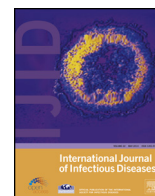




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## Review

## Health literacy and infectious diseases: why does it matter?



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## SUMMARY

**Objectives:** Multifactorial interventions are crucial to arrest the threat posed by infectious diseases. Public involvement requires adequate information, but determinants such as health literacy can impact on the effective use of such knowledge. The influence of health literacy on infectious diseases is examined in this paper.

**Methods:** Databases were searched from January 1999 through July 2015 seeking studies reporting on health literacy and infections such tuberculosis, malaria, and influenza, and infection-related behaviours such as vaccination and hand hygiene. HIV was excluded, as comprehensive reviews have already been published.

**Results:** Studies were found on antibiotic knowledge and use, the adoption of influenza and MMR immunizations, and screening for sexually transmitted and viral hepatitis infections. There was a lack of investigations on areas such as tuberculosis, malaria, hand hygiene, and diarrhoeal diseases.

**Conclusions:** Limited or insufficient health literacy was associated with reduced adoption of protective behaviours such as immunization, and an inadequate understanding of antibiotics, although the relationship was not consistent. Large gaps remain in relation to infectious diseases with a high clinical and societal impact, such as tuberculosis and malaria.

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## 1. Introduction

The planetary scale of the threat presented by infectious diseases to human health and society has been well described.<sup>1</sup> An intricate arrangement of clinical, societal, and ecological determinants powers the emergence of new infectious pathogens such as Ebola virus, and the resurgence of others previously considered to be under control. These same factors drive the unsustainable use and consumption of antimicrobials,<sup>2</sup> sketching the looming prospect of a 'world without antibiotics' reflected upon by many,<sup>3</sup> and without new therapeutic agents likely to be developed at a sufficient rate and periodicity to provide a significant counterbalance.

Equally, effective responses to the challenge posed by infectious diseases require multifactorial components, including not only the

obvious availability of adequate clinical care but also improvements in the living conditions of citizens and access to education.<sup>4</sup> Indeed, enhancing the self-efficacy of citizens to adopt recommended preventive behaviours such as vaccination, and encouraging their engagement in similar public health interventions, has been recognized as crucial.<sup>5</sup> Such public involvement, to be successful, requires that adequate information and advice be provided so individuals know what they need to do. However, different factors influence the ability of citizens to understand the information provided, follow health instructions and guidance, and ultimately make effective decisions related to their health and care. Whilst some of the key aspects seem logical, such as education and socioeconomic status, other influences such as health literacy have received limited attention until now. Health literacy (HL) refers to the ability of people to access and use information to make decisions related to their health.<sup>6</sup> Conceptually, HL has evolved from incorporating functional skills in a medical setting to being a multidimensional notion that involves

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advanced skills, such as the capacity to influence the health system and others,<sup>7</sup> distinguishing between proficiency in 'functional', 'interactive', and 'critical' facets. Other authors have further described the HL terrain across health systems in order to identify similarities and divergences.<sup>8</sup>

Regardless of the definition selected, it seems unquestionable that a large proportion of citizens do not have adequate or effective levels of HL to successfully navigate the increasingly complex healthcare landscape.<sup>9</sup> Several studies have already described the consequences of such inadequate levels of skills, including a more limited knowledge of health and social care preventive and curative services,<sup>10</sup> and a higher frequency of hospital admissions with increased morbidity and mortality.<sup>11,12</sup> The mounting evidence demonstrating the impact of inadequate HL has naturally led to an increasing interest in developing interventions to provide support for citizens and reduce the resulting inequalities. Current perspectives, on the other hand, suggest that concentrating on identifying those with low HL should be avoided and that instead, health and social care services should be designed and provided in a way that ensures that all individuals, regardless of their abilities, are able to make use of the information and opportunities available and be empowered to make effective decisions.<sup>13,14</sup>

As mentioned, the relationship between HL, health outcomes, and the use of healthcare resources has already been well established. Some documents have also briefly highlighted the significance of HL for the outcomes of infections and infectious diseases. The European Centre for Disease Prevention and Control (ECDC) has described the role that HL can play regarding infectious diseases.<sup>15</sup> However, and with the exception of HIV/AIDS, there is a paucity of data and experiences on the relationship and impact of HL on a variety of clinical and social outcomes from infectious diseases. This paper reviews the existing evidence on the interaction between HL and infection, including preventive behaviours such as vaccination, with the aim of highlighting research gaps and facilitating the advancement of this emerging field.

