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Gender differences of health literacy in persons with a migration background: a systematic review and meta-analysis

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ABSTRACT

Objective To investigate gender differences of health literacy in individuals with a migration background.

Design Systematic review and meta-analysis. OVID/MEDLINE, PsycINFO and CINAHL were searched in March 2018 and July 2020.

Setting Studies had to provide health literacy data for adult women and men with a migration background, collected with a standardised instrument, or report results that demonstrated the collection of such data. Health literacy data were extracted from eligible studies or requested from the respective authors. Using a random-effects model, a meta-analysis was conducted to assess standardised mean differences (SMDs) of health literacy in men and women. Two researchers independently assessed risk of bias for each included study using the Appraisal Tool for Cross-Sectional Studies.

Results Twenty-four studies were included in this systematic review. Thereof, 22 studies (8012 female and 5380 male participants) were included in the meta-analyses. In six studies, gender-specific health literacy scores were reported. The authors of additional 15 studies provided their data upon request and for one further study data were available online. Women achieved higher health literacy scores than men: SMD=0.08, 95% CI 0.002 to 0.159, p=0.04, I^2=65%. Another 27 studies reported data on female participants only and could not be included due to a lack of comparable studies with male participants only. Authors of 56 other eligible studies were asked for data, but without success.

Conclusion Men with a migration background—while being much less frequently examined—may have lower health literacy than women. As heterogeneity between studies was high and the difference became statistically insignificant when excluding studies with a high risk of bias, this result must be interpreted with caution. There is a paucity of research on the social and relational aspects of gender in relation to health literacy among people with a migration background, especially for men.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first systematic review to investigate gender differences of health literacy in persons with a migration background.
⇒ Our study incorporates previously unpublished gender-specific health literacy data of 15 studies.
⇒ Data of 56 potentially eligible studies could not be retrieved.
⇒ Heterogeneity between studies was high and statistical significance of gender differences vanished when excluding studies with high risk of bias; results must be interpreted with caution.

INTRODUCTION

Health literacy can be described as having the 'knowledge, motivation and competencies of accessing, understanding, appraising and applying health-related information within the healthcare, disease prevention and health promotion setting, respectively'.[1] This broad definition is often referred to as 'comprehensive health literacy'. A somewhat narrower concept, designated as 'functional health literacy', focuses on a person's ability to read and understand written health information and perform simple arithmetic tasks in a health context.[2] Empirical research has shown that limited health literacy is associated with more frequent hospitalisation and emergency treatments, reduced use of preventive measures, poor adherence to medical treatment, and an increased risk of morbidity and mortality.[3–6] Studies examining overall health literacy in the USA[7] and eight European countries (Austria, Bulgaria, Germany, Greece, Ireland, the Netherlands, Poland and Spain)[8] have found inadequate or problematic levels of self-reported health literacy in 30%–50% of the general population, which are thought to result in substantial additional costs in healthcare systems.[9] Importantly, health literacy is subject to the influence of societal, environmental, personal and situational factors.[1] The exchange of health information, for example, in the treatment setting, depends on the respective social context.[10] Thus, rather than being an individual skillset,

health literacy should be regarded as a social-relational concept.[11]

Limited health literacy is not evenly distributed among populations; current studies have found some populations to be more vulnerable than others, especially migrants.[12 13] For the purpose of this review, we defined persons with a migration background as either first-generation or second-generation migrants. For first-generation migrants, we follow the definition of the International Organization for Migration (IOM): 'IOM defines a migrant as any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence, regardless of (1) the person's legal status; (2) whether the movement is voluntary or involuntary; (3) what the causes for the movement are; or (4) what the length of the stay is.' Meanwhile, second-generation migrants are defined as persons with at least one parent being a migrant; it is important to include this group as the health-related effects of migration can also affect the second generation.[14 15] This broad definition is in line with the term 'person with a migratory background', as defined by the European Commission.[16]

In a representative, cross-sectional study in Germany, 71% of persons with a migration background reported major difficulties in processing health information and translating it into healthy choices.[17] Lower health literacy scores compared with the native-born population have also been measured in immigrants in Canada,[18] Sweden[19] and in some immigrant subpopulations in the USA, for example, elderly[20] and Hispanic/Latinx immigrants.[21] With the number of international migrants worldwide rising steadily, reaching an estimated 272 million in 2019,[22] and a constant high level of global migration expected for the near future,[23] understanding the factors that influence health literacy in migrants is considered a highly relevant task. As plenty of research yielded profound differences between men and women regarding health information processing,[24 25] health behaviour[26 27] and health outcomes,[28] gender could be one of these factors.

However, the usage and understanding of the terms gender and sex within medical research appears to be inconsistent.[29] For conceptual clarity, we refer to *gender* as relating to social aspects concerning gender identities, norms and relations, while *sex* is reserved for biological differences between men and women.[30] Given the social-relational character of health literacy,[1] possible differences between men and women are much more likely to reflect socially influenced gender dissimilarities than biologically determined sex differences. Therefore, we will use the term gender consistently throughout this review, even though we expected most studies to dichotomise gender in a biologically inspired way as male/female.[31]

Correlations have been found between health literacy scores and gender,[4 32–35] with ambiguous results regarding the strength and direction of these results; some reported higher health literacy scores for women,[33] while others reported higher scores for men.[35] Moreover, for migrant populations, studies found health behaviour[36] and health information-seeking strategies[37] differed between the genders. Men and women migrate for different reasons and their experiences during and after migration differ as well, including their interactions with the health systems of the receiving countries.[38] Consequently, researchers have repeatedly called for taking gender aspects into account when it comes to examining the health literacy of persons with a migration background.[39 40]

Accordingly, this systematic review and meta-analysis aims to investigate gender differences of health literacy in persons with a migration background, which were assessed using standardised instruments to measure health literacy.

This study is part of an overarching research project on 'Gender-specific health literacy in individuals with migration background' (GLIM). It includes two qualitative focus group studies, one on gender aspects of health literacy in migrants,[41] and one on systemic aspects of intercultural treatment settings.[42] Furthermore, a Cochrane review on interventions targeting the health literacy of migrants[43] and a qualitative Cochrane review on gender differences in the health literacy of migrants[44] are currently conducted within GLIM.

METHODS

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[45] The protocol has been registered in advance on the International Prospective Register of Systematic Reviews,[46] including descriptions of the review question, search strategy and inclusion and exclusion criteria of studies and participants.[41]

Search strategy

As a first step, we defined and set the search terms in English, addressing the main concepts, that is, 'health literacy' and 'migration background'. As a second step, we developed two-parted search strings—one section referring to health literacy and the other encompassing migration background—and pretested them in PubMed. All parts were combined using the Boolean operator 'AND'. Following the preliminary search, we identified key publications and analysed them for wording used in the title and abstract as well as index terms to expand and adapt the search terms to cover additional and divergent wording. After the search terms and search strings were finalised for PubMed, the search strategy was adapted to each of the additional databases and the actual search was conducted in the OVID (MEDLINE), PsycINFO and CINAHL databases. The first search was conducted in March 2018, followed by an update search in July 2020. Further details on the search terms and search strategy are provided in online supplemental file 1.

