



ORIGINAL ARTICLE

Public knowledge of low vision and blindness, and readability of on-topic online information

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KEYWORDS

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Abstract

Purpose: To explore the laymen knowledge of low vision and blindness concepts, and to assess the readability of some on-topic information available online.

Methods: A cross-sectional study was performed in March 2019. Knowledge was evaluated by means of an *ad hoc* questionnaire-survey with two dichotomous questions about concepts related to low vision and blindness, followed with a list of 10 true-or-false statements. Readability of two on-topic online texts of different complexity was evaluated asking participants to rate the difficulty they experienced on a Likert scale and, objectively, by means of the freeware *INFLESZ Readability Scale* for Spanish language. Data analysis included descriptive statistics, t-tests, and ANOVA test (statistical significance: $p < 0.05$).

Results: Fifty-two percent of 103 participants declared never having heard of low vision. Ninety-four percent participants were aware about the word blindness, although most of them misinterpreted it. Neither academic level nor age influenced knowledge ($p > 0.05$). Higher academic level was related to better readability scores of the complex online text ($p < 0.05$). **Conclusion:** Overall, the general public has a limited awareness of low vision and a large misconception of blindness. Therefore, visual health education actions should aim at fostering knowledge and literacy on the issue. This strategy may encourage individuals to seek the advice of eye care providers in order to prevent and treat visual impairment, with relevant consequences in time, both in terms of quality of life and costs.

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Introduction

Vision impairment (VI) is a functional limitation of the eyes and/or the visual system associated with visual acuity (VA) loss and/or visual field (VF) loss.¹ According to the 11th revision of the International Classification of Diseases, ICD-11,² VI may be classified as moderate ($VA \leq 6/18$) or severe ($VA \leq 6/60$). The term 'low vision' (LV) includes both moderate and severe VI, although the term *Moderate to Severe Visual Impairment* (MSVI) is currently gaining acceptance. Finally, the characteristics that define 'blindness' are $VA \leq 3/60$ and/or central fixation $VF \leq 10$ degrees.

The worldwide population with vision impairment is estimated at near 1.3 billion people³ although approximately 80% of vision threatening conditions may be avoidable, provided adequate treatment is accessible (spectacles, contact lenses, or medical or surgical treatment). If the treatment is not available or is not successful, VI can lead to different levels of disability and negatively impact many daily activities and limit or restrict the opportunities to participate in society.⁴ Its coexistence with other impairments or disabilities (e.g., deafness, intellectual disability, locomotor disability) might limit the personal development to a greater extent.⁵

Causes of visual impairment vary according to region and income-level, with a predominance of age-related macular degeneration, diabetic retinopathy and glaucoma over cataracts, in high-income regions, and an inverse trend in lower-income regions.⁶ Population growth and ageing can result in a higher prevalence of visual impairment,⁷ although VI should not solely be approached from the perspective of ageing. Visual health policies, as any health policy, should focus not only on providing suitable resources, including efficient eye care services and properly trained optometrists,⁸ but also on population empowerment by fostering visual health literacy.⁹ Sørensen et al.¹⁰ define health literacy as an asset for improving people's empowerment within the domains of healthcare, disease prevention and health promotion; described as "being ill or as a patient in the healthcare setting" (healthcare); "as a person at risk of disease in the disease prevention system" (disease prevention); and "as a citizen in relation to the health promotion efforts in the community, the work place, the educational system, the political arena and the market place" (health promotion). These authors pose a model of health literacy summarized with a matrix of four dimensions of health literacy (access, understanding, appraisal and application of health-related information) and the three health domains noted above (healthcare, disease prevention and health promotion). In addition, Rudd¹¹ recommends analysing the efficacy of public health messages and the communication skills of health professionals, as well as the accessibility of written health information in terms of readability (easiness to read and understand) and usability (when the source of information is a website), to empower patients in their health-related decisions.