## 2. Methods

A scoping review of the literature was carried out to identify the nature and extent of the existing evidence. Scoping reviews, unlike other types of review, do not attempt to exhaustively assess or formally evaluate the quality of available research, but rather seek to identify the contribution of existing literature to an area of interest.<sup>16</sup>

### 2.1. Search strategy

Databases were searched from January 1999 through July 2015. AMED, Excerpta Medica Database (EMBASE), Health Management Information Consortium (HMIC), British Nursing

Index (BNI), Medline, PsycINFO, CINAHL, and Health Business Elite databases were interrogated for relevant studies in the English language. The search items used were tailored to the requirements of each database, and included combinations of 'health literacy' with terms such as 'tuberculosis', 'chlamydia', 'gonorrhoea', 'bacteraemia', 'blood stream infection', 'clostridium', 'dengue', 'influenza', and 'sexually transmitted infection'. Figure 1 provides details of the search strategy used.

### 2.2. Study inclusion and exclusion criteria

Studies were included if they reported primary research into the influence or relationship of HL on infectious diseases or self-care behaviours related to infection avoidance (such as vaccination), or if they described the impact of interventions to increase or support HL in people diagnosed or treated with infectious diseases. As infectious diseases are a global health concern, studies conducted on any healthcare system were included. Studies focusing on aspects of HIV management and care were excluded, as recent comprehensive reviews have already been published.<sup>17,18</sup> Figure 2 presents the study selection flowchart.

### 2.3. Data extraction

The data extraction procedure was conducted in two phases: (1) by title and abstract, and (2) by full text. Following the assessment of title and abstract, the primary reviewer (ECS) and secondary reviewer (RVC) performed the full-text evaluation. A third reviewer (AAE) acted to resolve any disagreements. A standardized electronic form was used to record the data.

## 3. Results

Seven hundred and eight references were initially obtained with the search strategy across all databases, resulting in 505 unique papers after removing duplicates. The screening of titles and abstracts identified 117 papers suitable for full-text evaluation. Twenty-seven studies were finally included in this review.

