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Health Literacy and Health Actions: A Review and a Framework From Health Psychology

Christian von Wagner, PhD
Andrew Steptoe, DSc
Michael S. Wolf, PhD
Jane Wardle, PhD

The association between performance on health literacy measures and health outcomes is well established. The next step is to understand the processes through which health literacy affects health. This review introduces a framework drawing on ideas from health psychology and proposing that associations between health literacy and health outcomes could be mediated by a range of health actions involving access and use of health care, patient-provider interactions, and the management of health and illness. The framework outlines routes through which health literacy might affect either health actions themselves or the motivational and volitional determinants that have been identified in social cognition models. The implications of the framework for future research and intervention strategies are discussed.

Keywords: *health literacy; causal pathways; social cognition models; public health education*

Health literacy has been defined as the degree to which individuals have the capacity to obtain, process, and understand the basic health information and services needed to make appropriate health decisions (Institute of Medicine, 2004). A recent overview of 85 studies concluded that 26% of Americans have low health literacy and another 20% have marginal literacy (Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005), although this conclusion needs to be tempered by the fact that few of the studies were population based and many focused on socioeconomically deprived or hospital-based samples. The results of the 2003 National Assessment of Adult Literacy (NAAL), which for the first time included a health literacy component (Kutner, Greenberg, Jin, & Paulsen, 2006), were published since Paasche-Orlow and colleagues' review. In this national sample of more than 18,000 adults, 14% had below-basic health literacy skills whereas another 22% had only basic health literacy skills. On the basis of these findings, the report estimated that more than 75 million adults in the United States have limited health literacy.

Christian von Wagner, University College London, Department of Epidemiology and Public Health, Health Behaviour Research Centre. Andrew Steptoe, University College London, Department of Epidemiology and Public Health, Psychobiology Unit. Michael S. Wolf, Health Literacy and Learning Program, Institute for Healthcare Studies, Feinberg School of Medicine at Northwestern University, Chicago, Illinois. Jane Wardle, University College London, Department of Epidemiology and Public Health, Health Behaviour Research Centre.

Address correspondence to Christian von Wagner, Health Behaviour Research Centre, Gower Street, University College London, London, WC1E 6BT, United Kingdom; phone: 207 679 6642; fax: 207 813 2848; e-mail: c.wagner@ucl.ac.uk.

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Information on health literacy outside the United States is limited. One recent survey investigated health literacy in a population-based, national sample of 759 British adults, using a modified version of a measure developed in the United States, the Test of Functional Health Literacy in Adults (TOFHLA). Marginal or inadequate functional health literacy was observed in 11% of participants, which was similar to the rate for below-basic literacy (14%) documented in the NAAL (Wagner, Knight, Steptoe, & Wardle, 2007). These British results also found important social and individual predictors of limited health literacy, of which the most prominent were education, age, and ethnicity (Paasche-Orlow et al., 2005).

Low Health Literacy and Health Outcomes

Low health literacy has been associated with a wide range of health-related outcomes, including poor general health status and high risk of hospitalization (Institute of Medicine, 2004). There continues to be a steady stream of public health research replicating these associations. To give one recent example, in a cross-sectional community study of 2,512 older adults, even after adjustment for sociodemographic variables, adults with only a sixth-grade reading level were more likely to report poor health, diabetes, and depressive symptoms and twice as likely to report poor health care access (Sudore, Mehta, et al., 2006). Risk of hospitalization has also been used as a marker of health outcomes. In a survey of emergency department patients who participated in the Literacy in Health Care Study, those with inadequate health literacy were twice as likely to have been hospitalized during the 2-year study period. After adjustment for sociodemographic variables, the risk of being hospitalized was 1.7 for patients with inadequate health literacy compared with patients with adequate health literacy, rising to 3.1 for readmission among those who had been hospitalized in the year before entry into the study (Baker, Parker, Williams, & Clarke, 1998). Health literacy was found to be significantly associated with all-cause mortality in 3,260 Medicare managed care enrollees in four U.S. metropolitan areas (Wolf, Gazmararian, & Baker, 2005).

Health literacy is also associated with health care costs. Weiss and colleagues analyzed data on the annual health care charges in a small sample ($N = 74$) of people enrolled in Medicaid (Weiss & Palmer, 2004). Mean charges among participants with a below third-grade reading level were substantially higher (\$10,688 per year) than for those with an above fourth-grade reading level (\$2,981 per year), a difference that persisted after adjustment for age, ethnic group, and health status. Another study of 3,260 elderly people enrolled in a Medicare managed care plan highlighted that low health literacy was particularly strongly associated with use of emergency care (Howard, Gazmararian, & Parker, 2005). After controlling for age, sex, race/ethnicity, education, income, alcohol and tobacco consumption, and comorbid conditions, the investigators found that individuals with inadequate health literacy care spent an average of \$108 more than individuals with adequate health literacy on emergency care during the study period.