Eligibility criteria

Types of studies

In this review, we included primary research studies that used quantitative methods such as observational,

prospective and retrospective cohort studies, randomised controlled trials and controlled trials. The inclusion criteria were as follows. (1) Studies had to include health literacy data collected with a standardised instrument that had been validated according to objectivity, validity and reliability. In cases where a validated assessment tool had been translated into another language but had not been validated in the target language, the minimum requirement was a forward-translation and back-translation process, as recommended by the WHO.[47] (2) Studies had to provide gender-specific health literacy scores, health literacy levels or they had to report results that demonstrated the collection of extractable health literacy data for women and men with a migration background. In the latter case, we requested the respective authors send us mean health literacy scores, SDs, and the number of male and female participants included in their study.

Types of participants

We included all adults with a migration background aged ≥18 years. Many studies from the USA focus on so-called *Latinos/Latinas* or *Hispanics,* blurring the categories of migration background and ethnic minority. Drawing on statistics related to the use of language within these populations,[48 49] we decided to include such studies only if participants (self-)identified as Latinos/Latinas/Latinx, Hispanics or Latin-American (eg, Mexican Americans) and stated that they speak Spanish as their first language at home or in medical consultations. We excluded studies that focused on ethnic minorities (eg, Roma, Asian Americans) if these studies did not state that the participants were first-generation or second-generation migrants. The inclusion and exclusion criteria are listed in table 1.

Types of outcome measures

Our primary outcome was gender differences in the health literacy of persons with a migration background assessed at baseline with standardised instruments to measure health literacy.

Table 1 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Primary research study	Studies on ethnic minorities without a migration background
Participants must be first-generation or second-generation migrants	Healthcare professionals as participants
Participants must be >18 years	Only a subtype of health literacy measured (eg, dental health literacy)
Health literacy must be measured quantitatively using a validated instrument	No quantitative assessment of health literacy
Gender-separated health literacy scores must be reported or delivered upon request	

Report characteristics

No time or language filters were applied.

Study selection and screening

The studies retrieved were exported to Covidence, a web-based systematic review tool.[50] Two researchers (DC, AB) independently screened the studies' titles and abstracts for eligibility. In a second step, they individually reviewed the full texts of the studies identified in the screening process using the predefined inclusion and exclusion criteria. Disagreements were resolved through involvement of a third author (AA).

Data extraction

We adapted a data extraction sheet provided from Cochrane[51] and tested it using the first three included studies. Study characteristics and results were extracted for each study, including authors, country of research, description of the population, number of male/female participants, type of health literacy measurement instrument and baseline mean and SD of health literacy scores for men and women. In addition, we extracted further study details according to PROGRESS (an acronym for place of residence, race, ethnicity/culture/language, occupation, gender/sex, religion, education, socioeconomic status and social capital), a framework for incorporating equity aspects into systematic reviews.[52] As we focused on quantitative gender differences, we did not extract data for the additional items described in PROGRESS Plus,[53] except for age. All extracted data were double-checked against the full text of the studies by a second researcher, as recommended in Chapter 5 of the Cochrane handbook.[54] In the case that a study did not include gender-specific health literacy scores, the authors of the study were emailed and asked to provide these data. If baseline health literacy scores and SDs were reported for more than one validated measurement instrument, we extracted the data produced by the tool measuring the broader conceptualisation of health literacy. Thus, we favoured comprehensive over functional health literacy and differentiated assessment tools, such as the Test of Functional Health Literacy in Adults (TOFHLA), over screening instruments such as the Brief Health Literacy Screen (BHLS).

Risk of bias in individual studies

Two authors (DC, AB) independently assessed the risk of bias for the studies included in the meta-analysis by using the Appraisal Tool for Cross-Sectional Studies (AXIS).[55] Differences were reconciled discursively. To categorise studies into low, medium and high risk of bias, we built a composite score, as proposed by Boxberger and Reimers.[56] AXIS comprises 20 criteria. We considered studies to have high risk of bias if less than 50% of the criteria were fulfilled. Medium risk of bias was ascribed to studies meeting between 50% and 66% of the criteria and low risk of bias was reserved for studies fulfilling more than 66% of the criteria.[57]

Synthesis of results

For meta-analyses, we imported gendered health literacy scores and SDs and numbers of male and female participants into Review Manager (V.5.4), a software provided by the Cochrane Collaboration for conducting systematic reviews and meta-analyses.[58] As there are different tools for measuring health literacy in various ways, we used standardised means and a random-effects model[59] to estimate the gender differences in health literacy scores, as recommended by the Cochrane Collaboration.[60] Heterogeneity between studies was assessed using Q and I^2 statistics.[61] For better interpretation, we transformed statistically significant ($p<0.05$) standardised mean differences (SMDs) into a commonly used scale (S-TOFHLA) using the pooled SD of scores in included studies that had applied this instrument.[62 63]

Tests for subgroup differences were carried out for region of origin, type of health literacy assessment tool and functional versus comprehensive health literacy. We undertook two kinds of sensitivity analyses: (1) excluding studies considered to have high risk of bias and (2) using a fixed-effects model instead of a random-effects model.

For visualisation, data were exported into RStudio V.1.3.[64]

RESULTS

Study selection

We identified 5742 studies, of which 2013 were excluded as duplicates. Thus, 3729 articles were checked for titles and abstract, of which 3437 were excluded, leaving 292 studies for full-text screening. At the full-text review stage, we excluded a further 268 studies, including 56 otherwise eligible studies that did not report gender-segregated health literacy data and whose authors did not provide these scores upon request. This includes the only study that made it into the full-text screening and was written in a language other than English (in this case, Chinese). Among the excluded studies were 40 that used unsuitable definitions of the term migrant (ie, focusing on ethnic or 'racial' minorities without providing information about whether the participants or their parents had migrated themselves). We also had to exclude 27 studies that included female participants only; as no studies with exclusively male participants met our inclusion criteria, there were no comparable counterparts for these studies. Finally, a total of 24 studies were included in the systematic review. Six studies[65–70] reported gender-separated mean health literacy scores and SDs as well as the number of participants for each gender. For 15 of the included studies,[71–85] the data were provided by the respective authors via email; and for 1 study,[86] we obtained it from a publicly available data set.[87] Two studies[19 88] reported health literacy levels (eg, low vs high health literacy) instead of scores and could not be meta-analysed. For the PRISMA[45] flow diagram, see figure 1.

Characteristics of included studies

Of the 24 studies included in this review, 16 were conducted in the USA, 6 in Europe and 2 in Asia. Participants included in the studies were of Hispanic/Latin (n=14), diverse (n=5), Korean (n=2), Chinese, Somali and Russian (each n=1) origin. Most studies (n=20) measured functional health literacy, while comprehensive health literacy was measured in five studies (one study reported results for both functional and comprehensive health literacy). Health literacy was measured using different instruments. Varieties of the BHLS,[89] containing 1–16 questions for self-assessment of functional health literacy, were used in seven studies. Meanwhile, five studies made use of the European Health Literacy Survey Questionnaire (HLS-EU-Q),[90] containing either 16 or 47 items to self-assess participants' comprehensive health literacy. Four studies made use of the Rapid Estimate of Adult Literacy in Medicine (REALM),[91] a performance-based oral reading and recognition test, or versions of the Short Assessment of Health Literacy in Spanish (SAHLSA, SAHL-S)[92 93] which was developed on the basis of REALM. The performance-based TOFHLA[94] was applied in three studies, including a short version called S-TOFHLA.[95] The TOFHLA measures functional health literacy by assessing the participants' reading comprehension of medical information. Further measurement tools for determining functional health literacy, each used in one study, were the Health Literacy Assessment Using Talking Touchscreen[72] and the Swedish Functional Health Literacy Scale,[96] both self-assessment instruments, and the performance-based Korean Health Literacy Scale.[97] Finally, the All Aspects of Health Literacy Scale,[98] an instrument for self-assessing comprehensive health literacy, was used in one study. All scales were reported with higher scores representing higher health literacy. None of the included studies focused on gender aspects. The characteristics of the included studies are presented in table 2.

