

# Limited Health Literacy in Portugal Assessed with the Newest Vital Sign

## Prevalência de Literacia em Saúde Inadequada em Portugal Medida com o Newest Vital Sign



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### ABSTRACT

**Introduction:** In Portugal, health literacy has started to be addressed through national policies, but research on the topic is still scarce. We aimed to estimate the prevalence and sociodemographic correlates of limited health literacy in Portugal using an existing health literacy instrument, the Newest Vital Sign.

**Material and Methods:** Following cross-cultural adaptation of the instrument, a sample of 249 participants was evaluated to assess reliability and construct validity of the Newest Vital Sign; the latter was tested assuming physicians would score highest, followed by health researchers, then by engineering researchers and finally by laypersons from the general population. We applied this validated version in a representative sample of 1544 Portuguese-speaking residents in Portugal aged between 16 and 79 years and quantified the associations between limited health literacy and sociodemographic characteristics.

**Results:** The instrument showed high reliability (Cronbach's  $\alpha = 0.85$ ). Health-related occupation showed association with higher scores in the Newest Vital Sign ( $p$  trend  $< 0.001$ ). The prevalence of limited health literacy in the Portuguese population was 72.9% (95% CI: 69.4 - 76.4). We found no differences between men and women, but persons with limited health literacy were significantly older ( $p < 0.001$ ) and less educated ( $p < 0.001$ ).

**Discussion:** The burden of limited health literacy in Portugal is higher than that in other European countries. It should drive a universal precautions approach to health communication at all levels of the health system.

**Conclusion:** We validated a brief and simple instrument and estimated the prevalence of limited health literacy in the literate Portuguese population at roughly three out of four people.

**Keywords:** Health Literacy; Portugal; Prevalence; Validation Studies

### RESUMO

**Introdução:** A literacia em saúde começa a ser alvo de políticas de saúde em Portugal, mas a investigação neste tema ainda é escassa. Pretendemos estimar a prevalência de literacia em saúde inadequada e os fatores sociodemográficos associados em Portugal, utilizando um instrumento de avaliação da literacia em saúde já existente, o *Newest Vital Sign*.

**Material e Métodos:** Após adaptação transcultural do instrumento, avaliamos uma amostra de 249 participantes para examinar fiabilidade e validade de constructo do *Newest Vital Sign*; esta última foi testada assumindo que os médicos teriam pontuação máxima, seguidos por investigadores na área da saúde, investigadores na área da engenharia e finalmente por leigos da população geral. Em seguida, aplicámos a versão validada numa amostra representativa de 1554 pessoas, residentes em Portugal, entre os 16 e os 79 anos, e quantificámos as associações entre literacia em saúde inadequada e características sociodemográficas.

**Resultados:** O instrumento revelou elevada fiabilidade ( $\alpha$  de Cronbach = 0,85). A profissão ligada à saúde associou-se a pontuações mais elevadas no *Newest Vital Sign* ( $p$  para a tendência  $< 0,001$ ). A prevalência de literacia em saúde inadequada na população portuguesa foi de 72,9% (IC 95%: 69,4 - 76,4). Não encontramos diferenças entre homens e mulheres, mas as pessoas com literacia em saúde inadequada eram significativamente mais velhas ( $p < 0,001$ ) e com menor escolaridade ( $p < 0,001$ ).

**Discussão:** A carga de literacia em saúde inadequada em Portugal é mais alta do que a observada noutros países europeus. Esta deve conduzir a medidas de precaução universais no âmbito da comunicação em saúde, a todos os níveis de cuidados.

**Conclusão:** Adaptámos um instrumento breve e simples e estimámos que, na população portuguesa alfabetizada, três em cada quatro pessoas possuem literacia em saúde inadequada.

**Palavras-chave:** Estudos de Validação; Literacia em Saúde; Portugal; Prevalência

### INTRODUCTION

Health literacy has been defined as people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions concerning healthcare, disease prevention and health promotion to maintain or improve quality of life.<sup>1</sup> It is commonly measured using instruments based on word recognition or pronunciation, such as the Rapid Estimate of Adult Literacy in Medicine (REALM),<sup>2</sup>

the Medical Term Recognition Test (METER),<sup>3</sup> or the Short Assessment of Health Literacy for Spanish-speaking Adults (SAHLSA),<sup>4</sup> as well as with instruments that assess reading comprehension and numeracy, such as the Test of Functional Health Literacy in Adults (TOFHLA)<sup>5</sup> or the Newest Vital Sign™ (NVS).<sup>6</sup> Most instruments were originally developed in English and are being adapted worldwide.<sup>7</sup>

