Psychological Assessment

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Validation of the Shortened Perceived Medical Condition Self-Management Scale in Patients With Chronic Disease

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Self-efficacy, or perceived competence, has been identified as an important factor in self-management behaviors and health outcomes in patients with chronic disease. Measures of self-management self-efficacy are currently available for multiple forms of chronic disease. One established measure is the 8-item Perceived Medical Condition Self-Management Scale (PMCSMS). This study investigated the use of the PMCSMS in samples of patients with a chronic disease to develop an abbreviated version of the scale that could be more readily used in clinical contexts or in large population health cohort studies. The PMCSMS was administered as either a generic scale or as a disease-specific scale. The results of analyses using item response theory and classical test theory methods indicated that using 4 items of the scale resulted in similar internal consistency (α = .70–0.90) and temporal stability (test–retest r = .75 after 2 to 4 weeks) to the 8-item PMCSMS (r = .81 after 2 to 4 weeks). The 4 items selected had the greatest discriminability among participants (α parameters = 2.49–3.47). Scores from both versions also demonstrated similar correlations with related constructs such as health literacy (r = .13–0.29 vs. 0.14–0.27), self-rated health (r = .17–0.48 vs. 0.26–0.50), social support (r = .21–0.32 vs. 0.25–0.34), and medication adherence (r = .20–0.24 vs. 0.20–0.25). The results of this study indicate that 4-item PMCSMS scores are equally valid but more efficient, and have the potential to be beneficial for both research and clinical applications.

Public Significance Statement
This study demonstrates, through the use of both traditional and modern evaluations of test items, the effectiveness of a shortened version of an existing scale designed to measure self-management self-efficacy of patients with chronic disease.

Keywords: self-efficacy, perceived competence, chronic disease, self-management

Perceived competence (Wallston, Wallston, Smith, & Dobbins, 1987), or the belief that one is capable of exhibiting a behavior or set of behaviors to achieve valued goals, has been identified as a construct of importance in the maintenance of self-care behaviors, particularly in the context of chronic diseases. Self-care behaviors have been associated with increased likelihood of positive health outcomes for patients with chronic disease. Specifically, perceived health competence has been associated with greater medication adherence (Williams, Freedman, & Deci, 1998; Williams, Rodin, Ryan, Grolnick, & Deci, 1998), dialysis treatment adherence (Christensen & Ehlers, 2002), following of dietary restrictions (Clark-Cutaia, Ren, Hoffman, Burke, & Sevick, 2014; Samuel-

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Hodge, DeVellis, Ammerman, Keyserling, & Elasy, 2002), and participation in exercise (Talbot, Nouwen, Gingras, Gosselin, & Audet, 1997), as well as better glycemic control in patients with diabetes (Iannotti et al., 2006) and lower serum phosphorus in patients treated with chronic hemodialysis (HD; Umeukeje et al., 2015; Wild et al., 2017). Additionally, perceived competence has demonstrated relationships with lower depressive symptoms (Williams, McGregor, King, Nelson, & Glasgow, 2005) and negative attitudes toward disease and life outcomes (Anderson, Funnell, Fitzgerald, & Marrero, 2000), and higher patient satisfaction (Williams et al., 2005). Yet measures of perceived competence brief enough to be effectively used in large population health cohort studies and as a part of rapid clinical screening procedures are still in short supply.

