More Than Meets the Eye: Relationship Between Low Health Literacy and Poor Vision in Hospitalized Patients

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Patient-centered care includes involving patients and their families in self-management of chronic diseases. Identifying and addressing barriers to self-management, including those related to health literacy and vision limitations, may enhance one’s ability to self-manage. A set of brief verbal screening questions (BVSQ) that does not rely on sufficient vision to assess health literacy was developed by Chew and colleagues in the outpatient setting. The authors aimed to evaluate the usefulness of this tool for hospitalized patients and to determine the prevalence of poor vision among inpatients. In a prospective study, the BVSQ and the Rapid Estimate of Adult Learning in Medicine–Revised (REALM-R; among participants with sufficient vision, ≥20/50 Snellen) were administered to general medicine inpatients. Of 893 participants, 79% were African American, and 57% were female; the mean age was 53 years. Among 668 participants who completed both tools, the proportion with low health literacy was 38% with the BVSQ versus 47% with the REALM-R (p = .0001). Almost one fourth of participants had insufficient vision; participants with insufficient vision were more likely to be identified as having low health literacy by the BVSQ, compared with those with sufficient vision (59% vs. 38%, p < .001).

There is a growing movement toward including patients and their caregivers in the self-management of their chronic diseases (Bodenheimer, Loring, Holman, & Grumbach, 2002; Koh, Brach, Harris, & Parchman, 2013). However, patients can be limited by low health literacy, leading to less effective self-care and worse health outcomes (Apter et al., 2013; Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Nam, Chesla, Stotts, Kroon, & Janson, 2011; Sperber et al., 2013; Wu et al., 2013). In addition, insufficient vision may represent an underrecognized, independent risk factor for poor self-management (McCann et al., 2012; Press et al., 2011). Applying universal precautions, such as materials designed at appropriate grade levels with the use of pictures and large font, has been widely endorsed (Paasche-Orlow, Schillinger, Greene, & Wagner, 2006). However, because some patients require expanded resource-intensive educational strategies, a clinical assessment tool to identify those at greatest risk for low health literacy may help to triage educational resources.

A number of validated research tools exist, including long and short versions of the Rapid Estimate of Adult Learning in Medicine (REALM) and the Test of Functional Health Literacy in Adults (TOFHLA; Baker, Williams, Parker, Gazmararian, & Nurss, 1998; Bass, Wilson, & Griffith, 2003; Davis et al., 1991; Murphy, Davis, Long, Jackson, & Decker, 1993; Nurss, Parker, Williams, & Baker, 2001; Parker, Baker, Williams, & Nurss, 1995). However, their clinical effectiveness is limited by their test-like nature, time intensiveness, and reliance on adequate vision. The brief verbal screening questions (BVSQ), developed by Chew and colleagues (2004), do not rely on the ability to see. Although the BVSQ has been validated in many outpatient settings (Chew, Bradley, & Boyko, 2004; Chew et al., 2008; Haun, Luther, Dodd, & Donaldson, 2012; Haun, Noland-Dodd, Graham-Pole, Rienzo, & Donaldson, 2009; Sarkar, Schillinger, Lopez, & Sudore, 2010; Wallace et al., 2007; Wallace, Rogers, Roskos, Holiday, & Weiss, 2006), its utility among hospitalized patients has not been studied. Further, the prevalence of poor vision among inpatients and its effect on health literacy assessment also have not been evaluated. Therefore, this study aimed to determine whether the BVSQ tool effectively identifies hospitalized general medicine patients with low health literacy, while evaluating the prevalence of poor vision among inpatients and the potential effect of poor vision on health literacy assessment.

Method

Trained research assistants obtained consent and enrolled participants as part of an ongoing prospective study measuring quality of care for hospitalized general medicine
patients at the University of Chicago Medicine and Mercy Hospital and Medical Center (Meltzer et al., 2002). The University of Chicago Medicine and Mercy Hospital and Medical Center institutional review boards approved the protocol.