Limited health literacy is more prevalent among the

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elderly, those with lower levels of education<sup>8</sup> and with chronic disease.<sup>9</sup> It is associated with less successful navigation of the healthcare system, poorer self-management skills, greater costs, higher morbidity and mortality.<sup>9-12</sup> Improving health literacy is regarded as a critical factor for enabling healthier choices and is becoming increasingly common in political health agendas worldwide.<sup>13,14</sup>

The prevalence of limited health literacy has been estimated to be 60% in Canada,<sup>15</sup> 59% in Australia,<sup>16</sup> over 50% in New Zealand<sup>17</sup> and around 26% in the United States.<sup>18</sup> The diversity of instruments used may partially explain differences between these countries. The European Health Literacy Survey, conducted in eight European countries (Austria, Bulgaria, Germany, Greece, Ireland, Netherlands, Poland, and Spain) in 2011, found that half of the population had limited health literacy.<sup>19</sup> This survey used the same instrument (HLS-EU-Q86 supplemented with the Newest Vital Sign) in all countries, with prevalence ranging from 28.7% in the Netherlands to 62.1% in Bulgaria.

In Portugal, health literacy has started being addressed through national policies, but research on the topic is still scarce.<sup>20</sup> It is a central part of the current Portuguese Health Plan,<sup>21,22</sup> and is targeted in a specific Health Programme, the Health Education, Literacy and Self-Management Programme.<sup>23</sup> The aims of this government initiative, subsequently merged with the Prevention and Management of Chronic Disease Programme and renamed Health Literacy and Integrated Care,<sup>24</sup> are to prepare and support informal caregivers in home-based care, preventing diabetes, obesity and promoting mental health and healthy aging, as well as the rational and safe use of medicines. The two-year associated pilot project approved in July 2017,<sup>25</sup> Literacy for the Safety of Healthcare, additionally aims to increase patient, family, caregivers and healthcare institutions' involvement in the improvement of the quality and safety of healthcare delivery, as well as to increase patient literacy in that area.

Given this recent investment, it is essential to validate measurement instruments that are fast, easy to administer, and can be used in clinical settings and in survey questionnaires without greatly increasing participant burden. We aimed to estimate the prevalence and sociodemographic correlates of limited health literacy in Portugal after adapting and validating the NVS in the Portuguese population.

## MATERIAL AND METHODS

The present article reports two complementary studies. Firstly, we validated an existing health literacy measure, the Newest Vital Sign<sup>TM</sup>,<sup>6</sup> in the Portuguese population. Then, we applied the validated instrument to estimate the prevalence of limited health literacy in Portugal.

### Validation of the Newest Vital Sign in the Portuguese population

#### Original instrument

The Newest Vital Sign<sup>TM</sup> is a health literacy assessment tool available in English and Spanish, in which an ice cream nutrition label is given to review and six questions asked

about it. Scores range from 0 to 6 (1 point for each correct answer): a score of 0 - 1 suggests high likelihood (50% or more) of limited literacy; 2 - 3 indicates the possibility of limited literacy; and 4 - 6 almost always indicates adequate literacy.<sup>6</sup> These three categories were based on the stratum-specific likelihood ratios for the two cut-off scores, stratified by dichotomised TOFHLA score.<sup>6</sup>

#### Cross-cultural adaptation

We used the standard procedure for the cross-cultural adaptation of health instruments.<sup>26</sup> Briefly, two native Portuguese speakers proficiently fluent in English translated the Newest Vital Sign<sup>TM</sup> independently and merged the translations into a single Portuguese version. Afterwards, two native English speakers, proficient in Portuguese, independently back-translated this version, blinded to the original version. The translators arrived at a consensus back-translated version, which was then revised and compared to the original by a multidisciplinary and bilingual expert committee (with backgrounds in Internal Medicine, Pharmaceutical Sciences, Psychology, Sociology, Nutrition and Epidemiology), resolving any discrepancies. This committee also ensured item and conceptual equivalence of the original and final versions. The final version was pre-tested in a small group of six lay people.

