Intelligence 44 (2014) 93–102

Contents lists available at ScienceDirect

Intelligence

Is health literacy an example of construct proliferation? A conceptual and empirical evaluation of its redundancy with general cognitive ability

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ARTICLE INFO

Article history:
Received 24 June 2013
Received in revised form 11 March 2014
Accepted 12 March 2014
Available online 16 April 2014

Keywords:
Health Literacy
Cognitive ability
Construct validity
Discriminant validity
Construct proliferation

ABSTRACT

During the last 20 years, health literacy has been promoted as an important determinant of individual and group differences in health outcomes. Despite a definition and pattern of associations with health outcomes highly similar to 'g' (i.e., the general cognitive ability factor), health literacy has been conceptualized as a distinct construct. This study evaluates the conceptual and empirical distinctiveness of health literacy. A sample of 167 students from a southeastern urban university (117 females and 50 males) between the ages of 18 and 53 ($M = 21.31$, $SD = 5.61$) completed a cognitive ability battery, three health literacy tests, two knowledge tests, and a questionnaire assessing 12 health behaviors and health outcomes. Across 36 tests of criterion-related validity, cognitive ability had an effect in all 36 cases, where the health literacy tests only showed measureable incremental validity in 6 of 36 cases. Factor analysis revealed only three factors defined by the traditional ability tests with the health literacy measures loading on the ability factors as predicted by the content validity analysis. There was no evidence of a health literacy factor. The combined results from a comparative content analysis, an empirical factor analysis, and an incremental validity analysis cast doubt on the uniqueness of a health literacy construct. It is suggested that measures of health literacy are simply domain-specific contextualized measures of basic cognitive abilities. Implications for linking these literatures and increasing our understanding of the influence of intellectual factors on health are discussed.

1. Introduction

Health literacy has become a topic of significant interest among health and medical researchers during the past two decades, particularly in regard to its potential explanatory role in health disparities. For example, low health literacy has been shown to be associated with a variety of health outcomes including increased risk of chronic health problems and decreased utilization of health care services (Berkman et al., 2004). Findings such as these have compelled health researchers to consider the elucidatory role of cognitive factors with respect to individual and group differences in health outcomes. At the same time, researchers in the science of mental abilities have amassed evidence that individual differences in basic cognitive abilities, in particular *g* (the general mental ability construct), are associated with a variety of health behaviors and health outcomes. For example, it has been shown that measures of cognitive abilities predict health behaviors such as amount of physical activity, eating fruits and vegetables, taking vitamins, and smoking (e.g., Anstey, Low, Christensen, & Sachdev, 2009; Batty, Deary, Schoon, & Gale, 2007).

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http://dx.doi.org/10.1016/j.intell.2014.03.004
0160-2896/

Despite the apparent similarity between these streams of research, there has been little effort to understand how the health literacy construct fits within the broader nomological network of intelligence. In fact, it would appear that evidence demonstrating the influence of cognitive abilities on health outcomes is still relatively unknown health psychology, medicine and associated fields. To date, only a few studies have investigated how cognitive abilities and health literacy are associated (e.g., Mõttus et al., 2013; Murray, Johnson, Wolf, & Deary, 2011; Wolf et al., 2012). For example, Mottus et al recently showed that health literacy tests have somewhat limited incremental validity after accounting for cognitive ability and education. As such, it remains unclear to what extent health literacy measures are assessing construct variance that is distinct from basic cognitive abilities.

We believe this is a potentially important oversight as it creates the conditions for construct redundancy and construct proliferation. Construct proliferation and redundancy has been noted as a major problem in psychology (e.g., Le, Schmidt, Harter, & Lauver, 2010; Morrow, 1983; Schwab, 1980) and can be viewed as a major failure to adhere to the canon of parsimony in science. As these authors have noted, "a science that ignores the mandate for parsimony cannot advance its knowledge base and achieve cumulative knowledge." (Le et al., 2010, p. 112). We believe a clear understanding of the role of cognitive differences in health outcomes will emerge more quickly with an accurate understanding of the construct space being assessed by purported measures of health literacy. As such, our purpose is to evaluate the conceptual and empirical uniqueness of the health literacy construct compared to known cognitive abilities.