Data Collection
Research assistants administered the BVSQ, which consisted of the questions, “How confident are you filling out medical forms by yourself?,” “How often do you have someone help you read hospital materials?,” and “How often do you have problems learning about your medical condition because of difficulty understanding written information?,” scored on a Likert scale from 0 to 4. Participants had low health literacy if they had a score of 2 or less on at least one question (Chew et al., 2004; Chew et al., 2008). The REALM-Revised (REALM-R) was administered to participants with at least 20/50 acuity in at least one eye (Snellen Eye Chart). Participants were instructed to use corrective lenses if available. The REALM-R (Bass et al., 2003) is a list of eight medical terms and was used as the comparator to the BVSQ due to its brevity and feasibility for implementation. Sufficient literacy was indicated by a score greater than 6.

Data Analysis
Descriptive statistics were calculated to summarize data using means, standard deviations, and proportions. T tests tested for differences in means. Categorical comparisons employed chi-square tests. McNemar’s test was utilized for matched pair testing to compare the health literacy tools. A two-tailed p value of less than .05 defined statistical significance. Areas under the receiver operating characteristic curve (AUROC) allowed comparison between the BVSQ items, in individual and composite form, and the REALM-R tool. The AUROC, sensitivity, and specificity were therefore calculated for each individual question and as a composite to review tradeoffs with respect to improving sensitivity versus specificity (Chew et al., 2008; Morris, MacLean, Chew, & Littenberg, 2006; Wallace et al., 2006). Computations were performed using STATA version 11 (College Station, TX).

Results
From June 20, 2011, through August 20, 2012, 2,776 patients were screened; 1,061 were discharged before approach, 19 did not complete the BVSQ, 63 did not provide consent for participating in the vision screen and/or REALM-R, 35 were repeat participants, 4 required a proxy, and 701 did not complete vision testing. More than three fourths of participants (680/893) had sufficient vision, and 12 participants did not complete the REALM-R for other reasons, including refusing to complete the REALM-R or being discharged or otherwise unavailable (e.g., taken away for a test); 668 participants completed both the BVSQ and the REALM-R.

Participant Characteristics
Of the 893 participants, 79% were African American, 57% were female, and 29% were age 65 years or older. Of those reporting, 20% (173/874) had less than a high school education, 33% (221/678) did not have insurance or had Medicaid, and 51% (163/319) had an annual household income less than $25,000. When comparing participants with poor vision (completed BVSQ only, n = 213) to those with sufficient vision (completed both BVSQ and REALM-R, n = 668), significant differences emerged between
the groups with respect to race (91% vs. 81% non-White race, \( p = .001 \)), income (68% vs. 46% low income, \( p = .003 \)), educational level (30% vs. 16% without high school diploma, \( p < .001 \)), and age (40% vs. 26% age 65 years or older, \( p < .001 \)), but not with gender (59% vs. 56% female, \( p = .44 \)) or insurance type (26% vs. 34% without insurance or on Medicaid, \( p = .11 \); see Table 1).

Health Literacy

Among participants completing the BVSQ, 43% (384/893) had low health literacy. Of participants completing the REALM-R, 47% (311/668) had low health literacy. Among participants who completed both tools, the prevalence of low health literacy was greater with the REALM-R (311/668, 47%) than with the BVSQ (251/668, 38%; \( p = .0001 \)). The sensitivity of each BVSQ item (24%–34%) was less than the sensitivity of the combination of all three items (51%). The AUROC for the combination of the three items was 0.65 (see Table 2).

Vision

Nearly one fourth of participants had insufficient vision (213/893). Approximately one third of the cases of inadequate vision were due to each of the following: participants not having corrective lenses (35%), participants having inadequate corrective lenses (33%), or participants not having their lenses with them in the hospital (32%). Among participants with low health literacy on the BVSQ (\( n = 213 \)), those with insufficient vision were at greater risk of low health literacy (126/213, 59%) than those with sufficient vision (258/680, 38%; \( p < .001 \)).

Discussion

We found that within the same population, the REALM-R identified a greater proportion of patients with low health literacy than the BVSQ. Further, a nontrivial proportion of participants failed a vision screen, which may explain some of the divergent results.