Assessment of Health Literacy

The most widely used screening tests for limited health literacy are the Wide Range Achievement Test (WRAT) (Wilkinson, 1993), the Rapid Estimate of Adult Literacy in Medicine (REALM) (Davis et al., 1993), the Test of Functional Health Literacy in Adults (TOFHLA) (Parker, Baker, Williams, & Nurss, 1995), and, most recently, the Newest Vital Sign (NVS) (Weiss et al., 2005). Administration times vary from 2 to 3

minutes for the REALM to 25 minutes for the full-length TOFHLA. The REALM and the TOFHLA exclusively use words or scenarios from health care contexts, whereas the WRAT assesses word recognition and arithmetic with materials that are unrelated to the health domain. The NVS questions require extracting and manipulating nutrition information for the literacy assessment and appear to offer more scope to discriminate at higher levels of ability than the other tests.

The health literacy scale that formed part of the latest U.S. literacy assessment (NAAL) represents the most elaborate attempt at constructing a complex health literacy assessment. It consists of 28 different health tasks, each of which maps onto one of three continuous literacy scales (prose, document, and quantitative) allowing performance to be categorized into one of four levels (below basic, basic, intermediate, and proficiency). By providing the first national assessment of health literacy in the United States, the NAAL has been instrumental in demonstrating that once health literacy skills are conceptualized on a continuous scale, they become an important issue across the general population. For example, the NAAL showed that more than 45% of Americans possess only basic health literacy skills, which is likely to leave them struggling with tasks such as understanding moderately dense or unfamiliar prose texts, locating information in complex documents, or making simple inferences. Moreover, the survey demonstrated that variations in health literacy skills across the population predicted disparities in overall health, access to health information sources, and health insurance coverage (Kutner et al., 2006).

HEALTH LITERACY FRAMEWORKS

Although the impact of health literacy on health itself is widely accepted, it is unlikely that health literacy has direct effects on most health outcomes; rather, health outcomes are likely to depend on a range of mediating processes, most obviously actions to promote health, prevent disease, or comply with diagnosis and treatment (here collectively called health actions). In a recent editorial on health literacy, Paasche-Orlow and Wolf (2007) proposed causal pathways between limited health literacy and health outcomes. Their model distinguishes three different types of health actions that mediate the impact of health literacy on health: access to and utilization of health care, patient-provider interaction, and self-care. Each of these domains is defined not only by patient factors but also by external factors that can be attributed to the health care provider or the health system. The pathways are particularly useful in highlighting the role of health actions and providing a useful taxonomy of behavioral domains.

Health Literacy, Actions, and Outcomes

Figure 1 outlines a framework of health literacy and health action that uses established constructs from social cognition models of health to integrate health literacy into a wider framework of health actions. It makes proposals about how health literacy emerges as a result of acquiring skills such as reading and arithmetic. According to our framework, basic skills such as phonological processing, basic reading, and arithmetic allow a person to decode information from text and therefore constitute an essential requirement for the accomplishment of higher order cognitive tasks. To accomplish higher order tasks such as inference, critical thinking, or problem solving, information decoded from text needs to be used—together with existing knowledge—to derive