#### Sample and recruitment

The Portuguese adapted version of the instrument (NVS-PT) was administered to a convenience sample of 249 people in 2012, as part of a validation study of individual health literacy instruments in the Portuguese population.<sup>27</sup> Participants were recruited from four different groups: physicians from public hospitals and primary care health centres (n = 53), health researchers from a research institute in Public Health (n = 45), researchers from areas unrelated to health from an Engineering faculty (n = 50), and laypersons from the general population attending a primary care health centre (n = 101). To assess construct validity we assumed that physicians would score highest on health literacy tests followed by public health researchers, engineering researchers, and finally by the general population. To detect a medium effect size difference (30%) between these groups using the  $\chi^2$  test and three categories of health literacy with a significance level of 5% and 80% power, the total sample size was estimated at 151 participants.<sup>28</sup>

Eligibility criteria for the participants were age over 18 years and ability to speak and read Portuguese. People with impaired vision were excluded.

#### Statistical analysis

Psychometric testing of the NVS-PT excluded physicians, since the instrument was not designed to assess them, resulting in more than 32 persons per item. Items 5 and 6 were considered together, as in the original instrument question 6 is only asked if question 5 is answered correctly. Cronbach's alpha was used to measure internal consistency, exploratory factor analysis was performed on

the five items (1, 2, 3, 4 and 5-6), and visual analysis of the scree plot was used to evaluate homogeneity (i.e., to verify there was a single latent factor measuring reading comprehension and numeracy). All items showing absolute factor loadings higher than 0.4 were considered part of the factor. The global goodness of fit of the underlying model was evaluated using the comparative fit index (CFI), recommended for sample sizes below 250.<sup>29</sup>

Participant characteristics were described using frequencies, median and 25<sup>th</sup> - 75<sup>th</sup> percentiles (P25 - P75), as appropriate, by validation group, for sex, age and health literacy category, and compared across the groups using the  $\chi^2$  test for sex, the Kruskal-Wallis test for age and Fisher's exact test for health literacy, with a test for linear trend. Two-sided p values less than 0.05 were considered to define a statistically significant result.

Exploratory factor analysis models were fitted using MPlus (V.5.2; Muthen & Muthen, Los Angeles, California, USA). All other analyses were performed using Stata version 11.2 for Windows (StataCorp LP, College Station, TX).

## Prevalence of limited health literacy

### Sample and recruitment

This analysis was based on a national survey conducted in 2012, aiming to assess knowledge about obesity, diabetes, cardiovascular diseases and cancer, as well as health behaviours of the Portuguese population, and has been previously described.<sup>30</sup> The study evaluated a representative sample of Portuguese-speakers of any nationality in mainland Portugal, with respect to sex, age, education, marital status, and residence. A stratified probabilistic sampling procedure by residence according to nomenclature of territorial units for statistics II region (Norte, Centro, Lisboa e Vale do Tejo, Alentejo and Algarve) and number of inhabitants in geographical units with at least 10 dwellings (< 2000, 2000 - 9999, 10 000 - 19 999, 20 000 - 100 000 and > 100 000 inhabitants) was used to identify 150 geographical units. In these units, a total of 585 starting points were designated for the selection of households through standard random route procedures. Potentially eligible participants were identified in each household and the individual with the most recent birthday date was invited to participate; a total of 1624 valid interviews were obtained (response rate: 70.8% of those invited). Participants were evaluated through face-to-face interviews conducted using Computer Assisted Personal Interviewing with a structured question-

naire, including the validated instrument, NVS-PT, to assess health literacy.

### Statistical analysis

For the purpose of this analysis, individuals unable to read or write (n = 79) as well as one with missing education data were excluded, leaving a final sample of 1544.

All estimates were weighted to be representative of the Portuguese population, using the variables considered in the design. Demographic characteristics of the weighted sample were similar to those of the Portuguese population.<sup>31</sup> For a comparison between unweighted and weighted study sample characteristics, please refer to Appendix 1 (<https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/9135/5253>).

Health literacy was classified into the recommended categories,<sup>6</sup> as well as dichotomized into adequate and limited health literacy (for scoring purposes, questions that were answered as "do not know" or "no answer" were coded as wrong answers).

We calculated prevalence with 95% confidence intervals (95% CI) for the three categories of health literacy, stratified by sample characteristics and used the  $\chi^2$  test to test for comparisons between categories. We performed a sensitivity analysis including individuals unable to read or write in the lowest health literacy category. We computed adjusted prevalence ratios (PR) and 95% confidence intervals using Poisson regression with the dependent variable as the prevalence of having limited health literacy and sex, age and education as independent variables. Two-sided p values less than 0.05 were considered significant. All statistical analyses were carried out using STATA, version 11.2 (Stata Corp LP, College Station, Texas, USA).