Meta-analyses

Of the 24 studies included in this review, 2[19 88] reported health literacy categories (eg, low vs high health literacy) instead of numerical scores. These studies are not included in the meta-analysis; their results are reported narratively. The risk of bias was low, medium, and high in 16, 4, and 1 study, respectively, as represented in online supplemental file 2. We meta-analysed 22 studies with 13 392 participants reporting health literacy scores for women (n=8012) and men (n=5380).

Gender differences of health literacy in persons with a migration background

A small but significant gender difference (SMD=0.08; 95% CI 0.002 to 0.159; p=0.04) in health literacy scores could be identified, with women achieving higher scores than men. In S-TOFHLA units, which range from 0 to 36, the mean difference between scores of women and men was 0.90 (95% CI 0.03 to 1.78). A considerable level

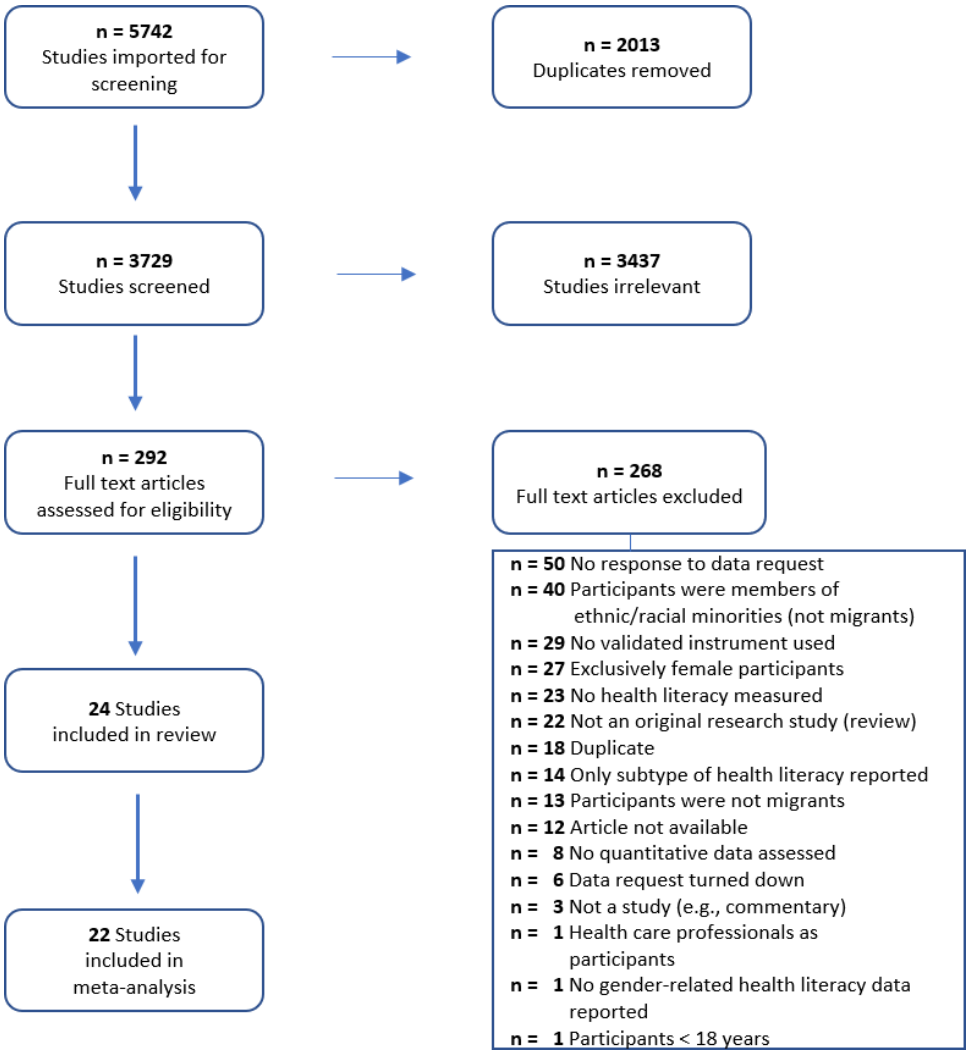

Figure 1 The PRISMA flow diagram shows the results of the search and the reasons for exclusion of studies. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

of heterogeneity (I^2=65%) between studies was found. Detailed results and a forest plot are depicted in figure 2.

Two studies not included in the meta-analysis reported health literacy levels instead of scores. Geltman *et al*[88] found significantly (p<0.001) higher health literacy levels in male (n=184; low health literacy: n=118; high health literacy: n=66) compared with female Somali refugees in the USA (n=255; low health literacy: n=208; high health literacy: n=47). Wångdahl *et al*[19] included refugees of diverse origins living in Sweden (n=455; 242 male; 204 female; 9 unknown) and measured functional as well as comprehensive health literacy. They categorised the results into inadequate, problematic and sufficient health literacy: sufficient functional health literacy was found in 17.6% and 22.3% of male and female participants (p=0.06), respectively, while sufficient comprehensive health literacy was reported for 39.3% and 48.1% of male and female participants (p=0.07), respectively. However, neither of these studies posited possible reasons for the gender differences they found.

Analysis of subgroups

Deviating from the protocol, we refrained from conducting tests for subgroup differences based on migratory status (eg, labour migrant, refugee, asylum seeker) as only two studies[74 84] included in the meta-analysis reported participants' migratory status. As we included baseline measures of health literacy only, we did not perform tests for subgroup differences based on the study design. Detailed data and forest plots for the tests on subgroup differences can be found in online supplemental file 3.

Region of origin

Most studies included migrants from diverse countries of origin without reporting separate scores for the respective groups. Gendered scores were not broken down by country of origin. Thus, we categorised the included studies into three groups regarding the following ethnicities:

(1) The category *Hispanic/Latinx* with 14 studies[65 68 69 71 73 74 76 77 79 81 82 86 99] including 10 858 participants (female: n=6593; male: n=4265) who were of Latin