As a previous step to plan health literacy strategies centred on VI, it is necessary to explore the actual public knowledge level of concepts related to VI, and to acquire relevant indicators on the "access" and "understanding" dimensions of health literacy introduced above.¹⁰ There-

fore, the main purpose of the present study was to determine the laymen knowledge on low vision and blindness. Our secondary objective was to obtain a subjective assessment of the readability of two representative examples of online information on these topics. For this purpose, texts were selected to encompass different levels of difficulty based on a previous objective assessment.

Methods

Study design and sampling

The study design was cross-sectional. Twelve volunteer university students were instructed to recruit participants for the study from their personal networks and relatives by following a kind of driven sampling strategy.¹² Respondent-driven sampling combines snowball sampling with a mathematical model that weights the sample to account for the fact that the sample is not randomly collected. In this way, a representative sample of the population under study was recruited, with maximum diversity of age (16 years of age and older), sex, and academic level. All participants lived in Catalonia, a region on the north-eastern part of Spain.

Data collection

For the purpose of the study, a three-part *ad hoc* questionnaire-survey was designed (Table 1). Part one gathered demographic data; part two included two dichotomous questions and a 10-statement list; finally, part three was used to assess the readability, on a Likert scale, of two on-topic online texts of different complexity.

To design part two of the questionnaire-survey the existing literature on health knowledge assessment was examined,^{13–16} also considering the professional experience of the researchers regarding the beliefs of lay people about basic visual impairment aspects. To explore the actual knowledge of the participants, this part of the questionnaire assessed "declared knowledge", for which the term *awareness* will be used, as well as "real knowledge", for which *knowledge* will be used. *Awareness* was determined by two dichotomous questions: "Have you ever heard about low vision?" and "Have you ever heard about blindness?". When participants responded affirmatively, *knowledge* was assessed by instructing participants to provide a short definition of the corresponding term, and by answering a 10-statement list (possible responses: True, False or Don't know/No opinion). All statements are false except for #8 and #9. Six statements referred to low vision (1,3,5,6,8,10), other six to blindness (2,4,5,6,7,9), and two of them dealt with both low vision and blindness (5,6). *Knowledge* was rated as high (4–6 correct answers), medium (2 or 3 correct answers), or low (less than 2 correct answers).

Finally, in part three the readability of two texts (Text 1 and Text 2) was objectively assessed using INFLESZ, an online-validated freeware¹⁷ for Spanish language that provides the Flesch-Szigriszt Index and the INFLESZ-Scale Grade. This instrument is widely used to assess the readability of health information in Spanish.^{18–21} The INFLESZ-Scale grade characteristics may be found elsewhere.¹⁷ Briefly, five

Table 1 *Ad hoc* questionnaire-survey.**PART 1 – DEMOGRAPHIC DATA**

- * Age
- * Sex
- * Academic level[◇]

PART 2 – KNOWLEDGE OF LOW VISION AND BLINDNESS

- * Have you ever heard of *low vision*? If your answer is YES, could you describe your understanding of it?
- * Have you ever heard of *blindness*? If your answer is YES, could you describe your understanding of it?
- * Read each of the following statements and mark it as true (T) or false (F). In case you don't know the answer, mark NO (no opinion). Please, do not answer randomly.

1. People with low vision see blurred.	T	F	NO
2. People with blindness cannot see at all.	T	F	NO
3. People with low vision should use very thick glasses to see well.	T	F	NO
4. People with blindness cannot go out in the street alone.	T	F	NO
5. Children with low vision or blindness don't attend mainstream schools*.	T	F	NO
6. In Spain, there are more people with blindness than people with low vision.	T	F	NO
7. In Spain, people with blindness can only work at ONCE**, by selling lottery tickets.	T	F	NO
8. Type II diabetes is related to low vision.	T	F	NO
9. Blindness may be due by retinal detachment.	T	F	NO
10. Night myopia, is considered a low vision condition.	T	F	NO

PART 3 – READABILITY

- * Read TEXT 1 and TEXT 2. Please, rate on a scale 1–5 the difficulty you experienced to understand each text (1. Very easy - 2. Quite easy - 3. Normal - 4. Somewhat difficult - 5. Very difficult).
- * In case to score 4 or 5, could you tell us why? (briefly)

[◇] Elementary School; Middle School; High School or Professional training; University education.

