Social Science & Medicine 143 (2015) 185–193

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Towards an understanding of the relationship of functional literacy and numeracy to geographical health inequalities

Graham Moon [a, *], Grant Aitken [a], Paul Roderick [b], Simon Fraser [b], Gill Rowlands [c]

[a] Geography and Environment, University of Southampton, UK
[b] Primary Care and Population Sciences, University of Southampton, UK
[c] Primary Care and Ageing Research, Newcastle University, UK

ARTICLE INFO

Article history:
Received 19 February 2014
Received in revised form
14 August 2015
Accepted 26 August 2015
Available online 31 August 2015

Keywords:
England
Health inequalities
Functional literacy
Functional numeracy
Area deprivation

ABSTRACT

The relative contributions of functional literacy and functional numeracy to health disparities remain poorly understood in developed world contexts. We seek to unpack their distinctive contributions and to examine how these contributions are framed by place-based deprivation and rurality. We present a multilevel logistic analysis of the 2011 Skills for Life Survey (SfLS), a representative governmental survey of adults aged 16–65 in England. Outcome measures were self-assessed health status and the presence of self-reported long-term health conditions. Exposure variables were functional literacy (FL) and functional numeracy (FN). Age, sex, individual socio-economic status, ethnicity, whether English was a first language, non-UK birthplaces, housing tenure and geography were included as potential confounders and mediators. Geography was measured as area-based deprivation and urban/rural status. FL and FN were both independently associated with self-assessed health status, though the association attenuated after taking account of confounders and mediators. For long-term conditions, the association with FN remained significant following inclusion of confounders and mediators whilst FL attenuated to non-significance. Rurality did not influence these associations. Area deprivation was a significant factor in attenuating the association between FL and self-assessed health status. Policy makers and health professionals will need to be aware of the distinctive impact of FN as well as FL when combating health inequalities, promoting health and managing long-term conditions.

1. Introduction

Literacy and numeracy skills are required for citizens to 'achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society' (UNESCO, 2004, p 13). This recognition has been evident in health policy for many years, particularly in resource-poor settings in the global south where maternal literacy has long been linked to prospects for health improvement (Preston, 1980; Grosse and Auffrey, 1989; Phillips, 1990; Le Vine et al., 1994). In more recent years this work has been developed and extended through the formulation of the concept of health literacy (Nutbeam, 2000, 2008; Rudd, 2010; Kickbusch et al., 2013), a concept that has become a dominant framework for research into the impact of numeracy and numeracy on health status. At its 'functional' level (Nutbeam, 2000), health literacy relates to the ability to read and understand basic health-related information. This encompasses both the ability to read and understand words (termed literacy in this paper), and the ability to use quantitative information (which we term numeracy) (Berkman et al., 2011; Baker, 2006).

One shortcoming of empirical studies of functional health literacy is that, notwithstanding a concern with both literacy and numeracy, most have tended to focus either explicitly on literacy, or on a collective undifferentiated construct embracing both literacy and numeracy. Studies seeking to differentiate the effects of literacy and numeracy on health are rare. One health literacy study indicates that comprehension of food labelling is more strongly associated with higher level skills with numbers rather than words (Rothman et al., 2006). Others have included considerations of numeracy and literacy in relation to glycaemic control (Osborn et al., 2010), breast cancer risk interpretation (Brown et al., 2011), colorectal screening (Ciampa et al., 2010) and portion size estimation (Huizinga et al., 2009).

* Corresponding author. Geography and Environment, University of Southampton, Highfield, Southampton SO17 1BJ, UK.
E-mail address: g.moon@soton.ac.uk (G. Moon).

http://dx.doi.org/10.1016/j.socscimed.2015.08.045
0277-9536/

There are potentially important differences in the pathways through which literacy and numeracy might be hypothesised to impact differentially on health (Schonlau et al., 2011). These distinctive pathways relate to the differentiated consequences of being unable to follow or understand textual or numerical information (Peerson and Saunders, 2009). In the case of textual material (reading words), it may relate to service users' understanding of written communications from health professionals, pre-referral questionnaires or hospital information sheets. Shortfalls may reduce preparation for care and comprehension both of health conditions and of care regimes. Lower numeracy may, in contrast, impact on effective use of health care systems via understanding access tools such as bus timetables and opening hours, to compliance with medication through comprehension of dosage regimes. Aspects of health information and decision-making using numbers and numerical constructs (such as balancing the risks and benefits of different medical procedures, and understanding and taking medication correctly) differ from those aspects of health information transmitted via words (such as a description of diseases and treatments).