Table 2 Characteristics of included studies

Study	Reference	Country of research	Migrant group	Description of participants	Sample size	Male	Female	Migrants' main countries of origin	Health literacy type, instrument and language of instrument
Aguirre *et al*	65	USA	Hispanic/Latinx	Medicaid or Medicare recipients	1066	233	833	Puerto Rico 85% Dominica 10%	Functional S-TOFHLA, Spanish
Baird *et al*	66	USA	Asian	Korean Americans (≥60 years)	178	60	118	Korea	Functional BHLS 16 items, Korean
Chen *et al**	80	USA	Asian	Chinese immigrants	405	158	247	China	Comprehensive AAHLS, Chinese
Fernández-Gutiérrez *et al*	70	Spain	Diverse	Immigrant population	71	34	37	Morocco 47% Sub-Saharan Africa 27%	Comprehensive HLS-EU-Q16, Spanish
Geltman *et al*† (116)	88	USA	Others	Somali refugees in Massachusetts	439	184	255	Somalia	Functional S-TOFHLA, Somali
Gibbs *et al**	71	USA	Hispanic/Latinx	Spanish-speaking Latino population	51	11	36	Mexico 74%	Functional SAHL-S, Spanish
Guntzviller *et al**	73	USA	Hispanic/Latinx	Spanish-speaking adults	100	15	83	Mexico	Functional S-TOFHLA, Spanish
Hahn *et al**(117)	99	USA	Hispanic/Latinx	Hispanics	149	58	85	Mexico	Functional Health LiTT, Spanish
Hall *et al**	74	USA	Hispanic/Latinx	Migrant seasonal farm workers with hypertension	45	20	25	Mexico	Functional SAHLSA, Spanish
Lubetkin *et al*	67	USA	Hispanic/Latinx	Haitian immigrants in primary care	85	22	63	Haiti	Functional BHLS, English & Haitian Creole
Merchant *et al**	81	USA	Hispanic/Latinx	Spanish-speaking patients	1585	604	1001	NA	Functional SAHL-S, Spanish
Miranda *et al**	82	Netherlands	Hispanic/Latinx	Individuals with a Surinamese background	7194	1601	2385	Suriname	Functional REALM-D, Dutch
Rayan-Gharra *et al**	83	Israel	Others	Ethnic minorities (Russian speaking)	198	82	116	The former Soviet Union	Functional BHLS, Russian
Sarkar *et al*‡	86	USA	Hispanic/Latinx	Latinos in the USA	2921	1468	1453	Mexico 66%	Functional BHLS, English
Schaeffer *et al**	75	Germany	Diverse	Persons with a migration background	157	77	80	NA	Comprehensive HLS-EU-Q47, German
Smith *et al**	76	USA	Hispanic/Latinx	Native Spanish speakers	50	25	25	NA	Functional TOFHLA, Spanish
Song *et al**	84	South Korea	Asian	North Korean defectors	399	106	293	North Korea	Functional KHLS, Korean
Soto Mas *et al*	68	USA	Hispanic/Latinx	High school students (≥21 years)	97	10	79	Mexico	Functional S-TOFHLA, Spanish
Soto Mas *et al*	69	USA	Hispanic/Latinx	Spanish-speaking adults with low-to-intermediate English proficiency	181	38	143	Mexico	Functional TOFHLA, English
Sudore *et al**	79	USA	Hispanic/Latinx	Spanish-speaking primary care patients ≥55 years with chronic or serious illnesses	433	119	314	Central America 67% North American Latino countries 27%	Functional S-TOFHLA, Spanish

Continued

Table 2 Continued

Study	Reference	Country of research	Migrant group	Description of participants	Sample size	Male	Female	Migrants' main countries of origin	Health literacy type, instrument and language of instrument
Svendsen *et al**	85	Denmark	Diverse	Immigrants or descendants of immigrants	599	289	310	NA	Comprehensive HLS-EU-Q16, Danish
Trubitt *et al**	77	USA	Hispanic/Latinx	Predominantly Hispanic population residing along the US–Mexico border	109	41	68	NA	Functional BHLS, Spanish
van Rosse *et al**	78	Netherlands	Diverse	Ethnic minority patients in Dutch hospitals	522	309	218	Suriname 40% Turkey 18% Morocco 18%	Functional BHLS, Dutch
Wangdahl *et al*†	19	Sweden	Diverse	Adult refugees who attended language schools for immigrants	446	242	204	Somalia 27% Syria 23% Iraq 22% Afghanistan 10%	Functional S-FHL, Comprehensive HLS-EU-Q16 Both in Arabic, Somali, Dari & English

*Health literacy scores for men and women received by authors on request.
†Study not included in meta-analysis.
‡Raw data taken from publicly available data set.[87]
AAHLS, All Aspects of Health Literacy Scale; BHLS, Brief Health Literacy Screen; Health LiTT, Health Literacy Assessment Using Talking Touchscreen; HLS-EU-Q, European Health Literacy Survey Questionnaire; KHLS, Korean Health Literacy Scale; NA, not available; REALM, Rapid Estimate of Adult Literacy in Medicine; SAHL-S, Short Assessment of Health Literacy in Spanish; S-FHL, Swedish Functional Health Literacy Scale; S-TOFHLA, Test of Functional Health Literacy in Adults-Short Version.

American origin (including the Caribbean, Guyana, French Guyana and Suriname) or were denoted as Hispanics or Latinos/Latinas/Latinx in the paper; (2) the category *Asian* entailing three studies[66 80 84] with 982 participants (female: n=658; male: n=324) from Asian countries; and (3) the category *Mixed/Others* containing five studies[70 75 78 83 85] with participants from diverse countries and regions of origin within the same study and one study with participants from the former Soviet Union.[83] The Mixed/Other category contained 1552 participants (female: n=761; male: n=791).

Women with a Hispanic/Latinx background scored significantly higher in health literacy than men of the same background (SMD=0.12; 95% CI 0.02 to 0.23; p=0.02) with considerable heterogeneity between studies (I^2=71%). No significant gender differences were found for participants of Asian (SMD=–0.01; 95% CI −0.29 to 0.27; p=0.93; I^2=75%) and Mixed/Other origins (SMD=0.04; 95% CI: −0.07 to 0.15; p=0.48; I^2=14%).

The differences between these subgroups were not significant: X^2=1.48, df=2 (p=0.48), I^2=0%.

Type of health literacy measurement instrument

We grouped instruments to measure health literacy into five main subgroups: BHLS, HLS-EU-Q, SAHLSA/REALM, TOFHLA and a residual category (Others). Within the studies selected for the meta-analysis, six[66 67 77 78 83 86] belonged to the BHLS subgroup. For this subgroup, we did not find any significant gender difference in health literacy (SMD=0.015; 95% CI: −0.05 to 0.08; p<0.085, I^2=0%). The same was true for the subgroup HLS-EU-Q[75 85 100] (SMD=0.04; 95% CI: −0.20 to 0.28; p<0.001, I^2=49%), TOFHLA[65 68 73 76 79] (SMD=0.08; 95% CI: −0.25 to 0.41; p<0.001, I^2=84%) and the residual category Others[80 84 99] (SMD=0.08; 95% CI: −0.22 to 0.38; p<0.001, I^2=0%). Only the SAHLSA/REALM subgroup[71 74 81 82] showed a significant gender difference in health literacy scores (SMD=0.14; 95% CI: 0.09 to 0.20; p<0.001, I^2=0%), with women achieving higher scores than men. Again, the differences between these subgroups were not significant: X^2=9.19, df=4 (p=0.06), I^2=56.5%.

Functional versus comprehensive health literacy

Of the studies included in the meta-analysis, 18[65–69 71 73 74 76–79 81–84 86 99] reported functional health literacy and 4 studies[70 75 80 85] measured comprehensive health literacy. There was no significant gender difference found in the functional (SMD=0.08; 95% CI: −0.01 to 0.17; p=0.10; I^2=69%) nor the comprehensive health literacy group (SMD=0.10; 95% CI: −0.08 to 0.28; p=0.03; I^2=51%). Here too, the differences between these subgroups were not significant: X^2=0.03, df=1 (p=0.86), I^2=0%.

