by general literacy proficiency, we first calculated the absolute probabilities of self-rated poor health from the logistic regression coefficients. We then estimated the confounding of the general literacy proficiency–self-rated poor health association by parental education and self-education, and the attenuation of the self-education–self-rated poor health association by general literacy proficiency as the relative percentage change in the absolute probability from the respective baseline model to the adjusted model.

Table 1 Distribution of adults (25–65 year olds) across levels of general literacy proficiency, parental education and self-education in the Programme for the International Assessment of Adult Competencies survey data from 33 high- and upper middle-income countries and national sub-regions (2011–2015)

	General literacy proficiency % (standard error)				Father's education % (standard error)		Mother's education % (standard error)	
	Level 1 and below	Level 2	Level 3	Level 4/5	Upper secondary at most	Tertiary degree	Upper secondary at most	Tertiary degree
Father's education								
Upper secondary at most	17.0 (0.3)	28.0 (0.4)	25.9 (0.4)	6.6 (0.2)				
Tertiary degree	1.3 (0.1)	4.2 (0.2)	7.9 (0.2)	4.2 (0.2)				
Mother's education								
Upper secondary at most	17.8 (0.3)	29.6 (0.4)	27.9 (0.3)	7.6 (0.2)				
Tertiary degree	1.0 (0.1)	3.2 (0.2)	6.3 (0.2)	3.4 (0.1)				
Self-education								
Lower secondary at most	9.8 (0.1)	7.6 (0.1)	2.6 (0.1)	0.2 (0.03)	17.8 (0.2)	0.6 (0.1)	18.3 (0.2)	0.5 (0.04)
Upper secondary	7.5 (0.2)	16.5 (0.3)	14.3 (0.2)	2.7 (0.1)	33.5 (0.2)	4.6 (0.1)	35.5 (0.2)	3.5 (0.1)
Tertiary degree	2.5 (0.1)	9.8 (0.2)	18.1 (0.2)	8.2 (0.2)	24.8 (0.2)	12.2 (0.2)	27.7 (0.2)	9.7 (0.2)

Table 2 Odds ratios for self-rated poor health in data pooled from 33 high- and upper middle-income countries and national sub-regions from the Programme for the International Assessment of Adult Competencies survey (2011–2015)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Father's education						
Tertiary degree	Ref.			Ref.	Ref.	Ref.
Upper secondary at most	1.3 (1.2, 1.4)			1.1 (1.0, 1.2)	1.2 (1.1, 1.3)	1.1 (1.0, 1.2)
Mother's education						
Tertiary degree	Ref.			Ref.	Ref.	Ref.
Upper secondary at most	1.2 (1.1, 1.3)			1.1 (1.0, 1.2)	1.1 (1.0, 1.3)	1.1 (1.0, 1.2)
Self-education						
Tertiary degree		Ref.		Ref.		Ref.
Upper secondary degree		1.5 (1.4, 1.7)		1.5 (1.4, 1.6)		1.4 (1.3, 1.5)
Lower secondary at most		2.4 (2.2, 2.7)		2.3 (2.1, 2.5)		1.9 (1.8, 2.1)
General literacy proficiency						
Level 1 and below, lowest			2.5 (2.2, 3.0)		2.4 (2.0, 2.8)	1.9 (1.6, 2.2)
Level 2			1.6 (1.4, 1.9)		1.5 (1.3, 1.8)	1.3 (1.1, 1.6)
Level 3			1.3 (1.1, 1.5)		1.2 (1.0, 1.4)	1.2 (1.0, 1.4)
Level 4/5, highest			Ref.		Ref.	Ref.

All models adjusted for age, employment status, income, gender, country of birth and country fixed effects

Results

The overall prevalence of self-rated poor health in the PIAAC survey was 24% (median 19%; interquartile range 16–23%), ranging from about 12% in Canada to more than 45% in South Korea and the Russian Federation. The proportion of participants with general literacy proficiency of level 4/5 was 10% (IQR 7–14%), ranging from less than 2% in Chile and Turkey to more than 20% in Japan and Finland (Supp. Figure 1 in ESM 2). Across all countries, those with a tertiary or higher degree had a mean general literacy proficiency score of 292 (level 3), ranging from 254 (level 2) in Chile to 313 in Japan (level 3). Those with a lower secondary degree at most had a mean general literacy proficiency score of 231 (level 2), ranging from 177 (level 1) in Chile to 260 in Japan (level 2). On average, the difference between the average general literacy scores of those with a tertiary degree and those with a lower secondary degree at most was the highest in the USA and Singapore, and the lowest in the Russian Federation and Cyprus (Supp. Table 2 in ESM 2).