### 3.1. Behaviours and knowledge

#### 3.1.1. Antibiotic use

Several studies have reported parental decision-making to be associated with antibiotics received by children. A 2009 study in the USA established the relationship between parental HL level, as measured using two standardized screening tools, and knowledge and beliefs about upper respiratory infection (URI) care.<sup>19</sup> A large proportion of the 154 Latino parents participating in the study had inadequate HL levels (between 83% and 35% of parents, depending on the screening test used to report results). The findings

```
(health AND literacy) AND ((antibiotic OR antimicrobial) OR bacteraemia OR (blood AND stream
AND infection) OR brucellosis OR campylobacter OR chickenpox OR chlamydia OR Clostridium OR
cholera OR dengue OR escherichia OR giardia OR gonorrhoea OR hepatitis OR herpes OR influenza
OR leprosy OR leptospirosis OR lice OR listeria OR lyme OR lymphogranuloma OR malaria OR
measles OR mumps OR norovirus OR pneumococc* OR polio OR rabies OR rubella OR salmonella
OR (sexually AND transmitted AND infect*) OR shigella OR syphilis OR tuberculosis OR tetanus OR
vaccin*).ti,ab
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Figure 1. Search strategy.

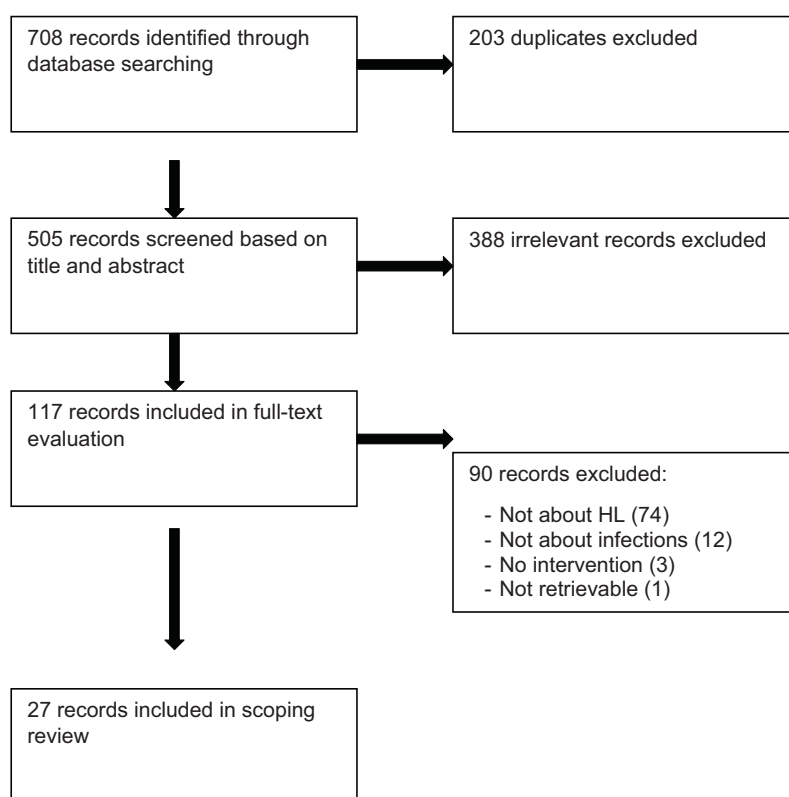


Figure 2. Study selection flowchart.

highlighted the need to increase and support parental HL to benefit paediatric healthcare. Depending on the HL screening tool used, there were discrepancies in the associations between outcomes and HL scores, which may reflect the focus of each tool on slightly different dimensions. For example, the Newest Vital Sign (NVS) suggested a greater likelihood of association between adequate HL and US birth status, >5 years US residency, and higher antibiotic knowledge scores. Using the Short Test of Functional Health Literacy in Adults (S-TOFHLA), on the other hand, resulted in increased odds of adequate HL associated with access to a regular healthcare provider. Scores consistent with adequate HL on the NVS, but not the S-TOFHLA, were associated with correct beliefs regarding antibiotic use for URIs in comparison to scores of participants with inadequate HL.

Another study centred on the perceptions of Latino parents regarding URIs and their treatment evaluated the impact of a pilot community-based HL intervention, achieving increases in knowledge and attitudes as well as self-reported care practices.<sup>20</sup> As with other interventions focused on knowledge, its impact on the sustainability of any effect remains unreported.

A prospective trial by Olives et al. focused on emergency department attendees stratified by HL level and their compliance with outpatient antibiotic therapy and follow-up recommendations.<sup>21</sup> The authors used the NVS tool and identified that 23% of the participants had an NVS score of 0–1 (suggesting low HL), whilst 46% obtained 4–6 points. In terms of outcomes, no difference across the different NVS scores was revealed in self-reported medication compliance at 30 days. However, the proportion of prescriptions filled at 72 h did vary significantly depending on the HL score.

Finally, the influence of HL and HL-focused clinical practices on the quality of optimal antibiotic use was reflected in a case study describing the presentation of Guillain-Barré syndrome, an uncommon sequela of campylobacteriosis, in a patient previously

treated for the infection. The patient was able to recognize the symptoms and was promptly able to attend the emergency services thanks to appropriate education supported by the teach-back methodology, a recognized technique aimed at facilitating HL practices in patients.<sup>22</sup>

### 3.1.2. Vaccination-related behaviours

HL appears to be a key determinant in vaccination-related behaviours,<sup>23</sup> in view of the complex information and the multiple steps involved in the successful adoption of immunization.<sup>24</sup> It is therefore unsurprising that a significant proportion of citizens with insufficient HL skills remain unvaccinated, and that persons with low HL are less likely to be vaccinated, if compared to individuals with adequate HL.<sup>25–29</sup>

The lack of effective vaccination status has been related to limited HL, allowing negative ideas or feelings not based on adequate evidence to influence decision-making about vaccines. Limited HL can also lead to an overestimation of risks associated with vaccinations, including the effect of preservatives and vaccine-booster components.<sup>25</sup> Lupattelli et al. investigated the association of HL with beliefs about the safety and risks of medications, within the context of suboptimal adherence to medications prescribed during pregnancy.<sup>26</sup> Almost 5000 pregnant women from different European and North American countries were recruited through an internet-based tool in 2012, and asked to provide socio-demographic and clinical information as well as responses to a non-standardized HL tool. Higher risk perception for medications, including the swine influenza vaccine developed at the time, and generalized negative perceptions of medications were associated with low HL. A quarter of women with low HL also reported suboptimal adherence to prescribed medications, compared to just under 20% of those in the high HL group. Overall, the study elicited a complex picture of non-adherence and medication beliefs shaping and being shaped by HL.