Sensitivity analyses

One study[73] was considered to have high risk of bias. When omitting this study from the main analysis, the gender differences in the health literacy of persons with

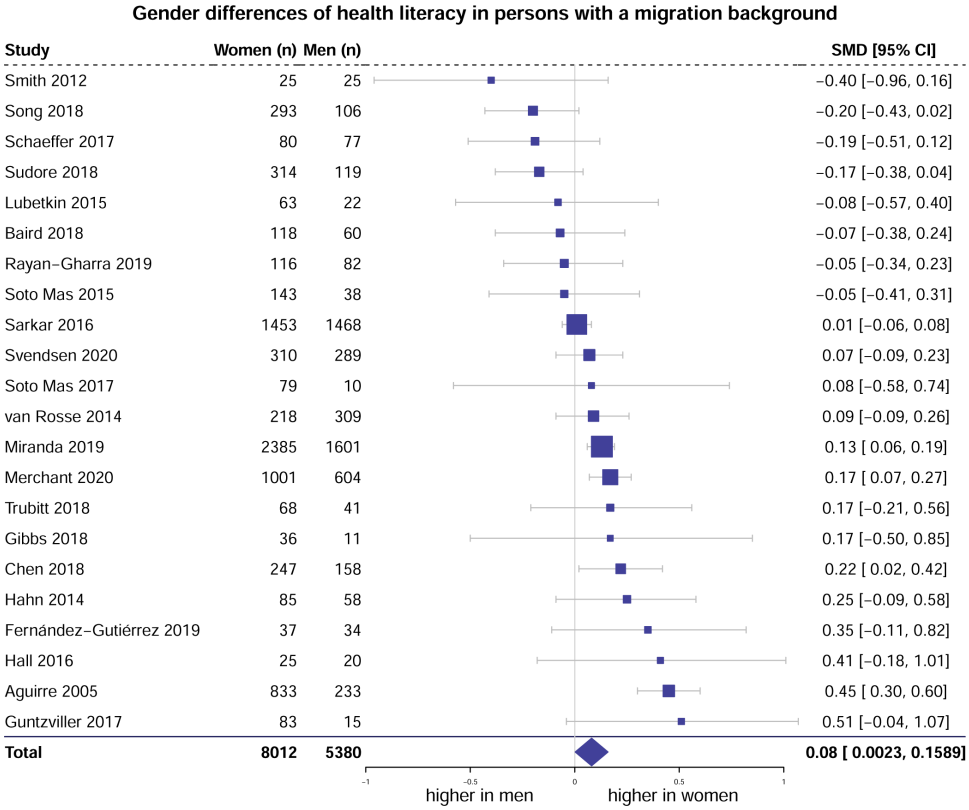

Figure 2 Forest plot showing gender differences in health literacy scores. Heterogeneity: tau^2=0.02; X^2=60.64, df=21 (p<0.0001); I^2=65%; test for overall effect: Z=2.02 (p=0.04). SMD, standardised mean difference.

a migration background ceased to be statistically significant (SMD=0.07; 95 % CI: −0.01 to 0.15; p=0.07; I^2=66%) and differences between subgroups remained statistically insignificant. As recommended in the Cochrane handbook,[101] we also calculated all meta-analyses using a fixed-effects model, which yielded very similar results. Gender differences in the health literacy of persons with a migration background were somewhat more pronounced in the fixed-effects model (SMD=0.10; 95% CI 0.10 to 0.13; p<0.001), and the subgroup differences regarding type of health literacy measurement instrument became significant (p=0.008) with women now also scoring significantly higher in the TOFHLA category (SMD=0.20, 95% CI 0.09 to 0.31, p<0.001). All other subgroup differences remained statistically insignificant.

DISCUSSION

Main findings

This systematic review aimed to investigate gender differences of health literacy in individuals with a migration background assessed using standardised instruments. Overall, we found health literacy in female persons with a migration background to be higher than in their male counterparts. Tests for subgroup differences regarding region of origin, type of health literacy (functional or comprehensive) and measurement instrument did not reveal clues to potential explanations for this finding. As further indicators possibly interacting with gender (eg, education) were not reported separately for men and women in the included studies, the reasons for slightly higher health literacy scores in migrant women remain unclear.

Of the 22 studies included in the meta-analysis, 6 reported gender-separated health literacy scores but without providing explanations for possible gender differences or relating them to further criteria such as age or migratory status. The remaining scores were retrieved from the authors of the respective studies (n=15) by request and, in one case,[86] taken from a publicly available data set also used by the respective study. With 56 of our 71 data requests remaining unanswered or turned down, there seems to be a high number of unreported cases. We found a further 27 studies that investigated the health literacy of only female migrants but could not include them, as we could not find eligible studies on migrant men. Thus, it appears there is a severe lack of research on health literacy in male migrants. This finding may not be restricted to migrants: a current scoping review found only 12 studies on men's health literacy worldwide.[102] In contrast to that, another systematic review focusing on health literacy in women living in Iran revealed 34 studies.[103] Furthermore, even within the studies included in the meta-analysis, the number of female participants (n=8012) far exceeded that of men (n=5380). Thus, in the context of male migration, gender might be a blind spot in health literacy research. This may also be seen

from the fact that none of the studies included in this review provided a definition of gender. Most studies (n=30) did not mention how gender was assessed and only one study[81] reported having assessed genders beyond the male/female dichotomy. This is in line with the observation that a lack of theoretical foundation and adequate operationalisation of gender still is a common phenomenon in research.[104] For example, gender roles are likely to exert an influence on health literacy[105] ; for the context of migration this has been described in qualitative studies.[11 106 107] Nevertheless, gender roles were not mentioned in the included studies; not considering gender roles appears to be a severe omission in health literacy research.

Implications for research

This systematic review revealed a need for more studies on the influence of gender-specific aspects on the health literacy of persons with a migration background. Future research should provide thorough theoretical foundations for examining gender in this context and operationalise the construct *gender* accordingly, thus evaluating personal, situational, cultural and societal aspects of gender. This is necessary to explore the influence of gender and its interactions with other factors such as education, age and culture, in relation to health literacy, which suggests the inclusion of a qualitative research methodology.[108] For example, a higher health literacy in migrant women indicates that there might be advantageous gender-specific traits or strategies for processing health-related information. These strengths should be further explored to enhance migrant women's health literacy skills. Furthermore, there is an urgent need for more research on the health literacy of (migrant) men in general, who may have lower health literacy than women. Further research should aim determining the causes of this possible disadvantage and how to enable men to improve their health literacy. Lastly, it is remarkable that sex (as the male/female dichotomy) often seems to be assessed but not as frequently reported. Therefore, publishing data of single studies in publicly available repositories such as the one provided by the Centre for Open Science[109] may help researchers investigate relationships beyond the purpose of the respective study, for example, when conducting systematic reviews and meta-analyses.

Implications for practice

Participative intervention development involving the respective migrant communities has proven to be an effective approach to foster health literacy in migrant populations.[43] A gender-sensitive methodology might help to further improve the effectivity of such interventions.[110 111] Specifically, promoting the health literacy of migrant men and further strengthening that of migrant women seem promising.

Strengths and limitations

To our knowledge, this is the first systematic review to investigate gender differences of health literacy in persons with a migration background. The results of our review revealed important gaps in health literacy research about gender aspects—the first and foremost being the neglect of migrant men's health literacy. As research on health literacy in non-migrant men is likewise scarce,[102] this insight might reach beyond the populations examined. A significant strength of this review lies in the acquisition of unpublished data on gendered health literacy scores, which were retrieved thanks to the cooperation of the authors of the respective studies.