The prevalence of self-rated poor health was highest in those aged 55 years and more (34%, range 16–74%) and those who were unemployed (38%, range 19–65%) in all countries. Self-rated poor health was more prevalent in women compared to men in 28 out of 33 countries (Supp. Table 3 in ESM 2). The prevalence of self-rated poor health was highest at general literacy proficiency of level 1 and below (34%, range 18–69%) for all countries and was more than three times that at level 4/5(10%, range 3–40%) (Fig. 2; Supp. Table 4 in ESM 2). The difference in prevalence of self-rated poor health between the lowest and highest categories of general literacy proficiency was the lowest in Greece (9%) and the Russian Federation (10%), and the highest in Chile (47%) and Turkey (37%). The prevalence of self-rated poor health was highest in those in the lowest categories of self-education (35%, range 20 to 74%) and parental education (father's education: 22%, range 13–55%; mother's education: 22%, range 12–54%) for all countries (Supp. Table 4 in ESM 2).

General literacy proficiency and self-rated poor health

After adjusting for age, employment status, income, gender, country of birth and country fixed effects (Model 3), the odds ratio of self-rated poor health for those with general literacy proficiency of level 1 and below compared to those in level 4/5 was 2.5 (95% CI 2.2–3.0) (Table 2). After additional adjustment for parental education (Model 5), the odds ratio attenuated slightly to 2.4 (95% CI 2.0–2.8), and with further adjustment for self-education (Model 6) the odds ratio was 1.9 (95% CI 1.6–2.2). There was a clear gradient in the unadjusted and adjusted odds ratios for the association between general literacy proficiency and self-rated poor health, with higher odds ratios for lower levels of general literacy proficiency.

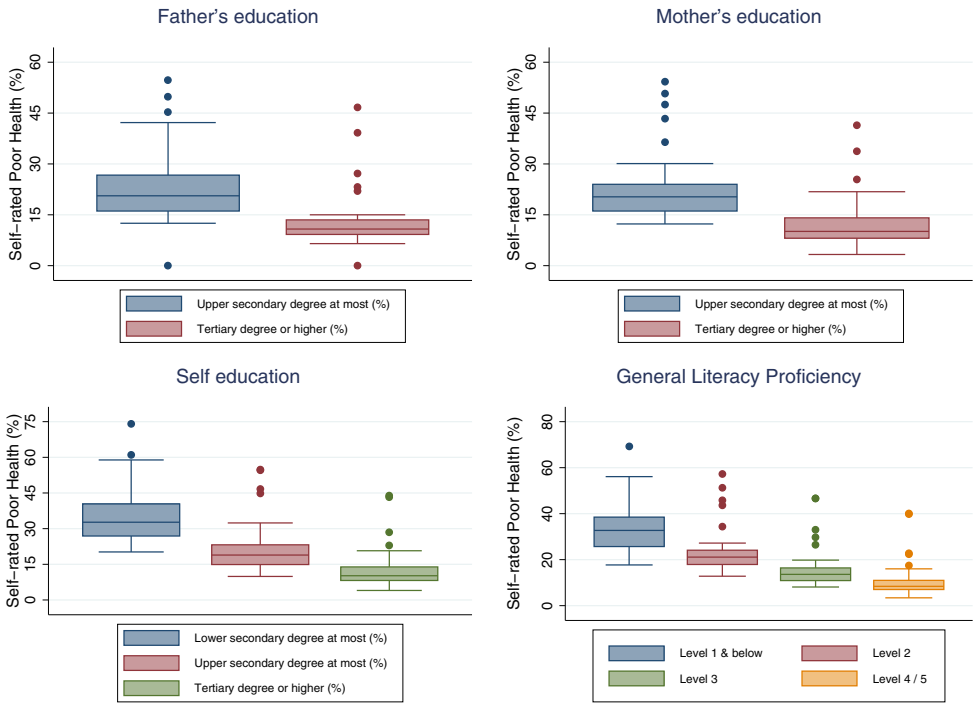

Fig. 2 Proportion of participants with self-rated poor health by levels of parental education, self-education and general literacy proficiency in the Programme for the International Assessment of Adult Competencies survey data from 33 high- and upper middle-income countries and national sub-regions (2011–2015)