Scores from the eight-item Perceived Medical Condition Self-Management Scale (PMCSMS) have been shown to be a reliable and valid way of measuring the perceived competence of patients with chronic disease in exhibiting self-management behaviors (Wallston, Osborn, Wagner, & Hilker, 2011; Wallston, Rothman, & Cherrington, 2007). Based on the Perceived Health Competence Scale (PHCS; Smith, Wallston, & Smith, 1995), a measure of generalized self-efficacy in health care, the PMCSMS has since been adapted for use both as a disease-specific measure of self-efficacy for self-management behaviors in diabetes (Wallston et al., 2007), HIV (Wallston et al., 2011), and chronic kidney disease (CKD; Wild et al., 2017), or as a generic measure that can be used without specifying an exact diagnosis (O'Neal, 2007). Prior work using the disease-specific PMCSMS has replicated that perceived competence of self-management behaviors has been associated with increased self-care behaviors (O'Hea et al., 2009; Osborn, Cavanaugh, Wallston, & Rothman, 2010; Walker, Smalls, Hernandez-Tejada, Campbell, & Egede, 2014; Wallston et al., 2007; White, Osborn, Gebretsadik, Kripalani, & Rothman, 2013). It also has been shown to mediate depression in patients with diabetes (Cherrington, Wallston, & Rothman, 2010), and to correlate with lower depressive symptom and negative affect scores and higher positive affect and quality of life scores in patients with HIV (Mukolo & Wallston, 2012). Importantly, these findings replicate across geographically and culturally diverse patient groups, supporting generalizability.

Though the eight-item PMCSMS has strong psychometric properties and is already relatively brief, further refinement of the scale could maximize its utility in clinical and research contexts. An even shorter scale could be more easily incorporated into clinic intake questionnaires, as has been done with instruments such as the three-item Brief Health Literacy Screen (BHLS; Wallace, Rogers, Roskos, Holiday, & Weiss, 2006; Wallston et al., 2014), and would further decrease survey burden in clinical trials or large observational cohort studies. Patients are already inundated with questions whenever visiting a health care provider, and survey length has been shown to be a deterrent to survey completion (Rolstad, Adler, & Rydén, 2011). Information on a patient's perceived competence to self-manage their health has tremendous value because of its association with health-related outcomes. As a result, a measure that is short enough to be administered with minimal burden on patient and provider time is highly desirable and increases the likelihood that such a measure will be adopted.

Additionally, the psychometric properties of the PMCSMS, the PHCS, and similar perceived competence constructs have been determined using classical test theory (CTT). However, there is a growing literature demonstrating the benefits of using item response theory (IRT) to construct the most reliable and discriminant measures (Embretson, 1996; Hambrick et al., 2010; Reise, Ainsworth, & Haviland, 2005). IRT uses estimates of the parameters of a specified function with known properties to model the relationship between a latent trait being measured and the items attempting to measure it (Reise et al., 2005). Utilizing the psychometric information provided by both CTT and IRT would allow for identifying a shorter measure that does not sacrifice reliability of scores as a result of item reduction (Embretson, 1996).

The goal of the current set of analyses was to further reduce the length of the PMCSMS, using both CTT and IRT methodologies, in order to create a more efficient measure that maintains the strong internal consistency and validity of scores of the original scale. The specific objectives were to reduce the number of PMCSMS items; maintain an internal consistency of Cronbach's alpha more than .70; more thoroughly understand the psychometric properties of the scale using IRT; and show similar associations with health literacy, self-reported health status, social support, and medication adherence to those found with the eight-item PMCSMS.

Method

Three independent investigations of the PMCSMS were conducted. The first study was a survey conducted with a large sample of patients who had at least one chronic disease who were members of the PatientsLikeMe (PLM; http://www.patientslikeme.com) community. The PLM community is an online patient powered research network that enables patients to share their data for research and support, and it has been used in a number of patient-reported outcome instrument development and validation studies (Bove et al., 2013; Kear, Harrington, & Bhattacharya, 2015; Tran et al., 2014). We also analyzed data from the disease-specific version of the PMCSMS administered in two separate clinical investigations of psychosocial factors in patients with kidney disease in order to cross-validate the findings from the online survey of PLM members. These participants were recruited and gave informed consent, and data were collected in person at the outpatient clinics of an academic medical center in the Southern United States.