## RESULTS

The first part of this section presents the results of the validation of the Newest Vital Sign in a convenience sample. Afterwards, the prevalence and sociodemographic associations of limited health literacy in a representative sample of the Portuguese population are shown.

### Validation of the Newest Vital Sign in the Portuguese population

#### Cross-cultural adaptation

To ensure conceptual equivalence, the expert committee transformed '(serving size) ½ cup' in the original

Table 1 - Characteristics of the validation sample by group

	Physicians (n = 53)	Health researchers (n = 45)	Other researchers (n = 50)	General population (n = 101)
Women, n (%)	34 (64.2)	37 (82.2)	6 (12.0)	64 (63.4)
Age in years, median (P25 - P75)	30.0 (27.0 - 34.0)	28.0 (26.0 - 31.0)	48.5 (31.0 - 53.0)	42.0 (34.0 - 58.0)
NVS-PT scores, n (%)				
0 - 1: high likelihood of limited HL	0 (0.0)	0 (0.0)	0 (0.0)	58 (57.4)
2 - 3: possibility of limited HL	0 (0.0)	5 (11.1)	4 (8.0)	24 (23.8)
4 - 6: adequate HL	53 (100)	40 (88.9)	46 (92.0)	19 (18.8)

NVS-PT: Portuguese version of the Newest Vital Sign; HL: Health literacy

version into '125 mL', as cups are not a common measurement unit in Portugal. Similarly, abbreviations 'sat' and 'cal' in the original version were replaced by full words, because they are not routinely abbreviated in Portuguese nutrition labels and the sentence "This information is on the bottom of an ice cream container" was added. The Portuguese adapted version of the instrument (NVS-PT) is presented in Appendix 2 (<https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/9135/5254>).

### Validation in a convenience sample of the Portuguese population

Demographic characteristics of the sample by validation group are summarized in Table 1. Women made up the majority of respondents in all validation groups except for the group of non-health researchers (12.0%),  $p < 0.001$ . Engineering researchers and laypersons from the general population were older ( $p < 0.001$ ).

The scree plot curve inflected at the first component, revealing one underlying dimension of the instrument (Fig. 1) and exploratory factor analysis confirmed it (Table 2). The CFI of the model was 1.00. NVS-PT showed high internal consistency, with a Cronbach's alpha of 0.85.

Physicians scored highest in health literacy, followed by

non-health researchers, health researchers and finally by the general population ( $p$  for trend of the original hypothesis  $< 0.001$ ; Table 1).

### Prevalence of limited health literacy

The proportion of women was 50%, the median age was 41.0 years (P25 - P75: 27.0 - 55.0 years), and nearly 40% had 4<sup>th</sup> grade or less schooling (Table 3). There were 0.3% of respondents (95% CI: 0.0 - 0.6) not answering any of the NVS-PT questions. An additional 16.2% (95% CI: 13.4 - 19.1) reported not to know how to answer all of the questions (data not shown). The latter proportion declined with increasing education from 47.8% (95% CI: 34.0 - 61.5) for persons with less than four years of formal education to 3.4% (95% CI: 0.4 - 6.5) for persons with complete college (sex and age-adjusted PR = 0.12 for persons with complete college when compared to people with  $< 4^{\text{th}}$  grade;  $p$  for trend  $< 0.001$ ).

The prevalence of limited health literacy in the literate Portuguese population aged between 16 and 79 years was 72.9% (95% CI: 69.4 - 76.4). A total of 30.4% (95% CI: 26.9 - 33.9) were classified in the intermediate category "possibility of limited health literacy" and 42.5% (95% CI: 38.3 - 46.6) in the lowest category "high likelihood of limited health