This study also has some important limitations. First, we were unable to retrieve data from 56 studies that could have contributed to the meta-analyses. However, we were able to successfully incorporate previously unpublished data on health literacy scores of men and women from 15 studies into our review. Second, the gender differences of health literacy in migrants we found in our meta-analyses were extremely small (SMD=0.08, p=0.04). On the other hand, health literacy is a complex construct and subject to the influence of many variables,[1] which indicates that a small effect might nevertheless be of some importance.[112] Furthermore, a small effect gains importance if it is constant and long-lasting[113] —as it is with gender, being present throughout a person's entire life span. Nevertheless, as statistical significance disappeared when excluding the one study considered to have a high risk of bias, these results must be interpreted with caution. Third, the heterogeneity of the studies was high (I^2=65%), insinuating a weak comparability of the included studies. This cannot be denied as persons with a migration background are a highly heterogeneous population and health literacy is subject to different definitions and measurement tools. Therefore, this review can only shine a spotlight on gender differences of health literacy in migrants. Nevertheless, our study contributes to the exploration of the continuously evolving concept of health literacy.

Conclusions

The results of this systematic review indicate that migrant women might have higher health literacy than their male counterparts. Furthermore, two research gaps can be identified: (1) a thorough theoretical foundation, operationalisation, analysis and reporting of gender are rarely found in health literacy research on migrants and (2) there is little research on the health literacy of male migrants. Adequately defining, measuring, analysing and reporting gender seem mandatory when designing research and interventions in the realm of health literacy.

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REFERENCES

1 Sørensen K, Van den Broucke S, Fullam J, *et al*. Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health* 2012;12:80.
2 Nutbeam D. The evolving concept of health literacy. *Soc Sci Med* 2008;67:2072–8.
3 Baker DW, Gazmararian JA, Williams MV, *et al*. Functional health literacy and the risk of hospital admission among Medicare managed care enrollees. *Am J Public Health* 2002;92:1278–83.
4 Berkman ND, Sheridan SL, Donahue KE, *et al*. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med* 2011;155:97–107.
5 Wolf MS, Knight SJ, Lyons EA, *et al*. Literacy, race, and PSA level among low-income men newly diagnosed with prostate cancer. *Urology* 2006;68:89–93.
6 Paasche-Orlow MK, Wolf MS. The causal pathways linking health literacy to health outcomes. *Am J Health Behav* 2007;31:S19–26.
7 Pleasant A, Rudd RE, O'Leary C. Considerations for a new definition of health literacy. *NAM Perspectives* 2016;6.
8 HLS-EU Consortium. Comparative report on health literacy in eight EU member states. The European health literacy survey HLS-EU: first revised and extended version. *Brussels* 2013.
9 Eichler K, Wieser S, Brügger U. The costs of limited health literacy: a systematic review. *Int J Public Health* 2009;54:313–24.
10 Ackerson LK, Viswanath K. The social context of interpersonal communication and health. *J Health Commun* 2009;14:5–17.
11 Chakraverty D, Baumeister A, Aldin A, *et al*. Gender-specific aspects of health literacy: perceptions of interactions with migrants among health care providers in Germany. *Int J Environ Res Public Health* 2020;17:17072189. doi:10.3390/ijerph17072189
12 Calvo R. Health literacy and quality of care among Latino immigrants in the United States. *Health Social Work* 2016;41:e44–51.
13 Beauchamp A, Buchbinder R, Dodson S, *et al*. Distribution of health literacy strengths and weaknesses across socio-demographic groups: a cross-sectional survey using the health literacy questionnaire (HLQ). *BMC Public Health* 2015;15:678.
14 Ceri V, Özlü-Erkilic Z, Özer Ürün, *et al*. Mental health problems of second generation children and adolescents with migration background. *Int J Psychiatry Clin Pract* 2017;21:142–7.
15 Sieberer M, Maksimovic S, Ersöz B, *et al*. Depressive symptoms in first-and second-generation migrants: a cross-sectional study of a multi-ethnic working population. *Int J Soc Psychiatry* 2012;58:605–13.
16 European Commission. Person with a migratory background 2019. Available: https://ec.europa.eu/home-affairs/what-we-do/networks/european_migration_network/glossary_search/person-migratory-background_en [Accessed 30 Apr 2021].
17 Quenzel G, Schaeffer D. *Health Literacy – Gesundheitskompetenz vulnerabler Bevölkerungsgruppen: Ergebnisbericht. [Health literacy of vulnerable populations: Outcome Report]*. Bielefeld, Germany, 2016.
18 Ng E, Omariba DWR. Health literacy and immigrants in Canada: determinants and effects on health outcomes: Canadian Council on Learning 2011.
19 Wångdahl J, Lytsy P, Mårtensson L, *et al*. Health literacy among refugees in Sweden - a cross-sectional study. *BMC Public Health* 2014;14:1030.
20 Gracie B, Moon SS, Basham R. Inadequate health literacy among elderly immigrants: characteristics, contributing, and service utilization factors. *J Hum Behav Soc Environ* 2012;22:875–95.
21 Becerra BJ, Arias D, Becerra MB. Low health literacy among immigrant Hispanics. *J Racial Ethn Health Disparities* 2017;4:480–3.
22 International organization for migration. world migration report 2020. *Geneva, Switzerland* 2019.
23 Sander N, Abel G, Riosmena A. The future of international migration: developing Expert-Based assumptions for global population projections. Vienna, Austria 2013.
24 Benyamini Y, Leventhal EA, Leventhal H. Gender differences in processing information for making self-assessments of health. *Psychosom Med* 2000;62:354–64.
25 Ek S. Gender differences in health information behaviour: a Finnish population-based survey. *Health Promot Int* 2015;30:736–45.
26 Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. *Soc Sci Med* 2000;50:1385–401.
27 Ricciardelli LA, Williams RJ. Role of masculinity and femininity in the development and maintenance of health risk behaviors. In: Blazina C, Shen-Miller DS, eds. *An international psychology of men: theoretical advances, case studies, and clinical innovations: Routledge*, 2011: 57–98.
28 Oksuzyan A, Juel K, Vaupel JW, *et al*. Men: good health and high mortality. Sex differences in health and aging. *Aging Clin Exp Res* 2008;20:91–102.
29 Hammarström A, Annandale E. A conceptual muddle: an empirical analysis of the use of 'sex' and 'gender' in 'gender-specific medicine' journals. *PLoS One* 2012;7:e34193.
30 Schiebinger L, Stefanick ML. Gender matters in biological research and medical practice. *J Am Coll Cardiol* 2016;67:136–8.
31 Phillips SP. Including gender in public health research. *Public Health Rep* 2011;126:16–21.