Attenuation analysis

The pooled probability of self-rated poor health for those with self-education of lower secondary degree at most reduced by 20% after adjustment for parental education, and by an additional 22% after adjustment for general literacy proficiency (Supp. Table 5 in ESM 2). This suggests that slightly more than 20% of the effect of self-education on health may be potentially mediated through general literacy proficiency. The relative change in the pooled probability of self-rated poor health for those with general literacy proficiency level 1 and below was − 29% after adjustment for parental education, and − 63% after further adjustment for self-education, suggesting that general literacy proficiency may have a substantial direct effect on poor health, independent of the effect of parental education and self-education (Table 5 in ESM 2).

Heterogeneity in the general literacy proficiency–self-rated poor health association by age and self-education

The adjusted odds ratio (Model 6) for self-rated poor health was significant only at general literacy proficiency levels of 2 and below in all age groups, except for ages 25–34 years where it was not significant at any level (Supp. Tables 6 and 7 in ESM 2). The odds ratio of self-rated poor health for general literacy proficiency level 1 and below was highest for ages 35–44 years [OR 3.4 (95% CI 1.6–7.2)], and slightly lower for ages 45–54 years [OR 3.1 (95% CI 1.3–7.7)], and ages 55 years and older [OR 3.1 (95% CI 1.4–7.1)].

For those with self-education of tertiary or higher degree, the odds ratio of self-rated poor health was 3.0 (95% CI 1.6, 5.5) at general literacy proficiency levels of 1 and below, 2.0 (95% CI 1.3, 3.2) at level 2 and not significant at level 3, after adjusting for parental education (Model 5). For those with at most an upper secondary degree, the odds ratio for self-rated poor health was significant only at general literacy proficiency levels of 1 and below [OR 2.1 (95% CI 1.0, 4.2)]. The association was not significant for those with a lower secondary degree at most (ESM 2).

Heterogeneity in the general literacy proficiency–self-rated poor health association by time and country

The adjusted odds ratio for self-rated poor health by general literacy proficiency in the PIAAC survey was less than that in the ALL survey for Norway, about the same for Italy and the USA, and greater than that in the ALL survey for the Netherlands, Canada and New Zealand (Fig. 3).

Across countries, the adjusted odds ratio (Model 6) of self-rated poor health for those in the lowest general literacy proficiency category was not significant in 17 countries, and in the remaining 16 countries ranged from 1.4 in Estonia to 3.9 in Germany (Fig. 4). For self-education, the adjusted odds ratio of self-rated poor health for those with lower secondary education at most was not significantly different from 1 in Germany and Spain, and in the other 31 countries ranged from about 1.5 in England (UK) and Russia to 4.9 in the Czech Republic.

Discussion

Our study has the following salient findings: first, we demonstrate that there is a strong and robust association across countries between general literacy proficiency and self-rated poor health, independent of self-education, parental education and income. Second, general literacy proficiency appears to account moderately to substantially for the association between self-education and self-rated poor health. Third, there is substantial heterogeneity across countries for the general literacy proficiency–self-rated poor health association, even after accounting for parental education, self-education and income. These salient findings need to be considered alongside the following observations revealed through sensitivity analysis. (a) The general literacy proficiency–self-rated poor health association is robust over time, even though change in the strength of this association varies by country. (b) After taking parental education, self-education and income into account, there seems to be no association between general literacy proficiency and self-rated poor health for young adults (ages 25–34 years), although the strength of the association remains stable from middle age (35–55 years) to old age (55 years and older). (c) After taking parental education and income into account, the association between general literacy proficiency and self-rated poor health is strongest for those with a self-education of tertiary or higher degree.

