Health Literacy in Patients on Maintenance Peritoneal Dialysis: Prevalence and Outcomes

Health literacy (HL) is defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (1). Limited HL is recognized as an important public health concern (2).

Limited HL may be particularly important in patients with end-stage renal disease (ESRD) who are treated with chronic dialysis (3). Patients with ESRD are commonly from lower socioeconomic backgrounds, take a multitude of daily medications, interact frequently with the healthcare system, and have multiple comorbid illnesses (4–7). We and others have demonstrated that a notable proportion of patients receiving hemodialysis (HD) have limited HL which is associated with serious adverse outcomes (5,8–10). However, the prevalence of limited HL in patients receiving chronic peritoneal dialysis (PD) is largely unknown (11,12). Limited HL may be particularly important in this patient group as chronic PD is performed daily and requires rigorous adherence to sterile technique and prompt recognition of complications. One prior study of 14 patients on chronic PD suggested that 50% of patients have limited HL. However, this study did not analyze its association with adverse outcomes (11). To address this knowledge gap, we sought to characterize the prevalence of limited HL in PD patients and assess its associations with key infectious complications and hospitalizations.

METHODS

Patient Population: This study included all patients treated with chronic outpatient PD at a single outpatient dialysis unit affiliated with the University of Pittsburgh who were older than 18 years of age.

Assessment of Health Literacy: Dialysis nurses performed a 1-time assessment of patients’ HL, by administering the Rapid

Estimate of Adult Literacy in Medicine (REALM) questionnaire, which was incorporated into routine clinical care, beginning in May 2012. The REALM assesses HL based on word recognition such that patients are asked to read and pronounce up to 66 increasingly complex health-related words (13). Scores on the REALM questionnaire range from 0 – 66, with scores ≤ 60 denoting the presence of limited HL. Scores with values > 60 denote a reading level of $\geq 9^{\text{th}}$ grade; 45 to 60 denote a 7^{th} to 8^{th} grade; 19 to 44 characterize 4^{th} to 6^{th} grade; and ≤ 18 denote a $\leq 3^{\text{rd}}$ grade level. The REALM has been demonstrated to be a valid tool for the assessment of HL in chronic HD (9,14).

Assessment of Study Outcomes: All patients receiving chronic PD at the University of Pittsburgh-affiliated dialysis unit are enrolled in a research registry at the time they initiate PD that maintains data on clinical variables, including demographics. We abstracted the data from this registry to identify all episodes of exit-site infections (ESI), peritonitis, and hospitalizations that occurred from the time patients initiated chronic PD through May 2013. For our analyses, we linked patients’ REALM scores with these outcomes. Our analyses are based on retrospective assessment of outcomes prior to the time of REALM administration and prospective assessment of these outcomes from the time of REALM administration.

Statistical Analyses: We described demographic and clinical characteristics using frequencies and/or proportions for discrete variables; medians and interquartile range (IQR) for continuous variables. We used Fisher’s exact test and Mann-Whitney test to compare baseline categorical and continuous variables, respectively, between patients with and without limited HL. We used incident rate ratios (IRR) to compare episodes of ESI, peritonitis, and hospitalizations accounting for differential durations of outcome assessment. We considered a p value of < 0.05 to represent statistical significance. We used STATA version 12.1 (College Station, TX, USA). This study was approved by the Institutional Review Board of the University of Pittsburgh.

RESULTS

Participant Characteristics: A total of 32 patients were included in the study. The mean age was 48 years, the median Charlson comorbidity index (CCI) score was 4 (2 – 8), and the median time on PD was 2.1 years (0.1 – 8.36) (Table 1).

Health Literacy Scores: The REALM scores ranged from 54 to 66. Overall, 6 patients (19%) had REALM scores ≤ 60 , consistent with the presence of limited HL, while 26 (81%) had REALM scores > 60 denoting adequate HL. All patients with limited HL had REALM scores between 45 and 60, corresponding to a 7^{th} to 8^{th} grade reading level. There were no statistically significant differences in age, racial background, comorbid illness burden, dialysis adequacy, or median time on PD between the 2 groups. Patients with limited HL were more likely to have less than a