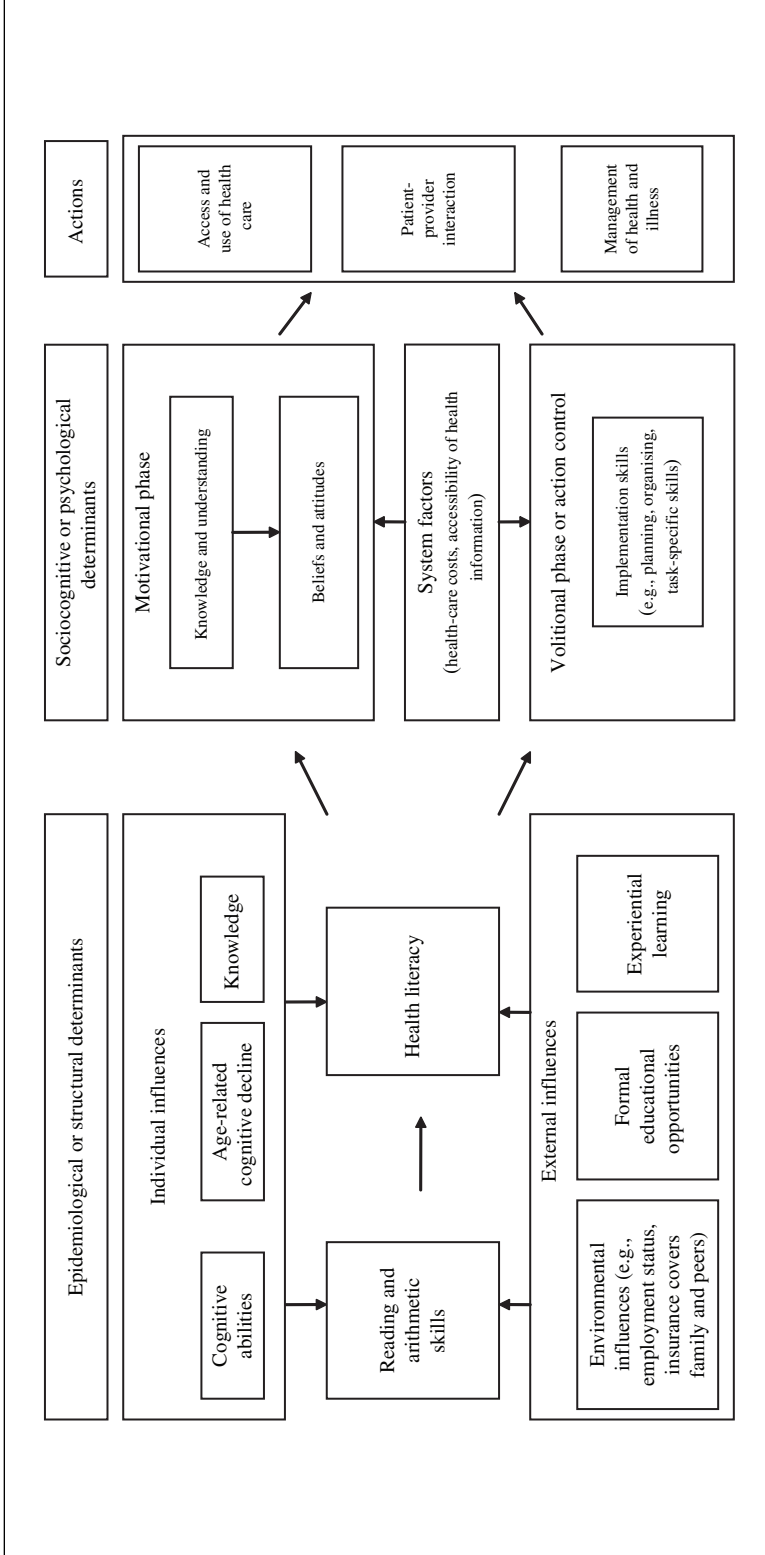


Figure 1. Framework of health literacy and health action.

meaning (Anderson, 1985). There is thus an important hierarchy of skills in which simple processes are used as part of more complex cognitive strategies, including the ability to locate and select relevant information, follow instructions, and perform quantitative operations, which in turn are necessary to eventually integrate, synthesize, and analyze information (Kutner et al., 2006). Health literacy in particular describes the ability to rely on literacy and numeracy skills when they are required to solve problems in the health domain.

The framework places health literacy within the context of the external and individual variables that influence development and maintenance of literacy. The social environment, specifically stimulation provided by parents, is critical in the development of reading and literacy. Parent–infant interactions are also important determinants of the ability to acquire knowledge about concepts and oral language skills (Anderson, 1985; Theriot et al., 2003). Resources provided during formal education are, of course, central to literacy and numeracy.

There are other opportunities for external influences to maintain and strengthen health literacy skills throughout the life span, such as life events (e.g., work, family, or health-related events) that increase exposure to written materials or provide a continuous challenge to literacy skills. Learning opportunities may also arise in the form of community-based literacy interventions. However, across all these domains there are individual differences that affect the development and maintenance of health literacy skills, including cognitive aptitude (Gottfredson, 2004), age-related cognitive decline (Baker, Gazmararian, et al., 2002), and preexisting knowledge.

The primary aim of the framework is to draw attention to the impact of health literacy on health actions and their determinants. Social cognition models of health actions, such as the health belief model (HBM; Janz & Becker, 1984) or theory of planned behavior (TPB; Ajzen, 1991), share the idea that health actions such as quitting smoking, attending for screening, or complying with medication advice, result from choices between different routes of action. In the motivational phase (see Figure 1), variables such as knowledge of relevant facts—for example, about screening programs or exercise and health—provide the impetus to form intentions about health actions. These models vary in their emphasis on different processes. For example, according to HBM, the motivational phase would be dominated by a person's perception of the specific illness he or she is trying to prevent or treat, whereas other theories such as the TPB might place greater emphasis on an individual's attitudes toward a health action. The motivational phase therefore refers to a wide variety of related constructs including knowledge about opportunities for screening and treatment as well as a person's perception of his or her own personal risk. Within the framework, motivational processes ultimately result in a decision about whether to attempt to perform a health action. Meta-analytic reviews have shown that these constructs have considerable predictive utility, accounting for up to 40% of variance in behavioral outcomes (Armitage & Conner, 2001). Motivational constructs have also been instrumental in the design of effective behavior change interventions (Rutter & Quine, 2002).

Social-cognition models acknowledge that motivation alone is not the sole predictor of taking a health action. Concepts such as self-efficacy, and practical barriers such as the financial costs associated with the action, influence the translation of intentions into action, that is, the action phase (Bandura, 2001; Sheeran, Trafimow, & Armitage, 2003). Of particular interest here has been individuals' use of planning to ensure that their intentions are enacted. One strategy that has received empirical support over recent

years is the concept of implementation intentions (Gollwitzer, 1993). The ability to formulate and organize environmental cues to ensure that a health action can be carried out is a central aspect of implementing goal intentions and one that in principal could be related to health literacy. Being able to specify environmental cues such as the location and time of an intended health action has been shown to promote performance of future health actions such as exercise participation or attending screening for cervical cancer (Milne, Orbell, & Sheeran, 2002; Sheeran & Orbell, 2000). The proposed framework also makes direct reference to system factors that influence both motivational and volitional processes. One example is attitudes by health care providers toward low-literate patients, which might shed light on disparities in patient-provider interactions.