A total of 1,261 patients with at least one chronic disease were recruited and consented in coordination with the PLM network. The primary diseases reported in this sample were multiple sclerosis (MS; $n = 638$), fibromyalgia ($n = 495$), and depression ($n = 128$). The two kidney disease patient samples recruited at the academic medical center included a sample of patients with CKD not yet receiving dialysis ($n = 237$) and a sample of patients already receiving HD ($n = 146$). Patients were required to be English-speaking, older than 18 years of age, and able to give informed consent. Additionally, the patients with CKD had an estimated glomerular filtration rate of less than 60 ml/min, and the patients on dialysis had been receiving HD for at least 30 days. All research procedures were Institutional Review Board (IRB) approved.

The eight-item PMCSMS was administered to all participants across samples. The PMCSMS is intended to measure patients' belief that they are capable of carrying out the self-management behaviors required by their medical condition. The scale is composed of four positively worded items and four negatively worded

items, each rated on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Negatively worded items are reversed scored, yielding a total score ranging from 8 to 40, with a higher score indicating stronger belief of perceived self-management competence. Scores from the eight-item scale have demonstrated internal consistency, test–retest reliability, and validity in multiple contexts across conditions (Wallston et al., 2007, 2011; Wild et al., 2017).

The generic version of the PMCSMS was used in the PLM sample of patients. The phrase "medical condition" was used in each item and participants completing the survey were asked to think of the condition that most affects them when responding to the items. The PMCSMS was administered a second time to participants in the PLM sample 2 to 4 weeks after the initial administration for the purpose of establishing test–retest stability. A total of 495 participants across the three chronic conditions responded to this follow-up. In the two clinical cross-validation studies, the phrase "medical condition" was replaced with the specific context (e.g., "kidney disease" or "dialysis") in each item.

Additionally, all three samples self-rated their health status on a 5-point scale ranging from *poor* to *excellent*. The BHLS (Cavanaugh et al., 2015; Chew, Bradley, & Boyko, 2004), a three-item measure of self-reported health literacy, was also collected from all participants. In the PLM sample, the six-item Enhancing Recovery in Coronary Heart Disease (Mitchell et al., 2003) social support inventory was used to assess perceived social support, and the seven-item version of the Adherence to Medications and Refills Scale (Kripalani, Risser, Gatti, & Jacobson, 2009) was used to assess medication adherence. In the dialysis sample, the Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet, & Farley, 1988) was used to measure an individual's perceived social support. The dialysis sample also completed a three-item medication adherence subscale of the Kidney Disease Behavior Inventory (Wild et al., 2017).

Data for the PLM and clinical samples were analyzed independently and then compared. For all samples, internal consistency reliability scores were calculated using IBM SPSS software (PASW Statistics 22.0). Comparisons of correlation coefficients using *z* scores were performed using a tool developed by Lee and Preacher (2013), which controls for the fact that the correlations being compared are from the same sample. For all samples, Spearman's correlation coefficients were calculated using IBM SPSS software and the psych package in R (Revelle, 2014). Data were only used when at least 75% of multi-item scales had been completed. In those instances, missing data were replaced with the average of the completed items for the given measure.

IRT analysis was performed on the PLM sample data, using the graded response model (GRM; Samejima, 1970, 2010). IRT is a strong measurement theory built on a set of assumptions about the data being modeled. These assumptions include known dimensionality; local independence, which is usually the case if a test is unidimensional (Hambleton & Swaminathan, 2013); and a latent variable that is monotonically related to item response probability. A variety of graphical and statistical techniques can be used to test these assumptions. To that end, a one-factor confirmatory factor analysis (CFA) was applied to test the applicability of a unidimensional polytomous IRT model to the PMCSMS data from the PLM sample.