A smaller study identified how the levels of maternal education were directly associated with Rapid Estimate of Adult Literacy in Medicine (REALM) scores, influencing decisions to vaccinate children.<sup>27</sup> Once more, HL and education were shown to play a fundamental role in shaping effective perceptions of vaccine safety and benefit, suggesting appropriate resources for interventions to improve vaccination rates in children.

The HL of pregnant women in Jamaica was matched with their ability to discuss benefits and safety aspects of bacille Calmette–Guérin (BCG) and hepatitis B virus (HBV) immunizations in the study by Wilson et al.<sup>28</sup> The HL scores were moderately and positively correlated with an adequate discussion of risks and benefits. Additionally, the study demonstrated the efficacy of the teach-back communication technique to increase immunization literacy among the participants.

Different results were obtained with US mothers when focusing on infant immunization.<sup>29</sup> The S-TOFHLA results were matched with immunization status results. The group was largely composed of African American single mothers. HL was inadequate in almost 25% of the participants. However, maternal HL was not significantly associated with the immunization of infants at either 3 or 7 months.

The interventions aimed at improving the skills of low literacy populations could be used as blueprints to increase immunization rates in individuals with low HL. For example, researchers in Karachi managed to increase the completion rates of diphtheria–polio–tetanus (DPT) and hepatitis immunizations significantly amongst individuals with low literacy, using simple educational interventions.<sup>30</sup> To remedy such inequalities, low-literacy information tools have been shown to successfully increase vaccination rates in population groups most likely to be undervaccinated.<sup>31</sup> Interestingly, none of the papers reported the paradoxical relationship observed in other studies between higher socioeconomic and education status and lower vaccination rates.<sup>32–34</sup>

### 3.2. Immunizations for vaccine-preventable diseases

#### 3.2.1. Measles/measles–mumps–rubella (MMR)

A forthcoming study reporting in 2016 will survey parents of adolescents in Switzerland to describe the influence of HL and related variables on the MMR vaccination status of adolescents,<sup>35</sup> with a view to expanding the limited evidence available regarding the interplay of factors determining decisions of parents to vaccinate their children<sup>36,37</sup> and optimize health communication campaigns.

#### 3.2.2. Tetanus

A study by researchers in Wisconsin explored the association between HL and health determinants at the population level.<sup>38</sup> More than 1500 individuals were surveyed using the S-TOFHLA to match literacy scores and the prevalence of self-care measures, including recent influenza and tetanus immunization. Amongst other protective care measures, adequate functional HL was not associated with tetanus vaccination but was associated with recent influenza immunization.

#### 3.2.3. Influenza

The use of text message reminders with additional HL information regarding vaccination increased the completion rates of influenza immunization in children in New York City, compared with children whose parents received messages with just reminder information, suggesting a benefit of this low cost intervention across different literacy groups.<sup>39</sup>

Bennett et al. focused on the mediating role of HL in disparities in self-rated health status and preventive behaviours in older adults.<sup>40</sup> The authors assessed the use of three recommended

preventive healthcare services, including influenza vaccination. The nationally representative sample of more than 2600 US adults included a large proportion (30%) with a fair or poor health status, with 27% of them not accessing influenza vaccination. When the analysis was adjusted for potential confounders, HL was significantly associated with racial and educational disparities and the use of influenza vaccination.

Bains and Egede investigated the influence of HL on the adoption of preventive healthcare behaviours and services in a nationally representative sample of 18 000 US adults.<sup>41</sup> Census information was matched to a national HL assessment survey, together with influenza and pneumonia vaccinations as outcomes of interest. HL scores and adequate preventive behaviours were inconsistently related, in a non-linear fashion. For example, HL scores were significantly correlated to receiving yearly cervical cytology examinations, whilst lower HL scores were associated with increased influenza vaccination.