In addition to all these potentially modifiable, social cognitive processes, there are of course demographic determinants (e.g., culture, gender) of health actions that are reviewed elsewhere (Shire, 2002). Employment status and personal wealth are determinants of health actions that are likely to be strongly associated with health literacy.

In our framework of health literacy and health actions, we used Paasche-Orlow and Wolf's (2007) proposed causal pathways of health literacy to outline three principal types of health actions, namely, access and utilization of health care, patient-provider interactions, and self-care. They describe health actions involved in the ability to seek and manage health care as well as health-related actions outside the health system. Dividing health actions into different domains has the advantage of enabling one to specify the context in which individual tasks have to be accomplished.

In the framework, we have broadened the domain of self-care by referring to it as "management of health and illness." Although the former domain name reflects the current emphasis on health literacy and adherence behaviors, we considered it timely to stress that this domain should also include conceptually related health actions which, as self-care, contain an element of autonomy (i.e., take place without clinical supervision) and routine (i.e., are not single events). These may include lifestyle-related behaviors, such as exercise and healthy eating, and the promotion of health in the family and larger community.

Access and Use of Health Care

Low health literacy has been associated with limited use of primary prevention services and high rates of emergency room use and hospitalization (Baker, Gazmararian, Williams, et al., 2002; Baker et al., 2004; Bennett et al., 1998; Garbers & Chiasson, 2004; Kalichman & Rompa, 2000; Lindau, Basu, & Leitsch, 2006; Scott, Gazmararian, Williams, & Baker, 2002; Wolf et al., 2006). In this review, we use the example of access and utilization of prevention services to outline how our framework can be used to explain why people with low health literacy are less likely to use these services. Figure 2 provides an expanded view of the pathways between health literacy and the specific health actions reviewed in this article, in this case participation in cancer screening.

To begin with, the motivational pathway describes the interaction between health literacy and established social cognition variables such as health-related knowledge, attitudes, or beliefs and the decision to use primary prevention services (e.g., to take part in a cancer screening program). The context in which these health actions take place suggests that health literacy may well play a role in determining motivational processes. For example, core health literacy skills such as the ability to read and comprehend written health materials play an important role in the uptake of these services because the

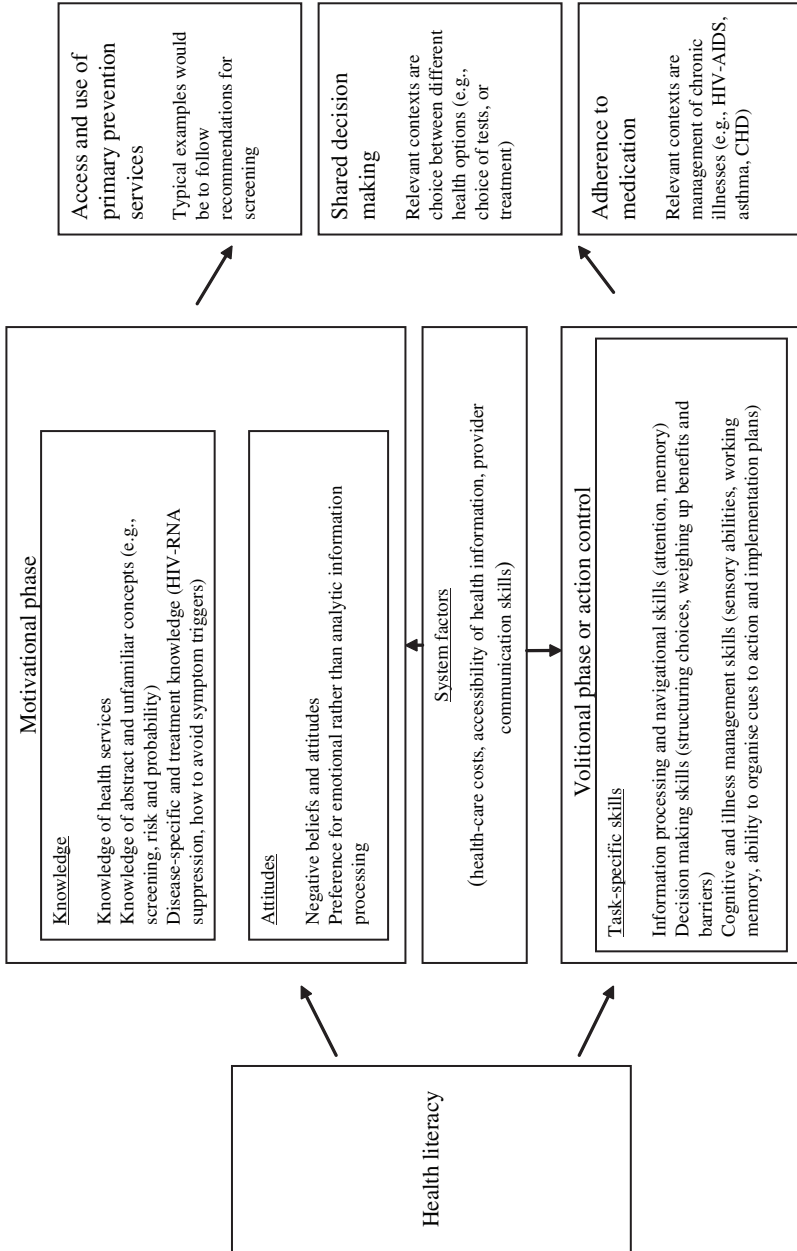


Figure 2. A detailed view of pathways between health literacy and screening use, shared decision making, and medication adherence.
 NOTE: CHD = coronary heart disease.

health system and providers of these services rely heavily on dissemination of written materials, a format that adults with limited health literacy have been found to struggle with, in terms of both access (Kutner et al., 2006) and comprehension (Baker, 1999).