1.1. A conceptual analysis

Within the larger process of construct conceptualization and validation, it is imperative to demonstrate the uniqueness of a construct by either its complete or partial independence from other comparable constructs (Cronbach & Meehl, 1955; Messick, 1989). The first step of that process requires the construct definition and nomological network of the target construct to be conceptually distinct from existing validated constructs. To avoid construct proliferation and redundancy, it is incumbent upon the newer proposed construct to distinguish itself from known constructs. In cases of where concepts compete for the same construct space, the parsimonious model is accepted as the superior model.

To begin, we can compare their definitions. Cognitive abilities (or "mental abilities") in general are defined as the sources of variance in performance on tasks requiring one to mentally process, comprehend, and manipulate information (Carroll, 1993; Reeve & Bonaccio, 2011a). While there are several specific abilities (e.g., quantitative reasoning; visual–spatial perception; cognitive speed), the general cognitive ability underlying all of these, or 'g' as it is known, has been defined as the factor reflecting individual differences in the ability to educe relations and correlations since it was first formally proposed by Jensen, 1998; Reeve & Bonaccio, 2011a; Spearman, 1904. As Gottfredson (2009) eloquently interpreted, this means "the generalized capacity to learn, reason and solve problems in essentially any context". Operationally, this means general ability would manifest behaviorally as the ability to obtain and understand information (i.e., to learn), process information (i.e., reason), and use information to make appropriate decisions (i.e., solve problems in context). Although the definition of health literacy used by researchers has evolved in the past fifteen years, the most commonly cited definition of health literacy is that adopted by the Institute of Medicine (Nielson-Bohlman, Panzer, & Kindig, 2004), the Department of Health and Human Services (Healthy People, 2010) and the World Health Organization (WHO) (1998) which states that health literacy is "the ability to obtain, process, and understand basic information and services need to make appropriate health decisions." Given the accepted definitions, it would appear that health literacy is essentially a restatement of the extant definition of 'g,' as it would be manifest in a specific context. That is, it is well established that general cognitive ability ('g') is indifferent to the indicator (Jensen, 1998; Spearman, 1927). This principle states that it is not the surface level features of items or situations that determine how well it measures 'g', but rather it is the underlying cognitive process. Any situation, regardless of context, that requires the eduction of relations and correlates and the application of knowledge to novel problem solving situations will measure 'g'. Thus, it appears that the primary conceptual difference is not in the cognitive processes per se, but in whether a model positing a general information processing capacity is more or less parsimonious than a componential model comprised of numerous domain-specific faculties.

In this respect, it has been predicted and confirmed that individual differences in health literacy scores are associated with health specific outcomes such as lower depression scores (Gazmararian, Baker, Parker, & Blazer, 2000), measures of morbidity, general health status, and use of health resources (DeWalt, Berkman, Sheridan, Lohr, & Pignone, 2004), mortality risk (Baker et al., 2007). However, in keeping with the definition *g*, Gottfredson (2004) posited that individual differences in *g* would manifest as the ability to comprehend, interpret and apply information in a health care context just as it has been shown to do so in educational, occupational, and social contexts (Kuncel, Hezlett, & Ones, 2004). This prediction has also been well supported. For example, evidence shows that individual differences in *g* are associated with lower depression scores, better general health, and significantly lower odds for stroke, congestive heart failure, chronic lung disease, heart problems, and hypertension later in life (Der, Batty, & Deary, 2009), reduced risk of mortality (Batty, Deary, & Gottfredson, 2008; Deary, Whalley, & Starr, 2003), reduced likelihood of smoking (Anstey et al., 2009; Reeve & Basalik, 2010), and higher diet quality and increased physical activity (Anstey et al., 2009; Batty et al., 2007) and other indicators of health (e.g., Mõttus et al., 2013). Thus again, this suggests potential for construct redundancy.

Thus, the conceptual question centers on the strength of the evidential basis for the most parsimonious theory. In this case, the empirical reality and the importance of the *g* construct have been well documented for more than 100 years. Going back to the early 1900s, a broad array of psychometric, biological, and behavioral genetic evidence (e.g., see Carroll,