32 Sørensen K, Pelikan JM, Röthlin F, *et al*. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). *Eur J Public Health* 2015;25:1053–8.
33 Clouston SAP, Manganello JA, Richards M. A life course approach to health literacy: the role of gender, educational attainment and lifetime cognitive capability. *Age Ageing* 2017;46:493–9.
34 Lee HY, Lee J, Kim NK. Gender differences in health literacy among Korean adults: do women have a higher level of health literacy than men? *Am J Mens Health* 2015;9:370–9.
35 Khosravi A, Ahmadzadeh K, Zareivenovel M. Evaluating the health literacy level among diabetic patients referring to Shiraz health centers. *Int J Inf Sci Manag* 2018;16:137–51.
36 Llácer A, Zunzunegui MV, del Amo J, *et al*. The contribution of a gender perspective to the understanding of migrants' health. *J Epidemiol Community Health* 2007;61:ii4–10.
37 Fatahi N, Krupic F. Factors beyond the language barrier in providing health care to immigrant patients. *Med Arch* 2016;70:61–5.
38 Brabete AC. Examining migrants' health from a gender perspective. In: Sánchez-López MP, ed. *The psychology of gender and health: conceptual and applied global concerns*. Saint Louis: Elsevier Science, 2017: 231–50.
39 Ward M, Kristiansen M, Sørensen K. Migrant health literacy in the European Union: a systematic literature review. *Health Educ* 2019;78:81–95.
40 Villadsen SF, Hadi H, Ismail I, *et al*. ehealth literacy and health literacy among immigrants and their descendants compared with women of Danish origin: a cross-sectional study using a multidimensional approach among pregnant women. *BMJ Open* 2020;10:e037076.
41 Chakraverty D, Baumeister A, Aldin A. Gender-specific aspects of health literacy in individuals with migration background, 2018. Available: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=85555 [Accessed 6 Feb 2018].
42 Baumeister A, Chakraverty D, Aldin A, *et al*. "The system has to be health literate, too" - perspectives among healthcare professionals on health literacy in transcultural treatment settings. *BMC Health Serv Res* 2021;21:716.
43 Baumeister A, Aldin A, Chakraverty D. Interventions for improving health literacy in migrants. *Cochrane Database Syst Rev* 2019.
44 Aldin A, Chakraverty D, Baumeister A, *et al*. Gender differences in health literacy of migrants: a synthesis of qualitative evidence. *Cochrane Database Syst Rev* 2019;5:8.
45 Shamseer L, Moher D, Clarke M, *et al*. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*2015;349:g7647.
46 Booth A, Clarke M, Dooley G, *et al*. The nuts and bolts of PROSPERO: an international prospective register of systematic reviews. *Syst Rev* 2012;1:2.
47 World Health Organization. Process of translation and adaptation of instruments, 2021. Available: https://www.who.int/substance_abuse/research_tools/translation/en/ [Accessed 5 Jan 2021].
48 Pew Research Center's Hispanic Trends Project. English becomes dominant language among later immigrant generations as Spanish declines 2017. Available: https://www.pewresearch.org/hispanic/2017/12/20/hispanic-identity-fades-across-generations-as-immigrant-connections-fall-away/ph_2017-12-20_hispanic-identity_10/ [Accessed 5 Jan 2021].
49 Pew Research Center's Hispanic Trends Project. Immigrant generations and U.S. Latinos 2017. Available: https://www.pewresearch.org/hispanic/2017/12/20/hispanic-identity-fades-across-generations-as-immigrant-connections-fall-away/ph_2017-12-20_hispanic-identity_03/ [Accessed 5 Jan 2021].
50 Babineau J. Product review: covidence (systematic review software). *J Can Health Libr Assoc* 2014;35:68–71.
51 The Cochrane Collaboration. Data extraction forms, 2021. Available: https://dplp.cochrane.org/data-extraction-forms [Accessed 17 Mar 2021].
52 O'Neill J, Tabish H, Welch V, *et al*. Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. *J Clin Epidemiol* 2014;67:56–64.
53 Campbell and Cochrane Equity Methods Group. PROGRESS-Plus, 2017. Available: https://methods.cochrane.org/equity/projects/evidence-equity/progress-plus [Accessed 25 Mar 2022].
54 Li T, Higgins JPT, Deeks JJ. Collecting data. In: Higgins JPT, Thomas J, Chandler J, eds. *Cochrane Handbook for systematic reviews of interventions*. 6th edn, 2022.
55 Downes MJ, Brennan ML, Williams HC, *et al*. Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). *BMJ Open* 2016;6:e011458.
56 Boxberger K, Reimers A. Parental correlates of outdoor play in boys and girls aged 0 to 12—A systematic review. *Int J Environ Res Public Health* 2019;16:16020190. doi:10.3390/ijerph16020190
57 Newell SA, Bowman JA, Cockburn JD. Can compliance with nonpharmacologic treatments for cardiovascular disease be improved? *Am J Prev Med* 2000;18:253–61.
58 The Cochrane Collaboration. Review manager (RevMan) [computer program]: version 5.4 2020.
59 Hedges LV. A random effects model for effect sizes. *Psychol Bull* 1983;93:388–95. doi:10.1037/0033-2909.93.2.388
60 Higgins JPT, Thomas J, Chandler J, eds. *Cochrane handbook for systematic reviews of interventions*. 6th edn, 2022.
61 Higgins JPT, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med* 2002;21:1539–58.
62 Murad MH, Wang Z, Chu H, *et al*. When continuous outcomes are measured using different scales: guide for meta-analysis and interpretation. *BMJ* 2019;364:k4817.
63 Thorlund K, Walter SD, Johnston BC, *et al*. Pooling health-related quality of life outcomes in meta-analysis-a tutorial and review of methods for enhancing Interpretability. *Res Synth Methods* 2011;2:188–203.
64 Kronthaler F, Zöllner S. *Data analysis with RStudio: an easygoing introduction*. Berlin, Germany: Springer Spektrum, 2021.
65 Aguirre AC, Ebrahim N, Shea JA. Performance of the English and Spanish S-TOFHLA among publicly insured Medicaid and Medicare patients. *Patient Educ Couns* 2005;56:332–9.
66 Baird B, Oh KM, Douglas C, *et al*. Health literacy, depression literacy, and depression among older Korean Americans. *J Health Commun* 2019;24:525–35.
67 Lubetkin EI, Zabor EC, Isaac K, *et al*. Health literacy, information seeking, and trust in information in Haitians. *Am J Health Behav* 2015;39:441–50.
68 Soto Mas F, Ji M, Fuentes BO, *et al*. The health literacy and ESL study: a community-based intervention for Spanish-speaking adults. *J Health Commun* 2015;20:369–76.
69 Soto Mas F, Jacobson HE, Olivárez A. Adult education and the health literacy of Hispanic immigrants in the United States. *J Lat Educ* 2017;16:314–22.
70 Fernández-Gutiérrez M, Bas-Sarmiento P, Poza-Méndez M. Effect of an mHealth intervention to improve health literacy in immigrant populations: a quasi-experimental study. *Comput Inform Nurs* 2019;37:142–50.
71 Gibbs HD, Camargo JMTB, Owens S, *et al*. Measuring nutrition literacy in Spanish-speaking Latinos: an exploratory validation study. *J Immigr Minor Health* 2018;20:1508–15.
72 Hahn EA, Choi SW, Griffith JW, *et al*. Health literacy assessment using talking touchscreen technology (health LiTT): a new item response theory-based measure of health literacy. *J Health Commun* 2011;16:150–62.
73 Guntzviller LM, King AJ, Jensen JD, *et al*. Self-efficacy, health literacy, and nutrition and exercise behaviors in a low-income, Hispanic population. *J Immigr Minor Health* 2017;19:489–93.
74 Hall E, Lee S-Y, Clark PC, *et al*. Social ecology of adherence to hypertension treatment in Latino migrant and seasonal farmworkers. *J Transcult Nurs* 2016;27:33–41.
75 Schaeffer D, Berens E-M, Vogt D. Health literacy in the German population. *Dtsch Arztebl Int* 2017;114:53–60.
76 Smith PC, Brice JH, Lee J. The relationship between functional health literacy and adherence to emergency department discharge instructions among Spanish-speaking patients. *J Natl Med Assoc* 2012;104:521–7.
77 Trubitt M, Alozie O, Shokar G, *et al*. Patterns and correlates of internet use, cell phone use, and attitudes toward patient portals among a predominantly Mexican-American clinic population. *Telemed J E Health* 2018;24:861–9.
78 van Rosse F, Essink-Bot M-L, Stronks K, *et al*. Ethnic minority patients not at increased risk of adverse events during hospitalisation in urban hospitals in the Netherlands: results of a prospective observational study. *BMJ Open* 2014;4:e005527.
79 Sudore RL, Schillinger D, Katen MT, *et al*. Engaging diverse English- and Spanish-speaking older adults in advance care planning: the PREPARE randomized clinical trial. *JAMA Intern Med* 2018;178:1616–25.
80 Chen X, Goodson P, Acosta S, *et al*. Assessing health literacy among Chinese speakers in the U.S. with limited English proficiency. *Health Lit Res Pract* 2018;2:e94–106.
81 Merchant RC, Marks SJ, Clark MA, *et al*. Limited ability of three health literacy screening items to identify adult English- and Spanish-speaking emergency department patients with lower health literacy. *Ann Emerg Med* 2020;75:691–703.