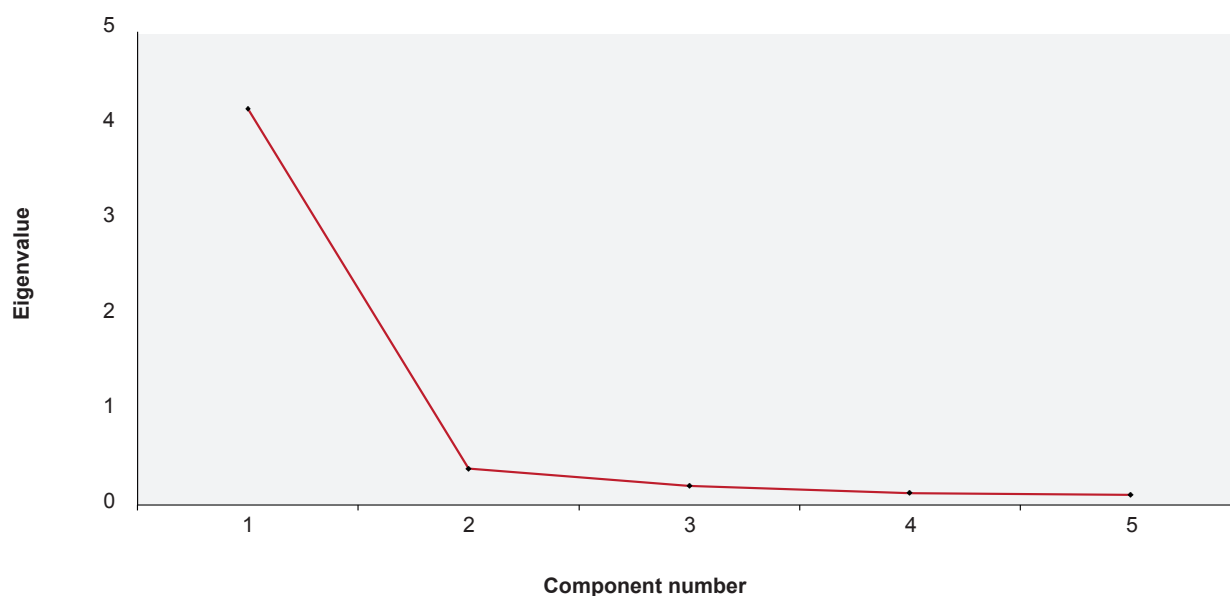


Figure 1 - Scree plot of eigenvalues from exploratory factor analysis

Table 2 - Correct answers per item, and standardised factor loadings in exploratory factor analysis

Item	Correct answers n (%)	Standardised factor loadings (one factor)
NVS-PT 1	116 (59.18)	0.949
NVS-PT 2	119 (60.71)	0.888
NVS-PT 3	114 (58.16)	0.917
NVS-PT 4	105 (53.57)	0.928
NVS-PT 5 6*	5 143 (72.96)	0.788
	6 102 (52.04)	

NVS-PT: Portuguese version of the Newest Vital Sign

\* Items 5 and 6 analysed together (NVS 6 only asked if NVS 5 was answered correctly)

Table 3 - Survey sample characteristics by health literacy category

	Total	Adequate HL	Possibility of limited HL	High likelihood of limited HL
	Weighted % (95% CI)			
<b>Sex</b>				
Women	50.0 (46.4 - 53.5)	25.0 (20.6 - 29.3)	34.6 (29.8 - 39.5)	40.4 (35.3 - 45.5)
Men	50.0 (46.5 - 53.6)	29.3 (24.0 - 34.5)	26.2 (21.6 - 30.8)	44.5 (38.7 - 50.3)
<i>p</i> value	0.045			
<b>Age (years)</b>				
16 - 24	18.6 (15.2 - 22.0)	38.3 (28.7 - 47.9)	29.5 (21.0 - 38.1)	32.2 (21.2 - 43.2)
25 - 34	18.1 (14.9 - 21.3)	36.5 (27.0 - 46.0)	32.0 (22.6 - 41.4)	31.5 (22.0 - 41.1)
35 - 44	19.5 (16.8 - 22.3)	35.2 (27.2 - 43.2)	25.3 (19.0 - 31.6)	39.5 (31.5 - 47.5)
45 - 54	18.4 (15.6 - 21.2)	19.4 (12.9 - 26.0)	36.4 (28.8 - 44.0)	44.2 (35.9 - 52.4)
55 - 64	14.9 (12.8 - 16.9)	15.4 (10.9 - 19.9)	31.7 (25.1 - 38.4)	52.9 (45.9 - 59.8)
65 - 79	10.5 (8.8 - 12.2)	6.3 (3.2 - 9.3)	26.4 (18.1 - 34.6)	67.4 (59.1 - 75.7)
<i>p</i> value	< 0.001			
<b>Education</b>				
< 4 <sup>th</sup> grade	11.1 (8.3 - 13.8)	2.5 (-0.7 - 5.7)	23.5 (12.0 - 35.0)	74.0 (62.2 - 85.7)
4 <sup>th</sup> grade	28.0 (24.4 - 31.5)	14.9 (9.5 - 20.4)	28.6 (23.1 - 34.0)	56.5 (49.2 - 63.9)
5 <sup>th</sup> - 9 <sup>th</sup> grade	19.5 (16.6 - 22.4)	25.9 (18.2 - 33.6)	30.8 (23.5 - 38.0)	43.4 (35.3 - 51.5)
10 <sup>th</sup> - 11 <sup>th</sup> grade	13.8 (11.2 - 16.5)	24.4 (15.2 - 33.5)	39.3 (28.3 - 50.3)	36.3 (25.2 - 47.4)
12 <sup>th</sup> grade	17.0 (14.1 - 19.8)	49.0 (39.4 - 58.7)	30.8 (22.0 - 39.6)	20.2 (13.3 - 27.1)
Complete college	10.7 (8.5 - 12.9)	55.5 (45.1 - 66.0)	29.6 (19.8 - 39.4)	14.9 (7.8 - 22.0)
<i>p</i> value	< 0.001			