* Instead, they must go to special education centres.

** The Spanish National Organisation for the Blind.

difficulty levels and score ranges are described, ranging from very easy (>80), quite easy (65–80), normal (55–65), somewhat difficult (40–55), to very difficult (<40).

The selection of Text 1 and Text 2 derived from a previous work (not yet published) in which the authors assessed the quality of online information on low vision and blindness. Briefly, the keywords “low vision” and “optic nerve hypoplasia” were used in the Google search engine and the first 10 web pages were inspected to find two texts with different objective levels of difficulty and with a similar extension (approximately 600 words). Text 1 described general aspects of low vision in plain language, and scored 59 (*i.e.*, graded *normal* by the INFLESZ scale: 55–65), and Text 2 contained information on optic nerve hypoplasia, a specific rare eye disease accompanied by visual impairment, and scored 53 (*i.e.*, graded *somewhat difficult* by the INFLESZ scale: 40–55). Texts were copied from the corresponding webpages to a Microsoft Word file, and converted to an easy to read format (Times New Roman type font, size 12, double spaced). Texts were then printed and presented to the participants in hard copy format.

After accepting to take part in the study, participants were instructed to complete the questionnaire; texts were presented following a counterbalancing scheme: half of the participants started with Text 1, followed by Text 2 and the other half started with Text 2, followed by Text 1. Participants were allowed a maximum of 10 min to read both texts and as long as required to answer the questionnaire, although most respondents completed it in less than 5 min. The Likert scale used to grade subjective reading difficulty

contained the same difficulty steps of the INFLESZ-Scale Grade. Participants were also permitted to add comments describing their reading experience.

Data analysis

Analysis was performed in both global data and data segmentation to determine the factors that could influence knowledge on low vision and blindness. Segmentation was performed considering sex, academic level and age (younger than 45 years, and 45 years of age or older). Age segmentation aimed at investigating whether knowledge and understanding of low vision and blindness was broader in participants already dependent on optical correction for presbyopia or in those caring for elderly relatives with age-related ocular diseases and conditions such as cataract, glaucoma, age-related macular degeneration, among others.

All data were analysed using the Minitab Statistical Software, version 18 (Minitab, LLC, State College, Pennsylvania, US). Descriptive statistics of sociodemographic data, responses to the 10-statement list and readability assessment are presented as mean, standard deviation (SD), frequency and percentage, or median and range. The Analysis of Variance (ANOVA) test and the Student's *t*-test were used for group and pair-wise analysis of quantitative normally distributed data, whereas the non-parametric Mann-Whitney or Kruskal-Wallis tests were employed to analyse the results of the Likert scale responses. The Spear-

Table 2 Demographic characteristics of the participants.

* AGE, years	Mean± SD Range	32,83±16,7 16–81		
* SEX, n (%)	Female	57 (55,3)	< 45-year-old 38 (52,0)	≥ 45-year-old 19 (63,3)
	Male	46 (44,7)	35 (48,0)	11 (36,7)
* ACADEMIC LEVEL, n (%)	Elementary School	3 (2,9)	1 (1,4)	2 (6,7)
	Middle School	20 (19,4)	13 (17,8)	7 (23,3)
	High School/Professional training	40 (38,8)	28 (38,4)	12 (40,0)
	University education	40 (38,8)	31 (42,5)	9 (30,0)

Table 3 Percentage of answers to each statement.

	1 ^{LV}	2 ^B	3 ^{LV}	4 ^B	5 ^{LV B}	6 ^{LV B}	7 ^B	8 ^{LV}	9 ^B	10 ^{LV}
% Correct answers	11.7	29.1	34.0	88.4	39.8	35.0	76.7	29.1	61.2	18.5
% Incorrect answers	54.4	69.9	35.0	7.8	32.0	10.7	7.8	6.8	4.9	29.1
% No opinion	34.0	1.0	31.0	3.9	28.2	54.4	15.5	64.1	34.0	52.4

n^{LV}, statement on low vision; n^B, statement on blindness; n^{LV B} statement on both low vision and blindness.

man coefficient of correlation test was used to explore possible associations between variables under study.