The multiple interactions between race, education, and HL, together with certain clinical and healthcare utilization outcomes, were examined with a view to identifying the relative weight and contribution of HL to such differences.<sup>42</sup> More than 2200 older adults in different US locations were screened using several standardized tools, with supplementary information collected on socio-demographic and economic characteristics, self-reported health status indicators, and the use of healthcare and preventive measures. Compared to persons with adequate HL, individuals with inadequate HL had significantly worse health outcomes and were significantly less likely to receive influenza vaccination (but not pneumococcal vaccination). The study found that HL explained only a small proportion of the differences in health status and, to a lesser degree, the receipt of vaccinations that would normally be attributed to educational attainment or race if literacy was not considered. The results of the study have to be appraised within the context of the US healthcare system, where the population group surveyed may have been encouraged to make use of self-care measures, thus reducing the impact of any HL deficits.

A similar approach was presented in a study identifying the relationship between HL and the use of preventive services such as influenza and pneumococcal vaccinations, using the S-TOFHLA as the screening tool to evaluate more than 2700 older adults in the USA.<sup>43</sup> In that study, the researchers identified low HL as directly associated with self-reported lack of preventive services. For example, participants with a low HL were much more likely to have never received an influenza vaccination (29% vs. 19% in those with adequate HL;  $p = 0.0001$ ) or a pneumococcal vaccination (65% vs. 54%;  $p = 0.0001$ ). The statistically significant differences remained after adjusting for demographic characteristics, level of education (as estimated by years of school completed), and income. The results obtained by White et al. corroborate the lack of significant association between pneumococcal vaccination and HL level.<sup>10</sup>

Sudore et al. surveyed 2512 older people in the USA, assessing their HL using the REALM tool and collecting demographic and clinical variables together with proxy variables of healthcare access, including a recent influenza vaccination.<sup>44</sup> The results indicated that study participants in lower literacy categories were less likely to have received an influenza vaccination in the previous 12 months. This association persisted for the lowest HL category even after adjusting for social and demographic factors, self-rated health, and comorbidities.

#### 3.2.4. Polio

The relationship between HL and the ability to discuss health information related to vaccination (using the inactive poliovirus (IPV) and the pneumococcal conjugate vaccine (PCV) as examples) in a small group of mothers was estimated by Wilson et al.<sup>45</sup> The authors used a self-care theoretical model to frame the

hypothetical relationship between HL and vaccine information, together with the REALM screening tool. Perhaps as expected, mothers with higher HL demonstrated greater knowledge about the benefits of polio vaccination, compared to mothers with lower HL levels. For both IPV and PCV vaccines, risks and benefits were correctly reported more frequently than safety aspects. The authors recommended further studies to evaluate how best to improve the mixed results obtained, increasing and consolidating parents' knowledge and communication skills.

### 3.2.5. *Human papillomavirus (HPV)*

A very comprehensive mixed-methods study identified the effect of HL on the decision of US college students to have the HPV vaccination.<sup>46</sup> The study described the application of several screening tools to the participants, including the extensively used S-TOFHLA and NVS, as well as the more innovative Cancer Message Literacy Test-Listening (CMLT-Listening) and eHealth Literacy Scale, in an attempt to accurately describe the components of HL that may be at play at the point of making decisions about vaccination. The study was innovative as it also included in-depth interviews to triangulate quantitative findings and describe key social and behavioural determinants of vaccination from the point of view of participants. Three quarters of the tests were not associated with the uptake of HPV vaccination, prompting the authors to argue that studies focusing on single assessment tools might be unlikely to depict accurately the HL skills of the participants. In spite of adequate HL skills, the qualitative segment of the study elicited reasons for vaccination that seemed to be related to compliance with social desirability (i.e., having a vaccine as being told or advised to do so by healthcare workers) rather than autonomous and rational decisions about the benefits of the vaccine.

### 3.3. *Sexually-transmitted and viral hepatitis infections*

Needham et al. focused on the influence of HL and comprehension of information about sexually transmitted infections (STIs) on the sexual behaviour of a cohort of young women attending sexual and reproductive health services in the USA.<sup>47</sup> Lower HL appeared to be related to lower comprehension of written information, but women with lower HL, on the other hand, were not more likely to engage in riskier sexual behaviours.