HL: Health literacy; Weighted: % of 1544 participants; CI: Confidence interval

literacy", whereas 27.1% (95% CI: 23.6 - 30.6) were classified as having adequate health literacy.

If individuals unable to read or write ( $n = 79$ ) were included in the lowest health literacy category, the weighted prevalence of limited health literacy would rise to 74.5% (95% CI: 71.1 - 77.8), 28.6% (95% CI: 25.4 - 31.9) would have the possibility of limited health literacy, and 45.8% (95% CI: 41.9 - 49.8) would have a high likelihood of limited health literacy, whereas the prevalence of adequate health literacy would drop to 25.5% (95% CI: 22.2 - 28.9).

Limited health literacy increased gradually with age ( $p < 0.001$ ) and decreased with education ( $p < 0.001$ ). Slightly more women were in the intermediate category of health literacy ( $p = 0.045$ ) (Table 3).

In the multivariable model, limited health literacy remained positively associated with age and inversely associated with education (Fig. 2). Persons over 64 years old were 21% more likely to have limited health literacy when compared to persons under 25 (sex- and education-adjusted  $p$  for trend = 0.006) and persons with complete college education were 50% less likely to have limited health literacy when compared to persons with less than the 4<sup>th</sup> grade (sex- and age-adjusted  $p$  for trend < 0.001). We found no significant differences between men and women (age- and education-adjusted  $p = 0.282$ ).

## DISCUSSION

We validated the NVS in the Portuguese population,

used it to estimate a prevalence of limited health literacy in Portugal of almost three out of four people, and showed that limited health literacy was positively associated with age and inversely associated with education.

### Validation of the Newest Vital Sign in the Portuguese population

We culturally adapted a brief and simple instrument and showed it was valid and reliable. The NVS-PT can be used to assess health literacy and to sort the Portuguese population according to adequate and limited health literacy.

Some validation studies of health literacy instruments have used concurrent validation, that is, through the comparison with an existing instrument.<sup>7</sup> This is a controversial option given the multiple proposed definitions of the underlying construct<sup>1</sup> and the diverse and restrictive scope of the instruments.<sup>32</sup> Additionally, the NVS has been shown to provide higher prevalence estimates of limited health literacy when compared to health literacy instruments without a numeracy component.<sup>33</sup> It cannot be presumed, however, that either estimate is more valid than the other.

Our strategy assumed that health literacy would be higher in physicians, followed by health researchers, people with a similar academic degree in areas non-related to health and by people with progressively lower levels of education. In our sample, however, non-health researchers scored higher than health researchers, although the difference between them was non-significant. This might