The study has the following data limitations. First, the cross-sectional study design does not permit us to establish a causal link between general literacy proficiency and self-rated poor health. However, except for younger age groups, it is unlikely that poor health leads to lower general literacy proficiency. Second, the PIAAC measures general literacy proficiency as it applies to engagement with written text, and this may not reflect an individual's ability to critically engage with and use information more generally to maximize health. Third, the association between general literacy proficiency and health may vary depending on the condition being studied, (Wolf et al. 2010) and self-rated poor health may only differentially capture different health

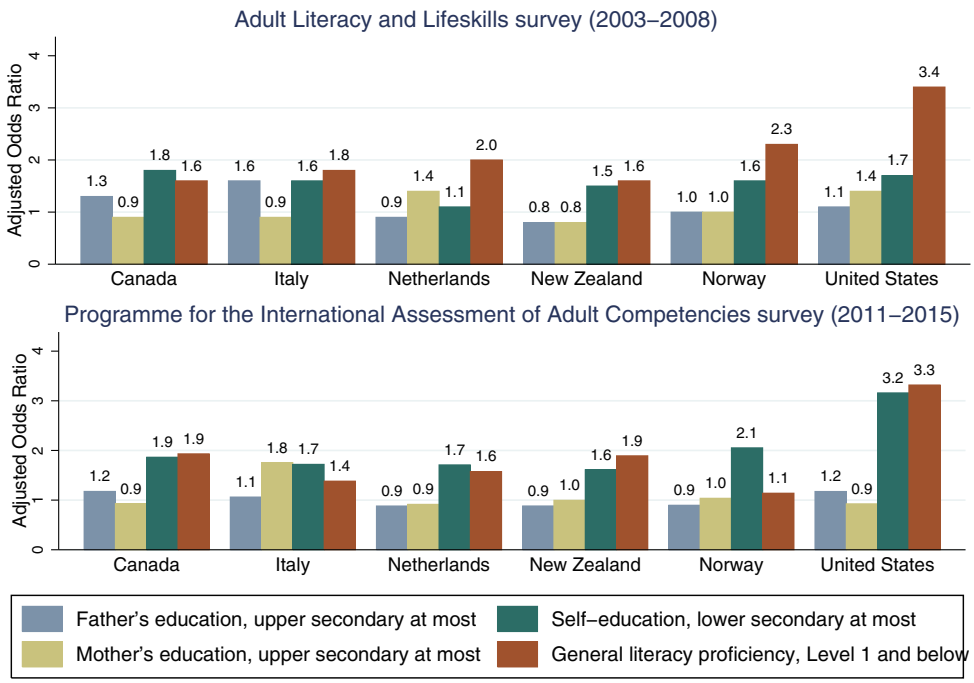

Fig. 3 Comparison of adjusted odds ratios for self-rated poor health for the lowest level of parental education, self-education and general literacy proficiency in six high-income countries common to the Adult Literacy and Lifeskills survey (2003–2008) and the Programme for the International Assessment of Adult Competencies survey (2011–2015)