#### 3.3.1. *Gonorrhoea*

In one of the very few studies evaluating the relationship of HL with sexually transmitted infection care, a widely disseminated and standardized HL screening tool was used to establish the influence of HL on the likelihood of adoption of a recent gonorrhoea test by individuals in several US states.<sup>48</sup> Among other factors, self-efficacy, younger age, and a high score on the HL screening test used were independently associated with gonorrhoea testing in the previous year, with the score screening test alone related to a 10% increase in the probability of having undergone the test. The results illustrate the impact of HL not just on acquiring STIs, but also on delaying access to diagnosis, care, and the health promotion offered in clinics.

#### 3.3.2. *Viral hepatitis infection*

Chikkana et al. aimed to evaluate the association of functional HL and treatment outcomes in people living with chronic hepatitis C virus (HCV) infection in the USA. The 46 participants provided demographic information and completed a knowledge questionnaire and the S-TOFHLA screening tool. The vast majority of patients were taking antivirals, and 90% had high HL levels. The study, however, failed to find any association between HL and HCV treatment outcomes. As an explanation, the authors attributed their findings to the characteristics of the population surveyed.<sup>49</sup>

A thesis by Obediah also explored the functional HL as well as the lived experience of depression and self-efficacy of military veterans living with HCV in the USA.<sup>50</sup> A battery of screening tools and validated scales including TOFHLA were used. The results did not establish any statistically significant association between HL scores and depression or self-care. Among the limitations were the small sample size, which may have led to the results obtained. The experience of people living with viral hepatitis infection was also assessed in the qualitative study by Sriphanlop et al. of factors related to HBV screening among African individuals in New York City.<sup>51</sup> HL, together with other classic elements such as the complexity of the US medical system, was predominantly identified as of key relevance to the migrants.

A couple of initiatives have aimed to resolve HL deficits identified among people living with viral hepatitis infection. A computerized patient education programme was developed to provide information to US women diagnosed with HBV infection during their pregnancy. The formative intervention also included traditional face-to-face visits with a clinician and printed resources.<sup>52</sup> Another intervention adopted a novel approach, developing a dedicated YouTube channel and incorporating HL together with health communication techniques to facilitate the understanding of the natural history and pathophysiology of HBV infection. Knowledge related to the infection increased significantly amongst the participants surveyed.<sup>53</sup>

### 3.4. *Tuberculosis*

Literacy has been identified as one of the key elements of the 'social infrastructure' of tuberculosis management and control,<sup>54</sup> and several studies have characterized the negative tuberculosis outcomes associated with illiteracy in Brazil<sup>55</sup> and India.<sup>56</sup> However, investigations on tuberculosis disease are yet to replicate the experiences in other health problems evaluating the impact of HL in clinical and social outcomes. The only research suggesting a link between HL and tuberculosis infection amongst Latino patients reviewed the literature related to adherence and used HL as synonymous with 'tuberculosis disease knowledge'. In the conclusion, the authors reported an inadequate HL level in Hispanics regarding tuberculosis infection, resulting in reduced concordance with medication.<sup>57</sup>

## 4. Discussion

This overview presents the current research overlap between infectious diseases and HL. The evidence depicts the association and influence of HL in a variety of infections and infection prevention-related behaviours. In general, limited or insufficient HL was found to be associated with the reduced adoption of protective behaviours such as immunization, and with an adequate understanding of antibiotic use for the treatment of infections, although the relationship was not found to be consistent or linear.

Nevertheless, any conclusions have to be appraised in light of the very reduced and fragmented body of evidence available. A priori, infectious diseases and immunizations appear ideal candidate areas to research the interaction with HL, due to the complexity of decisions involved in self-care measures and the multiple factors leading to the acquisition or avoidance of infection. However, the absence of studies related to essential behaviours such as hand hygiene, and to key health problems such as tuberculosis, viral hepatitis, and malaria, and dual diagnoses (tuberculosis/HIV, HIV/HCV), all associated with large clinical, social, and economic burdens, was remarkable (Table 1). Clearly, this review is limited by a reliance on the authors of the studies to identify their research as related to HL. In contrast, several papers claimed to concentrate on HL, with titles explicitly mentioning HL,