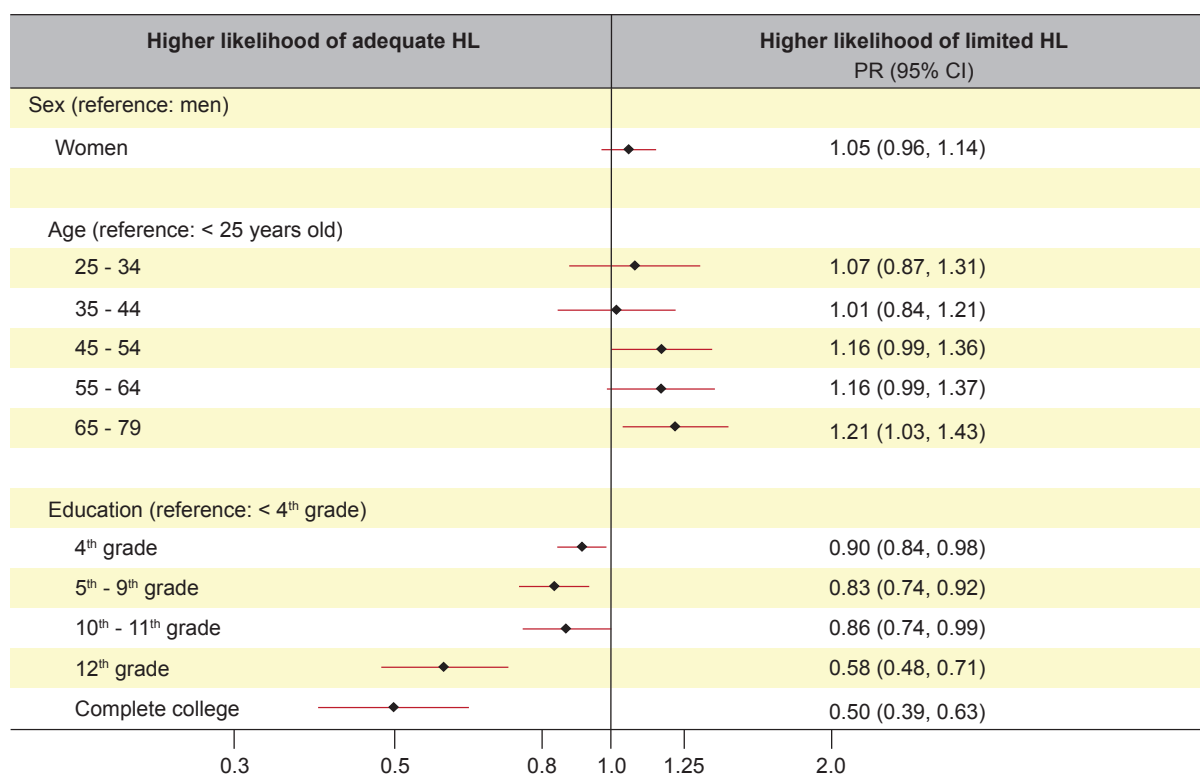


Figure 2 - Prevalence ratios and 95% confidence intervals [PR (95% CI)] for the association between limited health literacy (HL) and sample characteristics (adjusted for sex, age and education)

be related with the strong numeracy component of the instrument. Yet, physicians scored higher than either of the groups, suggesting the instrument is measuring more than numeracy. The NVS was designed to assess individual reading comprehension and numeracy skills, a small part in the health literacy construct. Nonetheless, assessment of patients' numeracy skills may have a critical role in improving appropriate use of medicines and avoiding dosing errors, aligning with the goals of the national Health Literacy and Integrated Care Programme.<sup>24</sup> Assessing health literacy as a cognitive capacity also disregards how people rely on their social network for support with health literacy-related tasks.<sup>34</sup> Notwithstanding, it has been used in multiple settings,<sup>35</sup> correlates well with more complex instruments such as the TOFHLA,<sup>6</sup> and NVS scores have been associated with health knowledge<sup>36,37</sup> and clinically relevant health outcomes.<sup>38,39</sup> Additionally, the patients find the instrument acceptable<sup>40</sup> and it can be used for international comparisons of the prevalence of limited health literacy. To study the role of individual health literacy in the management of complex chronic conditions or health literacy associations with the perception of risk communication, we suggest assessing health literacy with this instrument complemented with a word recognition instrument such as the METER<sup>27</sup> to provide a more comprehensive assessment of health literacy. As a limitation, we did not examine consistency of scores over time. Further research is needed to examine test-retest reliability and to explore if the NVS-PT can also be used as a quick screening tool in clinical settings in Portugal.