Difficulty in comprehending printed information means that individuals with lower health literacy are less likely to benefit from health education campaigns—for example, on cancer prevention—and would also be less likely to acquire new cancer knowledge. As a result, lower health literacy could be associated with beliefs (e.g., about cancer prevention and treatment) that are predominantly shaped by personal experience rather than up-to-date health education advice.

In support of this idea, a survey of 445 women sampled during primary care visits found that lower performance on the REALM was associated with lower mammography knowledge; 39% of women reading at or below third-grade level did not know why women are given mammograms, compared with only 12% of those reading at or above ninth-grade level (Davis et al., 1996). This finding demonstrated that individuals with limited health literacy can be disadvantaged in terms of the knowledge they possess about health services, particularly the potential benefits associated with participation in those services. The association between health literacy and health knowledge was also demonstrated in a study of 529 English-speaking patients in ambulatory women's clinics; 40% of patients were low in literacy (below the ninth-grade reading level) and literacy was the only independent significant predictor of cervical cancer knowledge (Lindau et al., 2002).

Lack of knowledge about preventive health care is also associated with negative beliefs about these services (Dolan et al., 2004). In a survey of 377 male veterans, none of whom had undergone colorectal cancer screening, respondents with limited literacy were more likely to be concerned that a fecal occult blood test (FOBT) was messy and inconvenient, felt less likely to use an FOBT kit even if recommended by their physician, and would put off getting a flexible sigmoidoscopy. All these associations remained significant after the investigators controlled for race and employment status. Interestingly, adults in the low literacy group believed that they were at average to high risk of developing cancer, so their lower enthusiasm for screening was not a consequence of lower perceived risk. Focus group studies have also found limitations in knowledge of anatomy and confusion between diagnostic and screening tests (Dolan et al., 2004). In another study, low-literate participants thought screening was unnecessary if they had no symptoms, and these participants were more likely to endorse the aphorism "If it ain't broke, don't fix it" (Davis et al., 2001).

Together these studies indicate that there may be an important pathway between low health literacy and the ability to acquire knowledge central to the development of important concepts such as prevention and early detection. This may explain why low health literacy has also been associated with a greater likelihood of reporting negative beliefs about screening tests. Finally, a greater reliance on personal experience and information obtained through lay networks may be associated with a higher degree of fatalism and more negative beliefs about the efficacy of screening. The studies therefore demonstrate how health literacy can play an important role in determining a person's motivation to use preventive and screening services as suggested by the motivational pathway in our framework.

Figure 2 also illustrates a second pathway that outlines how health literacy may influence volitional processes associated with the uptake of screening services. Most of the current evidence addresses motivational issues, partly because disparities in the understanding of abstract concepts such as prevention can be generalized across different

programs and indeed different health systems. In contrast, volitional variables tend to relate more to idiosyncratic features of individual tests (e.g., whether they are home based or require follow-up) that are less generalizable. However, there may be specific contexts in which health literacy would play an important part in determining a person's perceived or actual ability to take part in screening. This is particularly true for the screening programs that demand some form of user involvement (e.g., in the case of bowel cancer screening, self-administration of a home-based test kit).

Another skill that has often been cited in conjunction with health literacy is that of navigation. According to Paasche-Orlow and Wolf (2007), navigation includes all the skills needed to go from one place to another in pursuit of medical care. There are no empirical data or measures of the association between health literacy and navigation, but people with low health literacy have reported difficulty finding their way in health care facilities. It is unclear to what extent navigation may also refer more broadly to tasks including the navigation of media, such as the Internet, and the ability to choose appropriate health care services. Determining the impact of health literacy on the ability to access primary prevention services, particularly its association with navigational skills, is an important target for future research.

Finally, the financial cost associated with participation in screening programs provides a fundamental system-based barrier to health care use. Cost is likely to increasingly become an issue for those at risk of limited health literacy because they are vulnerable to rising costs of living and less likely to possess sufficient health insurance coverage. Current research evidence provides only indirect support for the pathways outlined in the framework. To directly test the relevance of the framework in the screening context, investigators would need to conduct experimental and longitudinal research studies to test the proposed link between knowledge, beliefs, and the decision to act. For example, experiments could provide a microanalytic perspective on individual processes through which health literacy operates, whereas longitudinal studies would be able to address the extent to which the link between health literacy and participation in screening is mediated by motivational or volitional processes.

Patient–Provider Interactions

Having limited health literacy skills has a profound impact on interactions with health care providers, as was described by Roter (2005) in her conceptual framework of health literacy and the patient–provider relationship.