A p-value of <0.05 was considered to denote statistical significance.

Results

Participants

A total of 103 participants responded to the questionnaire (Table 2). There were no significant differences in mean age or academic achievement in terms of sex ($p = 0.381$ and $p = 0.858$, respectively). No statistically significant differences were found between age groups (older or younger than 45 years) in neither sex ($p = 0.286$) nor academic level ($p = 0.174$).

Awareness regarding low vision and blindness

Whereas less than half of the participants had *awareness* on what low vision is (48%), only 6% were ignorant regarding blindness. *Awareness* on low vision was not found to be influenced by age ($p = 0.424$), but statistically significant differences were found according to academic level ($p = 0.047$). Similar results were found regarding *awareness* on blindness ($p = 0.337$ and $p < 0.001$, respectively). Upon examining the open answers allowed to participants responding affirmatively to the initial dichotomous question, it was found that low vision was a widely unknown concept and that the majority of respondents misinterpreted the concept of blindness. Many answers were vague, inaccurate or incorrect (e.g., regarding low vision: “to see blurry”, “difficulty to see well”, “to see less than normal, it is like myopia”; regarding blindness: “to see very little”, “to not receive any visual stimuli”). Sixty-two participants out of the 97 offering a definition of blindness incorrectly stated that “blindness is equivalent to seeing nothing”.

Knowledge regarding low vision and blindness

Table 3 presents a summary of the percentage of participants who answered correctly and incorrectly to each statement, as well as those with no opinion. Overall, participants provided more correct answers to statements about blindness than to those about low vision. Also, more than 50% of answers to statement 1 (*People with low vision see blurred*) and almost 70% of answers to statement 2 (*People with blindness cannot see at all*) were incorrect. Besides, the majority of participants expressed no opinion to the relationship between diabetes and low vision (statement 8) but linked retinal detachment to blindness (statement 9).

Table 4 summarizes the relationship between *awareness* and *knowledge* on low vision and blindness, respectively; data reflect the answers of participants who did express *awareness* on the concepts of low vision or blindness (i.e. those who had ever heard of low vision, $n = 49$, or blindness, $n = 97$). Responses from participants answering “No” to the initial dichotomous questions were attributed to chance and were excluded from the inferential analysis.

Among the participants answering “Yes” to the dichotomous question on low vision, 53% of them had *medium knowledge* and only 12% reached a high level (4–6 correct answers), with a mean of 2.0 ± 1.2 correct answers (i.e., low-medium level). Regarding blindness, 47% and 44% of participants had *medium* and *high knowledge* levels, respectively, with a mean of 3.3 ± 1.4 correct answers (i.e., medium-high level). Once segmented by age, younger participants had means of 2.0 ± 1.2 correct answers for low vision and 3.5 ± 1.4 correct answers for blindness, whereas older participants obtained means of 2.1 ± 1.3 correct answers for low vision and 3.0 ± 1.2 correct answers for blindness. No statistically significant differences were found in *knowledge* between age groups neither for low vision ($p = 0.382$) nor blindness ($p = 0.060$). Similar results were obtained when exploring *knowledge* and academic levels ($F = 0.940$, $df = 3$,

Table 4 Relationship between *awareness* and *knowledge*.

Number of correct answers (<i>Knowledge</i>)		0	1	2	3	4	5	6	SUM
<i>Awareness</i> on LOW VISION	Participants (n)	5	12	16	10	5	1	0	49
	%	10	25	33	20	10	2	0	100%
<i>Awareness</i> on BLINDNESS	Participants (n)	2	7	15	31	18	19	5	97
	%	2	7	15	32	19	20	5	100%

$p = 0.425$ for low vision, and $F = 0.090$, $df = 3$, $p = 0.967$ for blindness).