TABLE 1
Demographics and Clinical Outcomes*

Variable	All patients (n=32)	Limited HL (n=6)	Adequate HL (n=26)	P value
Gender (female), n, %	15 (47%)	3 (50)	12 (46)	0.80
Age in years, mean (SD)	48.1 (13.4)	48.0 (10.4)	48.3 (10.4)	0.90
Race (African-American), n (%)	11 (34)	4 (67)	7 (27)	0.06
Education (<high school), n (%)	13 (41)	5 (83)	8 (31)	0.02
CCI, median (IQR)	4 (2–8)	4 (3–7)	4 (2–8)	0.7
Diabetes mellitus, n (%)	10 (31.3)	1 (0.17)	9 (0.35)	0.39
Time on PD in years, median (IQR)	2.1 (0.1, 8.4)	2.6 (0.2, 4.1)	2.0 (0.1–8.4)	0.6
ESI	0.15	0.0	0.17	0.11
Peritonitis	0.16	0.21	0.15	0.55
Hospitalization	0.84	1.14	0.82	0.23

HL = health literacy; SD = standard deviation; CCI = Charlson comorbidity Index; IQR = interquartile range; PD = peritoneal dialysis.

* Outcomes reflect event rates per year on PD.

high school education than those with adequate HL (83% vs 31%, $p = 0.02$).

Association of Limited Health Literacy with Study Outcomes: There were 15 total episodes of ESI, 16 total episodes of peritonitis, and 87 hospitalizations in the entire study cohort. Compared with patients with adequate HL, patients with limited HL had similar annual incident rates of ESI (IRR = 0.0 vs 0.17, $p = 0.11$), peritonitis (IRR = 0.21 vs 0.15, $p = 0.55$), and hospitalizations (IRR = 1.14 vs 0.82, $p = 0.23$) (Table 1).

DISCUSSION

In this study, a notable proportion of patients receiving chronic PD demonstrated limited HL. However, limited HL does not appear to be associated with an increased incidence of infectious complications or a greater number of hospitalizations.

To our knowledge, there have been two other studies which examined HL in patients on chronic PD. One small study that enrolled 14 patients on chronic PD used the REALM to assess HL and found that 7 (50%) had scores < 60 consistent with limited HL (11). The second study used the S-TOFHLA (Short Test of Functional Health Literacy in Adults) and reported limited HL in 1 out of 18 PD patients (6%) (12). In our study, 6 of 32 patients (19%) demonstrated limited HL using the REALM which closely mirrors that seen in recent studies of patients receiving chronic HD (5,8). A study of 260 patients receiving chronic HD by our group found that 41 (16%) had limited HL based on REALM scores ≤ 60 (5). A recent meta-analysis by Fraser *et al.* that included 6 studies of patients with various levels of chronic kidney disease or ESRD used a number of different HL assessment tools including the REALM and reported a pooled prevalence of limited HL of 22.7% (95% confidence interval 20.6 – 24.8) (8). Thus, it appears that the prevalence of limited HL in patients receiving chronic PD in our study is comparable to that among the broader

population of patients receiving chronic HD and the general population (15).

A series of recent studies also demonstrated an association of limited HL with adverse outcomes among patients receiving chronic HD. Cavanaugh *et al.* found that incident HD patients with limited HL are more likely to die than those with adequate HL (9). Our group previously documented that patients on chronic HD with limited HL are more likely to visit an emergency department, miss dialysis, and be hospitalized than patients with adequate HL (6). In the present study, we found no association of limited HL with ESI, episodes of peritonitis, or hospitalizations. We believe that this is likely related to the very rigorous and thorough process of training that all patients initiating chronic PD at the University of Pittsburgh undergo. This 5-day training is conducted by nurses with extensive experience with PD and involves hands-on training with direct verbal instruction with little reliance on print materials. It also requires that patients be observed successfully performing an exchange. Moreover, retraining of all patients takes place annually as well as following a hospitalization and/or episode of peritonitis. Our findings suggest that limited HL should not preclude patients from being considered candidates for chronic PD therapy, particularly if they receive adequate training.

There are several limitations to the current study. First, we enrolled a small number of patients from a single medical center, which increases the potential for selection bias, thereby limiting the generalizability of our findings and decreasing the power of the analysis. Larger studies are needed to confirm the effect of limited HL on other key outcomes in this patient population, including cardiovascular events, transplant, and mortality. Second, our assessment was based on a 1-time administration of the REALM. However, there is little reason to believe that HL scores will change significantly over time. Third, we limited our analysis to key infectious-related complications and hospitalizations, as we believed *a priori* that such complications could be influenced by patients' HL level.

In summary, limited HL is reasonably common in patients treated with chronic PD, but does not appear to be associated with key adverse infectious complications or hospitalizations. The provision of comprehensive literacy-sensitive training by experienced nurses to patients at the time they initiate PD may negate any potential impact of limited HL on PD-related outcomes.

DISCLOSURES

SDW is an employee of the Department of Veterans Affairs. The opinions expressed in this article are those of the authors and do not represent the views of the Department of Veterans Affairs or the US Government.

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