Many patients with reading problems are ashamed and hide their inability to read. Shame is a deeply harbored emotion that plays an important role in understanding how low-literate patients interact with health care providers (Parikh, Parker, Nurss, Baker, & Williams, 1996). The sense of shame may be aggravated further by the reported difficulties of low-literate patients when interacting with the health care system, particularly with hospital staff who become angry and frustrated at the failure of patients with low literacy skills to understand signs or complete medical forms (Baker et al., 1996). Having less health-related knowledge may also have broader ramifications for patient–provider interactions, such as inhibiting low-literate patients from asking questions and becoming active participants in their health care (Paasche-Orlow & Wolf, 2007).

Shared decision making provides a notable example of a health action that is facilitated by patient–provider interactions and one that might well be influenced by health literacy. For example, Mancuso and Rincon (2006a) reported a cross-sectional study of 175 asthma patients, in which low health literacy was associated with a reduced desire

to participate in making decisions about clinical treatment, even after the investigators controlled for demographic and asthma characteristics. Figure 2 refers to motivational barriers to shared decision making. For example, medical decisions often involve technical terms, complex ideas, multiple options, and the need to differentially weight the relative value of unfamiliar choices. In addition, decisions are made in a dynamic process of structuring choices and considering these choices using analytic and experience-based arguments (Deber, Kraetschmer, & Irvine, 1996). To cope, patients may reduce their decision burden using potentially maladaptive strategies, such as allowing the most readily understood factor to prevail or denying the existence of certain bothersome factors. In broader terms, lower health literacy may predispose toward use of experiential/emotional rather than analytic information processing in the health domain (Epstein, 1994).

Figure 2 also outlines the influence of health literacy on skills that are central to a person's ability to take an active part in shared decision making. A very useful example of volitional processes underlying the association between health literacy and shared decision making was provided in an innovative experimental paradigm in which consent comprehension was assessed by reading aloud true or false statements concerning study procedures, risk, and confidentiality to a sample of 204 ethnically diverse participants (Sudore, Landefeld, et al., 2006). If a participant responded incorrectly to any of the statements, the information was reread to him or her. The primary outcome was the number of passes required to obtain complete comprehension. Only 28% answered all comprehension questions correctly on the first pass, but 98% achieved complete comprehension after three passes. After adjustment for confounders, lower literacy was strongly associated with requiring more passes through the consent process, demonstrating how low literacy can act as a barrier but can be overcome through repetition.

Another important barrier comes from health care providers being either disinclined to offer opportunities for shared decision making to individuals they perceive as being low literate or unable to help patients with low literacy to engage in the shared decision-making process. Self-report studies show that low-literate patients themselves often feel dissatisfied with the health care system. One example comes from a cross-sectional survey in which 339 HIV-infected men were presented with different situations that could interfere with medical care and asked to indicate whether each situation had caused them personal difficulty in receiving medical care. The participants were also asked to report care-related beliefs, perceptions of providers, and reasons for missed appointments (Kalichman & Rompa, 2000). After the investigators controlled for years of education, comparisons of health literacy groups showed that people with lower health literacy were more likely to endorse negative perceptions and experiences related to HIV-AIDS care, such as difficulty accessing care and mistrust in their health care providers.

A randomized controlled trial attempted to determine whether notifying physicians of their diabetes patients' limited health literacy affected physician behavior, physician satisfaction, or patient self-efficacy (Seligman et al., 2005). Results showed that physicians who were told about the health literacy status of their patients were more likely to use management strategies recommended for patients with limited health literacy (e.g., involvement of family members, referral to nutritionist) but were less likely to be satisfied with the visits (81% vs. 93%) and perceived themselves to be less effective than control physicians (38% vs. 53%). Furthermore, the intervention had no significant effect on a patient's postvisit self-efficacy scores.

Despite theoretical and conceptual contributions that have attempted to elucidate the interactional barriers associated with limited health literacy (Roter, 2005), there is very

little research on the role of health literacy in patient–provider interactions. Future research would benefit from including a stronger focus on mediating variables, such as attitudes toward health care providers and trust in the health system, which may determine the decision to participate in decision making. Furthermore, the direct contribution of the health care provider is particularly relevant in this. Research focusing more directly on the experience of health care providers with low-literate patients and including objective assessments of patient–provider interactions might help to clarify the reasons for negative experiences of health care associated with low literacy.

Management of Health and Illness

Although two of the three domains of health actions in our framework outline limitations associated with health literacy in relation to interacting with the health system or individual providers, it is similarly important to describe the role of health literacy in determining routine and predominantly autonomous health actions.

In this context, health literacy has traditionally been associated with actions relating to management of illness rather than health. Limited health literacy has been found to be significantly associated with understanding of disease and treatment (Gazmararian, Williams, Peel, & Baker, 2003), adherence to medical instructions (Graham, Bennett, Holmes, & Gross, 2007; Kalichman, Ramachandran, & Catz, 1999), and self-management skills (Schillinger et al., 2002). The scope of health literacy research has only recently been extended to health actions with the aim of managing health in everyday life (e.g., healthy eating, exercise) where its role is less well understood (Wagner et al., 2007), which is why for the purpose of this review we opted to retain the focus on illness management.