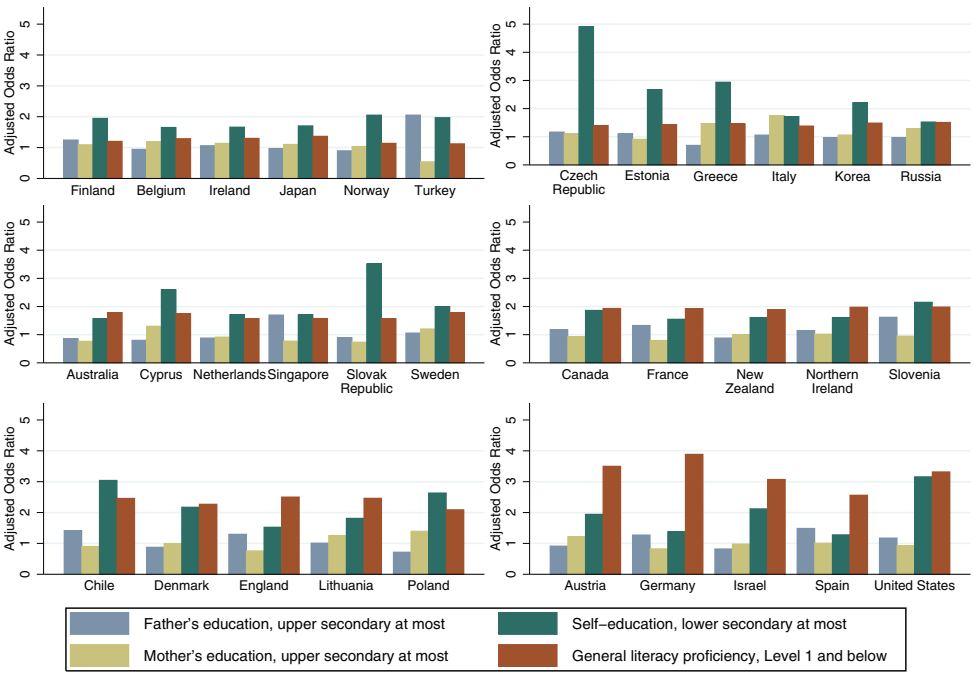

Fig. 4 Adjusted odds ratio for self-rated poor health in 33 high- and upper middle-income countries and national sub-regions from the Programme for the International Assessment of Adult Competencies survey (2011–2015)

conditions. Finally, the PIAAC survey does not evaluate the ability to write or produce text, skills commonly falling within the definition of general literacy proficiency.

The objective measurement of general literacy proficiency using a standardized assessment is an important strength of the PIAAC. Previous studies have used various instruments to measure general literacy proficiency, including but not limited to the Wide Range Achievement Test (WRAT), Rapid Estimate of Adult Literacy in Medicine (REALM) and the Test of Functional Health Literacy in Adults (TOHFLA) (Dewalt et al. 2004). The first two assess word recognition only, while the TOHFLA assesses literacy and numeracy proficiency without being able to tease apart the difference between the two, and does so only in a health context. Furthermore, the TOHFLA only has face validity (Dewalt et al. 2004). In contrast, the

PIAAC general literacy assessment measures general literacy proficiency as an individual's ability to understand, evaluate, use and engage with printed and digital written text in educational, work, personal and social contexts. The assessment of general literacy proficiency using digital text is especially relevant in the face of the information age. The PIAAC instrument has been rigorously tested for reliability across countries, (OECD 2013), although its validity has been a subject of debate (Reder 2011).

Our findings are critical from a policy perspective. Our study reveals a large degree of heterogeneity both within and across countries in the general literacy proficiency of individuals who obtained the same educational qualifications with important implications for their health. Such differences may be related to differences in the quality of the formal education and training individuals received, and to differences in the opportunities for skill development and consolidation individuals experienced after they completed formal education. While educational attainment tends to be relatively fixed over the life course, general literacy proficiency can be enhanced by life-long learning opportunities and therefore presents policy makers with an important lever to reduce inequities in health. Additionally, from a monitoring perspective, it is critical that in survey-based assessments of skills, health is considered as a factor that may influence general literacy proficiency, in addition to being an outcome of interest.

Conclusion

Our study confirms that low general literacy proficiency is associated with self-rated poor health, both independently and as a potential mediator of the effect of parental and self-educational attainment on health. This association is robust over time, consistent across countries and may vary in magnitude depending on contextual factors. Future studies are needed to establish causality and variance of this association across health conditions, and unpack the construct of general literacy further to establish what it is about general literacy proficiency that matters the most for health. Further research is also needed to explain between-country differences in the general literacy proficiency–self-rated poor health gradients.

Acknowledgements We would like to acknowledge the contributions of all participants of the Adult Literacy and Lifeskills (ALL) and Programme for the International Assessment of Adult Competencies (PIAAC) surveys, as well as researchers from the Organisation for Economic Cooperation and Development involved in the planning, design and implementation of the surveys and field staff in participant countries without whom this study would not have been possible.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The study was approved by the Institutional Review Board of the Harvard T.H. Chan School of Public Health.

Informed consent Informed consent was obtained from all survey participants.

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