Readability of online information on low vision and blindness

Subjective reading difficulty was assessed with a Likert scale and rated from very easy (score 1) to very difficult (score 5). Whereas almost all participants rated Text 1 as *very easy*, *easy* or *normal*, Text 2 was rated as *somewhat difficult* and *very difficult* by 43% of participants (Fig. 1). Median and range readability scores were 2 (1–5) for Text 1 and 3 (1–5) for Text 2 ($p < 0.001$). Participants grading Text 2 with a score of 4 or 5 offered comments describing difficulties with technical language and medical terms and concepts.

Subjective readability difficulty scores were not influenced by sex. Statistically significant differences among academic levels were found in the difficulty grades of Text 2, both for all participants ($p = 0.007$) and for the younger age group ($p = 0.044$). Weak negative correlations were disclosed between academic level and difficulty scores ($\rho = -0.246$, $p = 0.012$ for Text 1; $\rho = -0.288$, $p = 0.030$ for Text 2), and a stronger correlation was found for Text 2 when only the responses of the elder participants were considered ($\rho = -0.370$, $p = 0.039$).

Discussion

The purpose of the present study was to determine the level of public knowledge on low vision and blindness of a Spanish population sample, and to assess whether information available online on these topics was easy to read and understand. As far as we know, no previous research has been conducted on this field in Spain, particularly comparing *awareness* with *knowledge*, as determined by a simple *ad hoc* questionnaire-survey.

Nearly 50% of respondents were aware of the concept of low vision, a better knowledge than reported by a National Eye Institute & Lions Clubs International Foundation study, in which only between 10% and 27% of respondents had *awareness* on low vision.²² As expected, almost all participants had knowledge of the concept of blindness. Neither age nor sex influenced *awareness* on low vision and blindness, in contrast to academic level.

When assessing *knowledge* on low vision with a 10 true-or-false statement list, only 6% of total participants showed a high level of knowledge, while medium-to-high knowledge reached 31%. Several studies suggest a lack of public awareness on eye diseases, results that may be extrapolated to the concepts of low vision and blindness.^{15,23,24} Definitions

provided by participants evidenced a general misconception of both low vision and blindness.

Neither higher academic level nor older age was found to influence *knowledge* on low vision and blindness. Although previous research on health knowledge described a relationship between better knowledge and both higher academic level and female sex,^{14,25,26} other authors failed to evidence any influence of sex or education on ocular health awareness.²⁷

Our findings revealed that public knowledge on the topic is scarce. Consequently, individuals might not resort to eye care professionals in time to prevent and treat visual impairment and its consequences, and this could lead to adverse effects. For example, there is evidence on the relationship between poor vision and falls, and less social participation.^{28,29} Thus, actions aimed at improving public knowledge on this topic might not only benefit in detection and management of visual impairment, but also assist in preventing or reducing the risk of falling (and the incidence of falls and derived fractures) or loneliness, especially among the elderly. It would also be necessary to warn about the relationship between several systemic diseases and loss of vision; to our view, the fact that the majority of participants did not relate diabetes with low vision is worrying. With the framework of the health literacy model described by Sørensen et al.,¹⁰ a more complete public knowledge on low vision and blindness might positively influence attitudes and practices in all domains: healthcare, disease prevention, and health promotion.

In addition, it needs to be considered whether the available online information is understandable enough when people search for information on their own. Upon exploring the readability of two texts emulating the results of a possible online search conducted by a layperson, it was found that the excessive use of complex technical terms has a negative impact on understanding. Similar results have been reported assessing readability of several health conditions, such as, rheumatoid arthritis,²¹ aortic aneurysm,¹⁸ congestive heart failure,³⁰ or asthma.³¹ The findings on subjective difficulty were in agreement with prior objective assessment of the texts, giving support to the usefulness of instruments to explore the readability of patient educational materials and health information.³²

The Internet is a key source of health information worldwide, including in Spain.^{33–35} Health professionals must be mindful that their patients will search for information of their health conditions online. Thus, identifying the most adequate strategies and means to communicate this information to patients is a key aspect to consider not only in the consulting room but also in health-related websites.