Our study demonstrates less concordance, compared to previous studies, between the BVSQ and frequently used tools to measure health literacy. Responses to the BVSQ self-report items may differ because our inpatient population differs substantially from prior study populations of generally healthier ambulatory patients (Chew et al., 2004; Chew et al., 2008; Wallace et al., 2007; Wallace et al., 2006). Health literacy can also be context specific, varying by the setting or the problem being treated (Baker, Parker, Williams, & Clark, 1998; Koh et al., 2013; Morris, Grant, Repp, Maclean, & Littenberg, 2011; Six-Means et al., 2012). For example, inpatients may be facing new challenges based on their current sick state, which may influence how much help they need navigating the health care system compared to their usual well state.

Although the BVSQ may have less utility among inpatients, the tool does not rely on patients’ vision level. Our findings highlight that participants may have a dual risk of low health literacy and poor vision; those with vision limitations were more likely to have low health literacy. Poor vision may be an underrecognized barrier to self-care. Participants with poor vision were more likely to be African American, older, and have lower income.

Our findings have implications for interventions and practice by addressing barriers related to poor vision. Because one third of the study population did not have
Table 1. Characteristics of study population

| Characteristic                                      | Sufficient vision (n = 668) | Insufficient vision (n = 213) | p      |
|-----------------------------------------------------|-----------------------------|-------------------------------|--------|
| Age 65 years or older, n (%)                        | 171 (26)                    | 86 (40)                       | <.001  |
| Female, n (%)                                       | 375 (56)                    | 126 (59)                      | .44    |
| Non-White race, n (%)                               | 542 (81)                    | 193 (91)                      | .001   |
| Some high school or less education, n (%)           | 107 (16)                    | 63 (30)                       | <.001  |
| No insurance or on Medicaid, n (%)                  | 190 (34)                    | 26 (26)                       | .11    |
| Household income <$25,000, n (%)                    | 119 (46)                    | 39 (68)                       | .003   |

Note. BSVQ = Brief verbal screening questions; REALM-R = Rapid Estimate of Adult Learning in Medicine-Revised.

aData were missing for 1 participant in the sufficient vision group (completed both BVSQ and REALM-R); 375 of 667 participants in the sufficient vision group were female (56%), 292 of 667 participants were male (44%). Data were missing for one participant in the insufficient vision group (completed BVSQ only); 125 of 212 participants in the insufficient vision group (completed BVSQ only) were female (59%), 87 of 212 participants were male (41%).

bData were missing for nine participants in the sufficient vision group (completed both BVSQ and REALM-R). Race was dichotomized into White and non-White; 124 of 659 participants in the sufficient vision group (19%) were White, and all other responses were defined as non-White. African Americans made up the majority of the non-White category with 124 of 659 participants (19%); 6 of 659 participants (0.9%) were American Indian/Alaskan native, 2 of 659 participants (0.3%) were Asian/Pacific Islander, and 21 of 659 participants (3%) chose the “other” category. Data were missing for one participant in the insufficient vision group (completed BVSQ only). Race was dichotomized into White and non-White; 20 of 212 participants in the insufficient vision group (9%) were White, and all other responses were defined as non-White. African Americans made up the majority of the non-White category with 186 of 212 participants (88%), 3 of 212 participants (1%) were American Indian/Alaskan native, 0 of 212 participants (0%) were Asian/Pacific Islander, and 3 of 212 participants (1%) chose the “other” category.

cData were missing for 16 participants in the sufficient vision group (completed both BVSQ and REALM-R); education categories for this group include junior high school or less (17/652, 3%), some high school (90/652, 14%), high school graduate (188/652, 29%), some college/junior college (219/652, 34%), college graduate (87/652, 13%), and postgraduate (51/652, 8%). Data were missing for four participants in the insufficient vision group (completed BVSQ only); education categories for this group include junior high school or less (16/209, 8%), some high school (46/209, 22%), high school graduate (64/209, 31%), some college/junior college (54/209, 26%), college graduate (16/209, 8%), and postgraduate (13/209, 6%).