**Table 1**  
Infectious diseases and infection prevention areas without health literacy studies

Behaviours and knowledge
Hand hygiene
Sexually transmitted and viral hepatitis infections
Chlamydia
Herpes
Tropical diseases
Malaria
Leprosy
Dengue
Leishmaniasis
Diarrhoeal diseases
Clostridium
Giardiasis
Campylobacter
Cholera
<i>Escherichia coli</i>
Tuberculosis
Tuberculosis disease

but were instead found to discuss ‘disease knowledge’ or ‘education about a disease’ (see for example<sup>58–65</sup>), lacking any evaluation of HL using validated tools, or constructing ad hoc questionnaires.

A further structural inequality emerges from this review, associated with the disproportionate number of studies carried out in the USA or focusing on US-based citizens. This inequality is more evident when contemplating the geographical distribution of the diseases considered. Such disparity in studies has been identified previously in reviews about the HL of migrants and displaced individuals (Castro-Sánchez E. 2<sup>nd</sup> European Health Literacy Conference, Denmark 2014). The difference in publications may be explained by the longer tradition of HL research in the USA, the lack of a critical mass of researchers and clinicians interested in HL in low- and middle-income countries, or to perceptions that literacy and education deficits may be much more powerful contextual determinants yet to be resolved, therefore reducing the interest in characterizing HL. However, the different studies presented in this review have elicited the unique contribution of HL to negative care outcomes, independently from education.

In addition to the proposed scarcity of academic interest outside the USA and a minority of other countries, researchers in settings where some infectious diseases may be much more prevalent could have difficulties applying screening scales not yet adapted or validated for such environments.<sup>66</sup> A recent World Health Organization-commissioned toolkit aimed to address such shortcomings.<sup>67</sup> The limited variety of screening tools described in the studies reviewed was perhaps unexpected, considering the number of scales already available,<sup>68</sup> but it may again simply reflect the unsuitability of existing surveys to settings outside the USA, Australia, or England.

The studies reviewed rested on the functional and, to a much lesser extent, interactive facets of HL. However, the critical dimension of HL was not considered. This dimension, which focuses on supporting effective political and social action, seems markedly relevant in view of contemporary issues affecting access to effective treatments that are considered prohibitively expensive, such as newer HCV antivirals. The optimal mechanisms to empower citizens with low literacy to advance from functional HL to critical HL remain to be identified.

An additional gap in relation to the construction of critical HL is the lack of papers describing interventions in populations such as young adults and children, in particularly vulnerable groups such as prisoners and pregnant women, and in individuals in special settings such as nursing homes and long-term community centres. Equally, these groups and environments have frequently been overlooked regarding infections.<sup>69</sup>

The replication of studies in diverse populations and for a variety of infections should be encouraged, as even if the relationship between HL and clinical outcomes as well as healthcare utilization has been reasonably well established, research efforts focused on the impact of interventions and wider socioeconomic and cultural determinants of HL may be pertinent. Adapting and disseminating interventions that shape organizations or healthcare systems to be health literate remains an underutilized approach.<sup>70</sup> Many of the recommended actions for organizations to embrace HL, such as the identification and recognition of the impact of staff HL on the quality of patient-provider interactions, rather than any underlying deficits of patients, would overlap and act in synergy with optimal management strategies for infectious diseases.

In conclusion, infectious diseases and antimicrobial resistance constitute one of the most pressing challenges for healthcare systems. Current responses to such challenges acknowledge the vital role played by citizens and aim to benefit from increased population self-efficacy. However, the influence of a crucial social determinant such as HL on clinical and social outcomes related to infectious diseases remains unsatisfactorily explored, with most vulnerable groups likely to be affected by the dual burden of low HL and a high prevalence of infections.

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