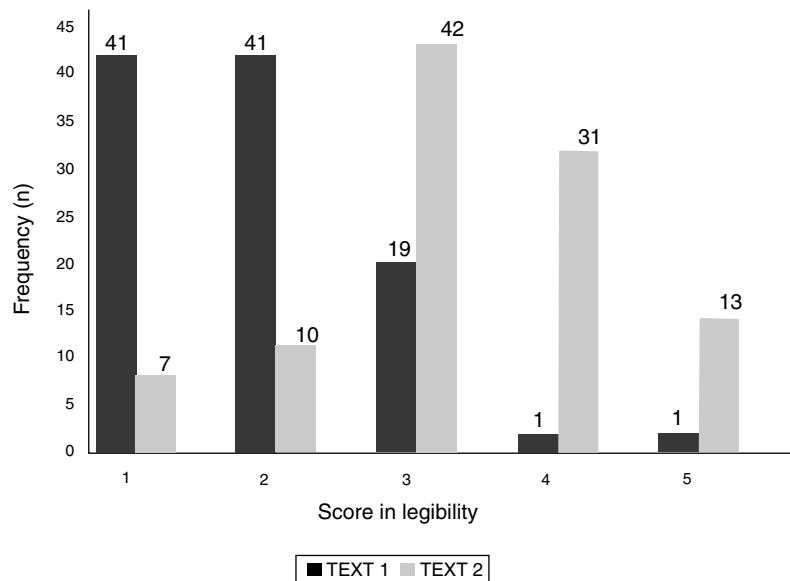


Fig. 1 Subjective readability scores of Text 1 and Text 2 (possible answers to the Likert scale are 1: very easy, 2: quite easy, 3: normal, 4: somewhat difficult, 5: very difficult).

Limitations of the study

We must be cautious when interpreting the results, as the study sample is relatively small and not randomly collected. Although driven sampling strategies account for this factor, some degree of sampling bias may not be dismissed. However, particular care was taken to avoid bias in terms of sex, age and academic level, as may be observed from the demographic characteristics summarized on [Table 2](#), and participants were recruited from different areas of the Catalan region in Spain. Further research with a larger, more diverse sample is required to endorse the present findings regarding *awareness* and *knowledge* on low vision and blindness, and to identify other relevant factors that may influence the level of challenge associated with reading medical texts.

In addition, it must be noted that an *ad hoc* questionnaire-survey was employed for the purpose of this research. Lacking a full validation of the questionnaire, which was beyond the scope of the present study, item selection was based on expert opinion and on the existing literature on health knowledge assessment, as well as on professional experience of researchers working on the beliefs of lay people about basic impairment aspects. To avoid unwanted bias, the number of items exploring low vision and blindness was the same and all items were tested to ensure they were easy to understand by lay people. Future efforts shall be devoted to the validation of this instrument.

Finally, the selection of the on-topic online texts could also be considered a limitation of the study in as much as they may not be representative of the whole corpus of available information. Indeed, text selection may reflect the way the Google search engine ranks web pages and it may be assumed that other search engines or combination of keywords may have resulted in a slightly different list of relevant web pages.

Conclusion

The present study disclosed that the general public has a limited knowledge of key concepts of visual health such as blindness and, particularly, low vision, and that the typical information available online might not always be easy to understand by the readership to whom it is addressed. Eye care providers face a great challenge, as an ageing population will increase the incidence and prevalence of visual impairment and its consequences. The availability of complete and easy to understand information may contribute to raise awareness on this subject, and to reduce the cases of avoidable visual impairment, with relevant repercussions in terms of quality of life and costs.³⁶ Health literacy in each of the three domains described by Sørensen and co-workers shall allow patients “to take control over their health by applying their general literacy and numerical skills as well as their specific health literacy skills to acquire the necessary information, understanding this information, critically analysing and appraising it, and acting independently to engage in actions overcoming personal, structural, social and economical barriers to health”.¹⁰ The goal of prevention and self-management through patient empowerment and health literacy should guide future political actions in the field of ocular and general health care.

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Declarations of interest

None.

Authorship

All three authors declare their substantial contribution in the conception and design of the study, the analysis and interpretation of data, the draft and revision of the article, and the final version of it for submission.

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