Within this context there is an increasing recognition of the importance of numeracy as a 'stand-alone' risk factor for poor health (Rothman et al., 2006; Ancker and Kaufman, 2007; Donelle et al., 2007; Peters et al., 2007). In their systematic review Berkman et al. (2011) reviewed the small number of published studies exploring numeracy and health including accuracy of risk perception, knowledge, skills taking medication, and disease prevalence and severity. Studies employed a wide variety of numeracy measures, reported significantly varying proportions of individuals with low numeracy, and found mixed associations with health. This led Berkman et al. to judge the overall strength of evidence for an association between health numeracy to health outcomes to be insufficient and an area for potential research.

A second shortcoming to studies of health literacy relates to limited knowledge of its association with place-based disadvantage. Systematic reviews reveal associations between low functional health literacy skills (undifferentiated between literacy and numeracy) and individual health disadvantage (DeWalt and Hink, 2009; Berkman et al., 2011; Sheridan et al., 2011; Sørensen et al., 2012). Lower skill levels are associated with greater 'inappropriate' use of medical services such as increased hospitalisations and greater emergency care use, lower use of preventative care such as mammography and vaccine uptake, poorer ability to demonstrate taking medications appropriately, poorer ability to interpret labels and health messages, poorer ability to manage long-term illnesses, and, among older people, poorer overall health status and higher mortality. These findings clearly implicate poorer health literacy, generally defined, in the generation and maintenance of individual health inequality.

The few studies giving explicit attention to place-based disadvantage and health literacy tend to focus on geographical variations in maternal health literacy in the Global South (Andrzejewski et al., 2009; Kumar et al., 2012; Rajan et al., 2013) though there have been attempts in the US to develop tools to map health literacy at small area levels (Martin et al., 2010) and comparative studies of the association with health outcomes between different US cities (Baker et al., 1997). National scale comparisons of levels of health literacy in Europe are also evident, though they do not distinguish literacy and numeracy (eg. HLS-EU Consortium, 2012). The extensive body of research on compositional, contextual and collective effects on health outcomes (Macintyre et al., 2002) points to a need to uncover whether place-based factors may compound or dampen the individual level associations of health status with literacy and numeracy.

1.1. Study aims

From the brief review above we identify a need for further research on (a) the relative importance of numeracy and literacy as factors associated with health status, and (b) the extent to which place-based factors affect this association. Our contribution is framed in three specific ways. First, we focus upstream, investigating the underpinning of health literacy by functional literacy and functional numeracy – the socially-differentiated presences of generic skills in reading texts and understanding numbers. We seek to provide important evidence of the independent and distinctive impact of baseline literacy and numeracy skills on health building on work using longitudinal data from the 1970 British Cohort Study (Sabates and Parsons, 2012) showing that a lack of adult numeracy skill was more strongly associated with deteriorating self-rated health than literacy skills even when socio-economic position at birth and indicators of childhood health were taken into account.

A second frame for our study is that, while many studies of inequalities in health in more developed settings mention literacy or indeed numeracy in passing, discussion is generally hypothetical and seldom grounded in empirical analysis. Survey evidence suggests that this is not a reflection of the disappearance of illiteracy (or innumeracy) in more developed countries (Kirsch et al., 2002; DBIS, 2012; OECD, 2013) although its significance in the less-developed world is undoubted (Smith-Greenaway, 2015). We focus on the developed setting of England, providing insights on the neglected role of literacy and numeracy in health inequalities in a developed world setting.

Third, we step away from the standard focus evident in studies of health literacy to consider the association of literacy and numeracy with health status rather than measures of the (health) effectiveness of user engagement with health services. We view health status both as a likely consequence of shortcomings in health service uptake and also as a construct deeply structured in its own right by social inequality at both the individual and area level. Within this context, following the cumulative complexity model of Shippee et al. (2012), we see health status as relating to the burden of disease, and literacy and numeracy as elements of patient capacity to deal with that burden and the associated treatment regimes.

In the following section we set out the data and methods used to address our two key aims: elucidating the independent association of literacy and numeracy with health status, and assessing the impact of place-based disadvantage on this association.

2. Methods

2.1. Data and measures

We use data from the English Skills for Life Survey (SfLS) (DBIS, 2012). The SfLS provides a nationally representative sample of adults aged 16–65 living in non-institutional settings. Participants were sampled between May 2010 and February 2011. This survey was commissioned by the English Department for Education and Skills to produce a national profile of adult literacy, numeracy and Information and Communication Technology (ICT) skills. To achieve this aim SfLS respondents were randomly pre-allocated for skills testing, with 4871 people being assigned to both literacy and numeracy assessments. This sub-sample forms the basis of the research reported in this paper.

We present analyses for two outcome measures of health status: self-assessed health and self-reported possession of a long-term health condition. Poor self-reported health has long been associated with mortality (Kaplan and Camacho, 1983; Sundquist and Johannsson, 1997) and health care utilisation (Miilunpalo et al.,