In Figure 2, we have included some of the specific motivational and volitional barriers that are associated with health literacy in relation to adherence to medication. Among other things, chronically ill patients with limited health literacy have been found to know less about their illness and the specific treatment, particularly the link between adherence and treatment effectiveness (as in the case of HIV-RNA suppression).

A survey of 204 HIV patients found a significant association between literacy (as measured by scores on the REALM) and self-reported adherence (over a 4-day period) to anti-retroviral medication (Wolf et al., 2007). Patients with low literacy had the highest rate of nonadherence (52.2%), less knowledge of their HIV treatment, and lower self-efficacy for taking their medications as prescribed. Importantly, patients' self-efficacy but not their knowledge mediated the impact of low health literacy on medication adherence.

There are other useful examples of motivational barriers associated with low health literacy, such as a recent cross-sectional questionnaire study of 479 patients from rheumatology/pain clinics. The survey found that interest in seeking and reading written medical information was predicted by health literacy alongside coping style and occupation (Koo, Krass, & Aslani, 2006).

Finally, we would also like to note that taking medication may be a complex activity that requires understanding of medication information. As noted in Figure 2, some of the required abilities are general cognitive abilities, such as mental processing speed and working memory; sensory abilities have also been noted as relevant health skills in this context (Morrow, Weiner, Steinley, Young, & Murray, 2007).

Not surprisingly, there is evidence that complexity of treatment regimen has a bearing on adherence. A prospective cohort study of 1,549 Medicare enrollees with coronary heart disease, hypertension, diabetes mellitus, or hyperlipidemia found that low refill

adherence (which occurred in 40% of the sample) was associated with health literacy and regimen complexity (Gazmararian et al., 2006). Regimen complexity was also associated with adherence in a longitudinal study of adherence to antiretroviral adherence in a cohort of patients with HIV-AIDS (Paasche-Orlow et al., 2006). Health literacy has been found to predict the acquisition of knowledge about self-management of asthma, such as learning how to avoid triggers, manage medications, monitor symptoms, and use inhalers and peak flow meters (Mancuso & Rincon, 2006b). Another study of 3,260 Medicare managed enrollees found that 23% of English-speaking and 34% of Spanish-speaking respondents could not adequately read and comprehend medical information in their spoken language and that these problems were specially prevalent among minority, low-income, and uneducated populations (Gazmararian et al., 1999).

The most direct evidence for a link between health literacy and comprehension was offered in a cross-sectional study using structured interviews with 395 English-speaking adults. The interviews measured understanding of instructions on five container labels and found that patients reading at or below the sixth-grade level were less able to understand all five label instructions. The association was independent of other confounding variables, such as age, sex, race, education, and the number of medications currently taken daily (Davis et al., 2006).

As with the other two health action domains, there is ample scope to review and refine research strategies. We will remain with the example of adherence. Paasche-Orlow and colleagues offered a highly relevant demonstration of why it is so important to follow up cross-sectional survey findings with more advanced and longitudinal designs (Paasche-Orlow et al., 2006). In their longitudinal study of 235 patients on antiretroviral therapy, the investigators found no evidence to support the prediction that low health literacy was associated with lower odds of adherence or virologic suppression. Paasche-Orlow and colleagues argued that patients with low health literacy may have difficulty acquiring the self-management skills required for a new drug regimen but once in a therapeutic state follow directions more readily than those with higher literacy. Further analyses to evaluate both motivational and volitional variables across different time points (e.g., at acquisition and maintenance) will be important to identify causal pathways explaining associations among health literacy, adherence, and health outcomes (Paasche-Orlow et al., 2006). Evidence of the volitional pathway connecting health literacy and adherence has been limited to comprehension, and it would be useful to study the association between health literacy and other cognitive skills associated with adherence, such as working memory and planning skills.

As noted above, the role of health literacy in managing health in the general population has received very little attention. Future research would therefore benefit from including the general population (as opposed to disease-specific patient groups) as targets for health literacy research and interventions. Furthermore, to explore the role of health literacy in health promotion, it would be timely to move beyond the highly individualized study of health literacy and personal health and address health outcomes relating to family and community health.

IMPLICATIONS FOR INTERVENTIONS

In this review, we have outlined a framework of health literacy and health action using three domains of health actions. We have described motivational and volitional pathways in each of these contexts and used the framework to extract recommendations

for future research. These recommendations have included expanding the scope of health actions to include lifestyle behaviors and promoting experimental and longitudinal research. The final aim of this review is to demonstrate that the framework can be used to design interventions in each of the three domains of health actions.

For example, this review highlighted that in the domain of access and use of health services, low health literacy is associated with poor access to all types of health information, suggesting that information-management skills, including navigational skills, in addition to reading ability, should be promoted in adults with low health literacy. Unfortunately, information skills training is usually limited to health care professionals and nursing and medical students (Li et al., 2005). One exception is a study that addressed computer literacy in older adults (Campbell & Nolfi, 2005). Five training sessions were given that covered using computers and Web browsers, locating and evaluating health information, and navigating high-quality information Web sites (e.g., Medline Plus, ClinicalTrials.gov). Of the 60 adults who began, 42 completed the 5-week program, and 27 completed the 1-year follow-up questionnaires. Regrettably, there were no robust treatment effects in terms of health care decision making, and changes in performance skills were not assessed, which could have been important outcomes.