The GRM (Samejima, 1970, 2010) is an appropriate model for ordered categorical data and was selected to be applied to this data set. The generalized partial credit model (GPCM; Muraki, 1992, 1997) is another model that can be applied to ordered categorical data and was compared for fit to the PMCSMS data. Model fit was assessed and compared between models using two fit statistics: the M_2 and root mean square error of approximation (RMSEA) statistics. Item-level fit was assessed using the chi-square statistic, and standard errors for item parameters are reported for the preferred model. Item information for all eight items and aggregated test information are also presented. Finally, differential item function (DIF) analyses were conducted for all eight items to assess equivalence of measurement across gender and by respondent condition (fibromyalgia, MS, or depression). CFA analyses were conducted using Stata 14 (StataCorp, 2015), and all IRT analyses were conducted with IRTPro 3.0 (Scientific Software International, 2015). Statistical significance was evaluated at $p < .05$.

Results

Of the 1,261 patients in the PLM sample, 82.7% (n = 1,048) were female, 89.5% (n = 1,134) were White, 48.9% (n = 620) had a college degree, and 57.3% (n = 726) were 50 years of age or older. In the CKD sample, 55.3% (n = 131) of participants were female, 83.1% (n = 197) were White, 31.6% (n = 75) had a college degree, and 75.9% (n = 180) were over the age of 50. Participants in the sample of patients receiving dialysis were 48.6% (n = 71) female, 28.1% (n = 41) White, with 15.8% (n = 23) having a college degree, and 56.2% (n = 82) over the age of 50.

Scale and IRT Analyses of the PMCSMS

The one-factor CFA model demonstrated reasonable fit (confirmatory fit index [CFI] = 0.908; Tucker-Lewis index [TLI] = 0.871; standardized root mean square residual [SRMR] = 0.063; and coefficient of determination [CD] = 0.910), with only RMSEA (0.137) and CFI/TLI higher than would be expected for a well-fitting model. The RMSEA has been shown to penalize models with small numbers of variables (Fan & Sivo, 2007). The CFA analysis suggested that a unidimensional IRT model reasonably fits to the eight PMCSMS items. Model fit testing for the GRM applied to the eight PMCSMS items produced a large M_2 figure (M_2 = 5,069.51 [df = 440]). Model fit was supported by the RMSEA value (0.09). The fit of the GPCM was less strong by both measures (M_2 = 17,729.29 [df = 440]; RMSEA = 0.18). Item-level fit statistics showed good fit (χ^2 $p > .01$) for two items (Items 4 and 8) to the GRM, and for one item (Item 8) to the GPCM. These results suggest that the GRM is a better IRT model for the PMCSMS data.

Figure 1 shows the category response functions for the eight items. This figure shows that the five response categories are operating as expected for Items 5 through 8. For the first four items, the second category is the most probable response category for only a very small range of the trait continuum (never for Item 1), suggesting weaker support for the ordered nature of the five categories for these items.

Item parameters and standard errors for the GRM are shown in Table 1. Category boundary location parameters show that the items each measure across a broad range of the trait continuum, with Items