### Prevalence of limited health literacy

We estimated a prevalence of limited HL in a representative sample of the literate Portuguese population aged between 16 and 79 years of almost three in four people. This prevalence is higher than the observed for other countries using the same measurement tool in the European Health Literacy Survey 2011. The Netherlands had the highest NVS scores, with only 23.7% of the respondents showing limited health literacy. The country with the lowest NVS scores was Spain, in which 63.1% of the population exhibited limited health literacy.<sup>41</sup> Given the close association between education and the numeracy component of health literacy, our findings could be explained by differences in education between countries. The average years of completed education over the age of 25 in Portugal was 8.2 in 2012, whereas in Spain it was 9.6.<sup>42</sup> As for the other seven countries included in the European Survey, average education was also higher than in Portugal.<sup>43</sup> Prevalence comparisons of limited health literacy with other countries are harder because of the diversity of instruments used.<sup>15-18</sup>

The choice of a health literacy instrument with relatively limited scope to calculate a prevalence of limited health literacy could be regarded as a limitation of this study. Our prevalence estimates are higher than the 49% found to have problematic or inadequate levels by Espanha *et al.*<sup>20</sup> However, in contrast with the latter, numeracy is assessed objectively and this health literacy component is a crucial competency to deal with the complex demands of chronic illness.<sup>44</sup> It also takes considerably less time to administer,<sup>7</sup> which makes it a better option in the context of longer surveys.

The sensitivity analysis based on the inclusion of illiterate people aimed to avoid underestimating health literacy, considering that Portugal has one of the highest illiteracy rates in Europe.<sup>43</sup> This approach increased our prevalence estimates by 1.9% representing approximately 67 000 additional persons with limited health literacy in Portugal.

A considerable proportion of participants reported not to know how to answer any of the NVS-PT questions. Although this is not commonly reported in other studies, we find it relevant as a potential proxy of acceptability of the instrument. Participants could have been afraid of answering incorrectly and thus decided not to answer.<sup>45</sup> It is likely, however, that if the instrument had been administered in a clinical setting, as intended by the developers, this proportion would be lower, as reported by Ryan *et al.*<sup>46</sup> The positive association we found between non-response and education is in accordance with the results from Griffin *et al*, which compared characteristics between interview participants and non-respondents in health literacy tests and found that non-responders were more likely to have lower education.<sup>47</sup>

The associations we observed between limited health literacy and older age are consistent with those found by the European Health Literacy Survey<sup>19</sup> and with studies conducted in other countries.<sup>8,15,18</sup> Education is consistently one of the main predictors of health literacy and our results confirm the association between limited health literacy and lower educational attainment.<sup>8,15,17-20</sup> These associations are worrisome, as the elderly and less educated are known to experience higher chronic disease burden and worse health outcomes.<sup>20</sup>

Future research in Portugal should focus on the association between health literacy and outcomes such as health status, health behaviour and healthcare use.

The high burden of limited health literacy in the Portuguese population advocates for a universal precautions approach to health communication by health professionals and the health care system in general, by lowering the health literacy demands placed on individuals. This means assuming most patients will have difficulties understanding health information and using the clearest health messages possible with all patients. Universal precautions by health professionals to improve communication include using plain, non-medical language, limiting content, repeating key information, using illustrations, videos and demonstrations, as well as designing easy to read educational material that patients can take home to complement spoken instructions. They also include fostering patient participation with the 'teach-back method' by asking patients to repeat in their own words what has been explained, promoting the National Patient Safety Foundation "Ask Me 3"<sup>48</sup> programme by encouraging patients and families to ask three simple but essential questions of their providers in every health care encounter (1. What is my main problem? 2. What do I need to do? 3. Why is it important for me to do this?), and by asking for direct patient feedback.<sup>49</sup>

Health institutions can employ additional strategies to reduce health literacy barriers that include training all staff in health literacy techniques, systematically offering assistance filling out forms, linking patients to non-medical support and resources, and creating a welcoming environment easy to navigate, with clear physical signage and direction instructions.<sup>50</sup> The universal precautions approach also translates into increasing communications skills and empathy of health professionals, in the involvement of patients' families and social networks, and in not assuming that communication has been achieved until demonstrated. Finally, these strategies and initiatives should be evaluated in the framework of the national project Literacy for the Safety of Healthcare.<sup>25</sup>

## CONCLUSION

The Newest Vital Sign was successfully validated in the Portuguese population and used to estimate a prevalence of limited health literacy of almost three in four people.

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## PROTECTION OF HUMANS AND DATA CONFIDENTIALITY

The Ethics Committee of Centro Hospitalar de São João approved the validation study and the Ethics Committee of the University of Porto approved the survey. All participants provided written informed consent.

## CONFLICTS OF INTEREST

None declared.

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