We emphasized the role of the provider in the section on provider–patient interactions. The increased salience of health literacy has led to increases and improvements in advice and resources that are available to address the issue of health literacy. For example, the National Center for the Study of Adult Learning and Literacy has developed training materials (Health Literacy Study Circles) designed for teachers who would like to increase their expertise in health literacy in three different health contexts: chronic disease management, health care access, and, most recently, illness prevention and screening (Rudd, Soricone, Santos, & Zobel, 2005). Each “circle” provides an extensive 15-hour program in which teachers are trained to help their students develop basic skills needed in a range of areas, including practical skills such as filling out forms, reading and interpreting complex documents about patients’ rights and responsibilities, making critical decisions about health care, understanding health information in the media, and being able to discuss symptoms with a medical professional. In the United Kingdom, Skilled for Health is a government–voluntary sector initiative that uses embedded learning to address people’s needs to better understand and to improve their health. The initiative has produced an extensive list of publicly available learning materials that are targeted at teachers working in community, employability, and health settings (Berry, Byatt, Hawkes, Meechan, & Summer, 2006).

Finally, in the domain of managing health and illness, we have argued that literacy-related disparities in task-specific skills may create barriers to adherence in patients with low literacy skills. Although empirical evidence for this association is limited, patient-directed adherence interventions have successfully targeted both motivational and volitional barriers. For example, Rothman and colleagues used individualized communication to enhance comprehension in 193 adults with type 2 diabetes who had poor glycemic control (Rothman et al., 2004). The intervention included focusing on selected key behaviors, decreasing the complexity of information, using concrete examples, limiting the number of topics covered in one session, avoiding jargon, and using “teach back” to ensure comprehension. The intervention led to improved control for patients with low literacy. Patients with higher literacy had similar odds of achieving the target level of glycated hemoglobin regardless of intervention status.

Another study showed that offering 30 minutes of one-to-one guideline-based instructions on asthma self-management eliminated differences in asthma medication knowledge

and dose-inhaling technique (Paasche-Orlow et al., 2005). At baseline, inadequate health literacy was associated with lower knowledge and worse inhaling technique. All patients received education at discharge and were then invited for a 2-week follow-up appointment and tested for inhaler technique and knowledge of the discharge regimen. Health literacy no longer predicted differences in knowledge of the discharge regimen, adherence, or asthma symptom control. The authors argued that this change in the apparent effect of health literacy from before to after the intervention demonstrated that poor health literacy is not an insurmountable barrier to patient knowledge and adherence.

In this review, we have also tried to highlight the importance for future research to extend the scope of health literacy beyond the individual, and we would like to close with an intervention that has demonstrated how health literacy can be addressed to target community outcomes as opposed to individual outcomes. This example was provided in a case study to develop an easy-to-read community guide to inform people about environmental issues (Zarcadoolas, Timm, & Bibeault, 2001); the authors' goal was to inform people about "brown-field" issues and encourage them to become actively involved in the process of planning for reuse and redevelopment. By including inner-city residents in the process of producing relevant and engaging information materials, this intervention attempted to address both motivational and volitional barriers toward increasing the level of activation in citizenship of individuals with low health literacy. Although the outcome in this example does not directly relate to health, it prompts consideration of other examples in which individual health actions might have an effect on communal rather than individual health outcomes. Examples of these include strategies to promote parental awareness of the link between individual decisions about vaccinating a child and communal health outcomes (such as "herd immunity") or the overprescription and overuse of antibiotics and their role in community-based antibiotic resistance.

CONCLUSIONS

The framework of health literacy and health actions is unique in that it specifically addresses possible mechanisms through which health literacy may affect health actions and systematic in that it groups mediating variables according to whether they refer to motivational or volitional determinants of health action. We have followed Paasche-Orlow and Wolf's (2007) approach of dividing health actions into three domains, namely, access and use of health services, patient-provider interactions, and management of health and illness. Key implications derived from this framework are that health literacy is a combination of cognitive skills, knowledge, and experience attained throughout the life span and that the relationship between health literacy and health action is mediated by at least two processes: motivation based and skill based. It is important for this framework to be tested—and likely revised—so that intervention strategies to mitigate the impact of low health literacy are informed and conceptually driven. Current approaches tested within a variety of health care contexts have had variable success, underscoring the need to better understand causal pathways. In particular, the proposed framework emphasizes motivational elements that fall beyond knowledge acquisition and transfer. It also considers the context of the action to be significant in determining the role of health literacy; influences on an individual during a single-event decision (e.g., cancer screening) are likely to be different from actions needed for the management of a complex, chronic disease (e.g., diabetes). With more

studies documenting associations between health literacy and health outcomes, greater clarity in the conceptualization of health literacy and clearly stated research questions and hypotheses will help advance the field. This should accelerate the process of formulating effective responses that acknowledge the array of individual and system barriers that act across the spectrum of health care contexts.

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