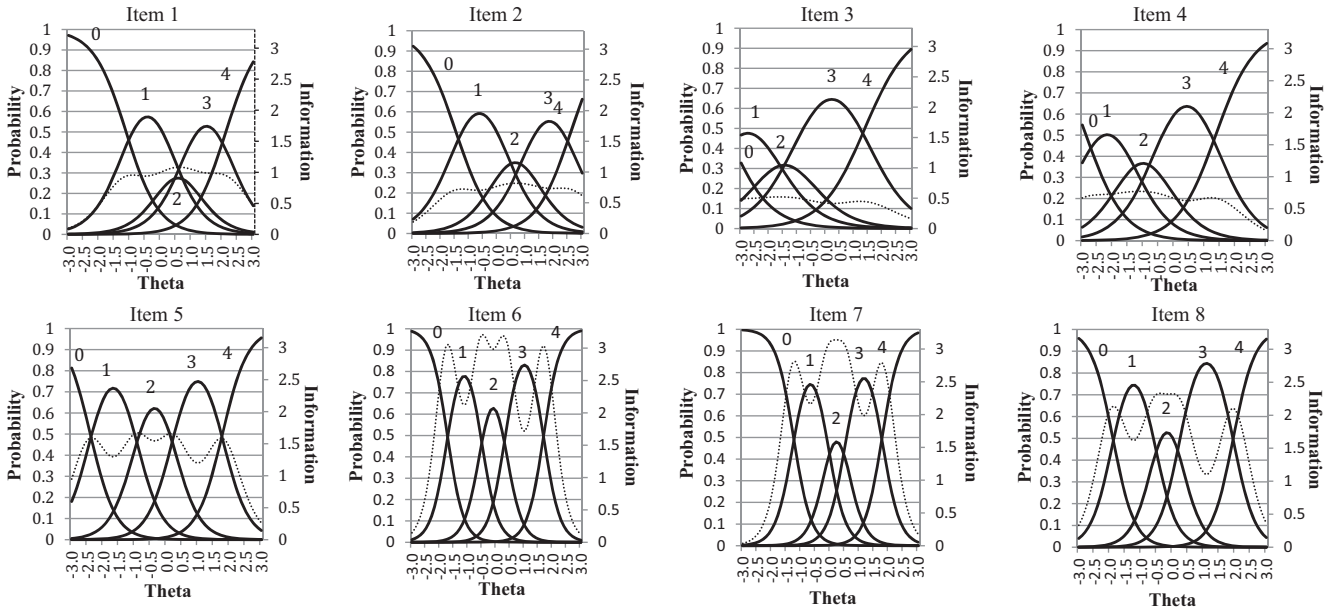

Figure 1. Category boundary response functions and item information functions for eight PMCSMS items. The five response categories are operating as expected for Items 5–8. For the first four items, the second category is the most probable response category for only a very small range of the trait continuum (never for Item 1), suggesting weaker support for the ordered nature of the five categories for these items.

5 to 8 doing so while providing higher levels of discrimination than the first four items. Figure 2 shows the test information function (TIF) for the PMCSMS-8 total score, for the PMCSMS-4 total score, as well as showing information functions for each item. This figure shows that the PMCSMS-8 total score provides higher levels of measurement precision (information >10.0) between theta: −2.0–2.0, which covers more than 95% of the trait scale. The PMCSMS-4 total score TIF shows some loss of measurement precision but with the greatest precision (information >7.5) over the same range of the trait scale. Tests of DIF based on the GRM showed no overall item DIF on the basis of gender, although at the parameter level, the discrimination parameter for Item 1 was larger for male than for female respondents (female a = 1.78, male a = 2.42; $\chi^2 = 4.0$ [1 *df*], $p = .045$). Testing item functioning across respondents in the three conditions represented in the dataset (fibromyalgia, MS, depression) identified overall item DIF for Item 1 and Item 3. This resulted from significant differences for the location parameters (Item 1: $\chi^2 = 22.6$ [4 *df*], $p < .001$; Item 3: $\chi^2 = 17.7$ [4 *df*], $p = .001$). Inspection of category location parameters shows that Item 1 is significantly more difficult for the fibromyalgia participant group to endorse than for MS or depression participant groups. In contrast, Item 3 is

Table 1
Results of Classical Test Theory and Item Response Theory Analysis of the PMCSMS in the PLM Sample