dData were missing for 102 participants in the sufficient vision group (completed both BVSQ and REALM-R); insurance categories for this group include Medicare (230/566, 41%), Medicaid (169/566, 30%), private (145/566, 26%), no payer (21/566, 4%), and grants (1/566, 0.2%). Data were missing for 112 participants in the insufficient vision group (completed BVSQ only); insurance categories for this group include Medicare (63/101, 62%), Medicaid (20/101, 20%), no payer (6/101, 6%), and private (12/101, 12%).

eData were missing for 411 participants in the sufficient vision group (completed both BVSQ and REALM-R); income categories for this group include $2,500 or less (26/257, 10%), $2,501 to $5,000 (10/257, 4%), $5,001 to $10,000 (6/257, 2%), $10,001 to $15,000 (31/257, 12%), $15,001 to $25,000 (31/257, 12%), $25,001 to $35,000 (29/257, 11%), $35,001 to $50,000 (26/257, 10%), $50,001 to $100,000 (52/257, 20%), $100,001 to $200,000 (29/257, 11%), and over $200,000 (6/257, 2%). Data were missing for 156 participants in the insufficient vision group (completed BVSQ only); income categories for this group include $2,500 or less (6/57, 11%), $2,501 to $5,000 (4/57, 7%), $5,001 to $10,000 (7/57, 12%), $10,001 to $15,000 (8/57, 14%), $15,001 to $25,000 (14/57, 25%), $25,001 to $35,000 (7/57, 12%), $35,001 to $50,000 (4/57, 7%), $50,001 to $100,000 (3/57, 5%), $100,001 to $200,000 (3/57, 5%), and over $200,000 (1/57, 2%).
their corrective lenses available, hospital-based interventions to increase access to corrective lenses could improve vision for some inpatients. Similarly, inpatient vision screening may identify access barriers that could prompt vision care referrals following discharge.

One limitation of this study is the generalizability of the findings because the majority of this inpatient population was African American. Although it is important to begin to obtain data on the utility of the BVSQ tool for this largely understudied population (Shea et al., 2004), future multicenter studies can build on this work to further evaluate the utility of the BVSQ among diverse hospitalized patients. Second, we only compared the BVSQ screening tool to the REALM-R. The BVSQ should be tested against other research tools such as the Short-TOFHLA or the full REALM for robust validation (Chew et al., 2004; Chew et al., 2008; Griffin et al., 2010; Haun et al., 2012; Powers, Trinh, & Bosworth, 2010). Lastly, vision may play a role in delirium, falls, or other inpatient hazards (Inouye, 1998). Future research should explicitly evaluate the extent to which poor vision is a proxy for low health literacy versus a unique risk factor that may have implications for self-care. The implications of poor vision on assessing health literacy and self-care also warrant further study.

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Table 2. Performance of health literacy screening questions for detecting inadequate health literacy (n = 668)

| Question                        | AUROC | Sensitivity (%) | Specificity (%) | +LR  | –LR  |
|---------------------------------|-------|-----------------|-----------------|------|------|
| 1. Confident with forms\(^a\)   | 0.60  | 24.4            | 92.7            | 3.34 | 0.82 |
| 2. Help read\(^b\)             | 0.60  | 33.8            | 82.9            | 1.98 | 0.80 |
| 3. Problems learning\(^c\)     | 0.60  | 30.9            | 86.6            | 2.31 | 0.80 |
| Combined                       | 0.65  | 51.1            | 74.2            | 1.98 | 0.66 |

Note. AUROC = area under the receiver operating characteristic curve; LR = likelihood ratio. Questions adapted from the Brief Questions to Identify Patients With Inadequate Health Literacy, by Chew, Bradley, and Boyko (2004).

\(^a\)Confident with forms = “How confident are you filling out medical forms by yourself?”

\(^b\)Help read = “How often do you have someone help you read hospital materials?”

\(^c\)Problems learning = “How often do you have problems learning about your medical condition because of difficulty understanding written information?”
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