82 Miranda R, Meeks KAC, Snijder MB. Health literacy and hypertension outcomes in a multi-ethnic population: the HELIUS study. *Eur J Public Health* 2019;30:545–50.
83 Rayan-Gharra N, Balicer RD, Tadmor B, *et al*. Association between cultural factors and readmissions: the mediating effect of hospital discharge practices and care-transition preparedness. *BMJ Qual Saf* 2019;28:866–74.
84 Song IG, Lee H, Yi J, *et al*. Health literacy and use of preventive health services among North Korean defectors in the Republic of Korea. *PLoS One* 2018;13:e0195964.
85 Svendsen MT, Bak CK, Sørensen K, *et al*. Associations of health literacy with socioeconomic position, health risk behavior, and health status: a large national population-based survey among Danish adults. *BMC Public Health* 2020;20:565.
86 Sarkar M, Asti L, Nacion KM, *et al*. The role of health literacy in predicting multiple healthcare outcomes among Hispanics in a nationally representative sample: a comparative analysis by English proficiency levels. *J Immigr Minor Health* 2016;18:608–15.
87 Livingston G. Hispanics, health insurance and health care access. Pew Research Center's Hispanic Trends Project, 2009. Available: https://www.pewresearch.org/hispanic/dataset/2007-hispanic-healthcare-survey/ [Accessed 17 Mar 2021].
88 Geltman PL, Adams JH, Cochran J, *et al*. The impact of functional health literacy and acculturation on the oral health status of Somali refugees living in Massachusetts. *Am J Public Health* 2013;103:1516–23.
89 Chew LD, Bradley KA, Boyko EJ. Brief questions to identify patients with inadequate health literacy. *Fam Med* 2004;36:588–94.
90 Sørensen K, Van den Broucke S, Pelikan JM, *et al*. Measuring health literacy in populations: illuminating the design and development process of the European health literacy survey questionnaire (HLS-EU-Q). *BMC Public Health* 2013;13:948.
91 Murphy PW, Davis TC, Long SW. Rapid estimate of adult literacy in medicine (REALM): a quick reading test for patients. *Journal of reading* 1993;37:124–30.
92 Lee TW, Kang SJ. Development of the short form of the Korean health literacy scale for the elderly. *Res Nurs Health* 2013;36:524–34.
93 Lee S-YD, Stucky BD, Lee JY, *et al*. Short assessment of health literacy-Spanish and English: a comparable test of health literacy for Spanish and English speakers. *Health Serv Res* 2010;45:1105–20.
94 Parker RM, Baker DW, Williams MV, *et al*. The test of functional health literacy in adults: a new instrument for measuring patients' literacy skills. *J Gen Intern Med* 1995;10:537–41.
95 Baker DW, Williams MV, Parker RM, *et al*. Development of a brief test to measure functional health literacy. *Patient Educ Couns* 1999;38:33–42.
96 Wångdahl JM, Mårtensson LI. Measuring health literacy - the Swedish functional health literacy scale. *Scand J Caring Sci* 2015;29:165–72.
97 Lee TW, Kang SJ, Lee HJ, *et al*. Testing health literacy skills in older Korean adults. *Patient Educ Couns* 2009;75:302–7.
98 Chinn D, McCarthy C. All aspects of health literacy scale (AAHLS): developing a tool to measure functional, communicative and critical health literacy in primary healthcare settings. *Patient Educ Couns* 2013;90:247–53.
99 Hahn EA, Kallen MA, Jacobs EA, *et al*. English-Spanish equivalence of the health literacy assessment using talking touchscreen technology (health LiTT). *J Health Commun* 2014;19:285–301.
100 Fernández-Gutiérrez M, Bas-Sarmiento P, Albar-Marín MJ, *et al*. Health literacy interventions for immigrant populations: a systematic review. *Int Nurs Rev* 2018;65:54–64.
101 Deeks JJ, Higgins JPT, Altman DG. Chapter 10: Analysing data and undertaking meta-analyses. In: Higgins JPT, Thomas J, Chandler J, eds. *Cochrane handbook for systematic reviews of interventions*. 6th edn. Cochrane, 2022.
102 Oliffe JL, Rossnagel E, Kelly MT, *et al*. Men's health literacy: a review and recommendations. *Health Promot Int* 2020;35:1037–51.
103 Charoghchian Khorasani E, Tavakoly Sany SB, Orooji A, *et al*. Health literacy in Iranian women: a systematic review and meta-analysis. *Iran J Public Health* 2020;49:860–74.
104 Lindqvist A, Sendén MG, Renström EA. What is gender, anyway: a review of the options for operationalising gender. *Psychol Sex* 2020:1–13.
105 Peerson A, Saunders M. Men's health literacy in Australia: in search of a gender lens. *Int J Mens Health* 2011;10:111–35.
106 Mengesha ZB, Perz J, Dune T, *et al*. Refugee and migrant women's engagement with sexual and reproductive health care in Australia: a socio-ecological analysis of health care professional perspectives. *PLoS One* 2017;12:e0181421.
107 Davey C, Vallianatos H. Postpartum food traditions of Bhutanese refugee women: a qualitative study. *J Int Migr Integr* 2018;19:541–53.
108 Hammarberg K, Kirkman M, de Lacey S. Qualitative research methods: when to use them and how to judge them. *Hum Reprod* 2016;31:498–501.
109 Open Science Framework. Centre for open science, 2021. Available: https://osf.io/ [Accessed 1 Jul 2021].
110 Oliffe JL, Hannan-Leith MN, Ogrodniczuk JS, *et al*. Men's depression and suicide literacy: a nationally representative Canadian survey. *J Ment Health* 2016;25:520–6.
111 Vila-Candel R, Martínez-Arnau FM, de la Cámara-de Las Heras JM, *et al*. Interventions to improve health among reproductive-age women of low health literacy: a systematic review. *Int J Environ Res Public Health* 2020;17:17207405. doi:10.3390/ijerph17207405
112 Ahadi S, Diener E. Multiple determinants and effect size. *J Pers Soc Psychol* 1989;56:398–406.
113 Abelson RP. A variance explanation paradox: when a little is a lot. *Psychol Bull* 1985;97:129–33.