Items	Category boundary (b_{ij}) parameters (*SE*)				Discrimination (a_i) parameter (*SE*)	Corrected item-to-total correlation	Alpha if item removed
	b_{i1}	b_{i2}	b_{i3}	b_{i4}			
Item 1 (r)	−1.13 (.06)	.26 (.05)	.86 (.06)	2.11 (.11)	1.88 (.10)	.64	.88
Item 2 (r)	−1.48 (.08)	.18 (.05)	1.07 (.07)	2.59 (.14)	1.64 (.09)	.59	.88
Item 3	−3.55 (.23)	−1.97 (.11)	−.97 (.07)	1.37 (.09)	1.31 (.08)	.50	.89
Item 4	−2.88 (.16)	−1.50 (.08)	−.54 (.05)	1.34 (.08)	1.60 (.09)	.57	.88
Item 5	−2.41 (.11)	−.96 (.05)	.21 (.04)	1.77 (.08)	2.49 (.13)	.71	.87
Item 6	−1.74 (.07)	−.54 (.04)	.31 (.04)	1.68 (.07)	3.47 (.19)	.77	.86
Item 7	−1.26 (.05)	−.10 (.04)	.53 (.05)	1.77 (.08)	3.32 (.18)	.78	.86
Item 8	−1.91 (.08)	−.58 (.04)	.23 (.04)	1.94 (.09)	2.89 (.15)	.74	.87

Note. Items followed by "(r)" are reverse-scored. Bolded items indicate the best performing items. Item wording: Item 1, "It is difficult for me to find effective solutions for problems that occur with managing my medical condition"; Item 2, "I find efforts to change things I don't like about my medical condition are ineffective"; Item 3, "I handle myself well with respect to my medical condition"; Item 4, "I am able to manage things related to my medical condition as well as most other people"; Item 5, "I succeed in the projects I undertake to manage my medical condition"; Item 6, "Typically, my plans for managing my medical condition don't work out well"; Item 7, "No matter how hard I try, managing my medical condition doesn't turn out the way I would like"; Item 8, "I'm generally able to accomplish my goals with respect to managing my medical condition." PMCSMS = Perceived Medical Condition Self-Management Scale; PLM = PatientsLikeMe; *SE* = standard error.

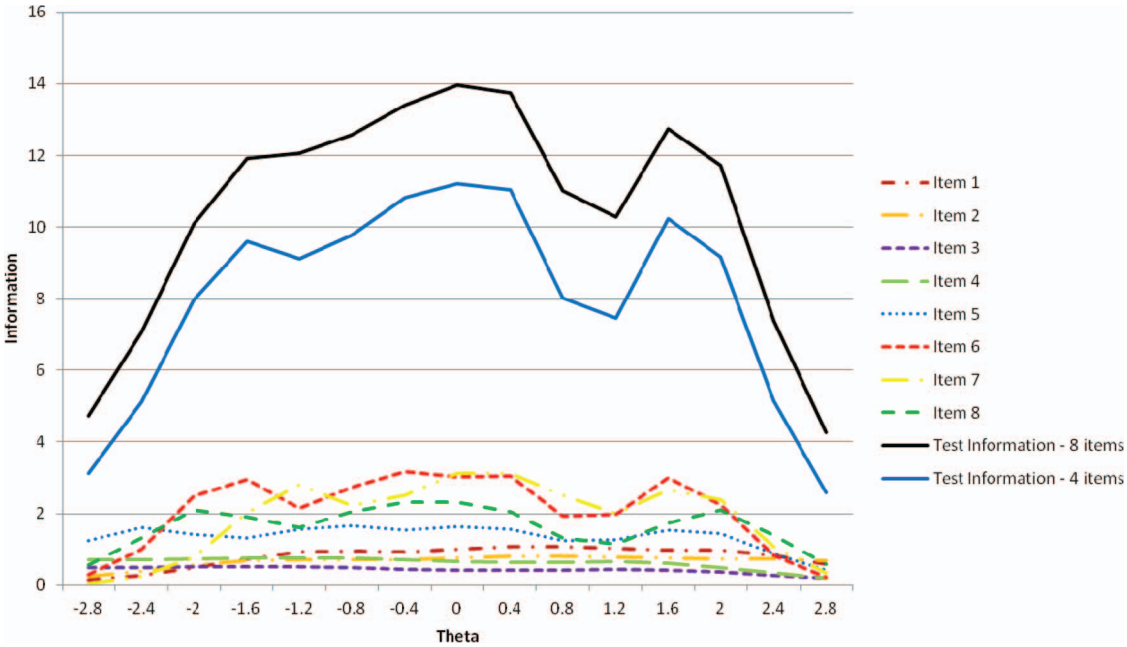

Figure 2. Test information functions and item information functions for PMCSMS-8 items. The four items selected for the PMCSMS-4 (indicated by solid blue line) perform similarly to the PMCSMS-8, though do provide less overall test information. The four items selected for the PMCSMS-4 (Items 5–8; dashed lines) provide the greatest item information across the range of theta. See the online article for the color version of this figure.

significantly easier for the fibromyalgia participant group to endorse than it is for MS or depression participant groups. Results for CTT analyses conducted on data from the PLM sample are also shown in Table 1. The last four items were also the items that resulted in the greatest loss of internal consistency if removed from the scale. Therefore, these four items comprise the short form of the PMCSMS.

Internal Consistency and Test–Retest Reliability of PMCSMS-4 Scores

Using the last four items of the PMCSMS-8 yielded Cronbach's alphas that were above 0.70 in all samples tested, with very similar performance to that of the full measure. In contrast, using the first four items (Items 1 through 4) as an alternative short form of the PMCSMS did not yield similar internal consistencies to the eight-item version (see Table 2). This replicates the IRT findings that the last four items are an equivalent distillation of the full measure that maintains the balance of two positively worded and two negatively worded items. Additionally, the range of Cronbach's alpha from 0.70 to 0.90 indicates that the PMCSMS-4 performed well across conditions and regardless of generic or disease specific wording. Furthermore, test–retest reliability of PMCSMS-4 scores in the PLM sample ($r = .75$, $p < .01$) revealed that the last four items were stable over a 2- to 4-week interval, similar to the eight-item version ($r = .81$, $p < .01$).

Validity of PMCSMS-4 Scores

The PMCSMS-4 total score was compared with several other measures that have been shown previously to be associated with

Table 2
Cronbach's Alphas and Average Interitem Correlations for the PMCSMS

Respondent conditions	*n*	Nonselected items[a]	PMCSMS-4 items	PMCSMS-8 items
PLM generic version	1,261	.71 (.38)	.88 (.65)	.89 (.50)
Fibromyalgia subsample	476	.63 (.30)	.87 (.62)	.86 (.43)
Multiple sclerosis subsample	619	.70 (.37)	.85 (.60)	.88 (.47)
Depression subsample	124	.75 (.43)	.90 (.69)	.90 (.53)
Specific condition version				
Hemodialysis	146	.56 (.25)	.70 (.37)	.76 (.29)
Chronic kidney disease	237	.64 (.32)	.76 (.44)	.83 (.39)

Note. Average interitem correlations are shown in parentheses. PMCSMS = Perceived Medical Condition Self-Management Scale; PLM = PatientsLikeMe.
[a] Items 1–4 on the PMCSMS-8.

the eight-item PMCSMS total score to ensure that the abbreviated measure had a similar relationship to related constructs as the original scale. PMCSMS-4 scores were positively correlated with all four of these constructs, maintaining equivalent relationships to those observed for the full eight-item version in all three samples examined (see Table 3). The most extreme difference between the four- and eight-item measures was in their relationship with health literacy ($r = .22$ vs. $r = .27$, respectively) in the PLM sample. Although the effect size difference was small, it was statistically significant ($z = 5.8$, $p < .0001$). This pattern was also the case for perceived social support and self-rated health status. No other differences in correlations were found to be significant between the two versions of the PMCSMS in the other samples.

Discussion

The results from the analyses summarized in this study indicate that the abbreviated, four-item version of the PMCSMS produces valid and reliable scores that not only replicate the strong psychometric properties of the original eight-item scale but also work well across conditions and with both generic and disease-specific wording. These results are promising for the use of the PMCSMS-4 in future research, particularly in epidemiological studies of the psychosocial factors affecting health outcomes in chronic disease or clinical trials in which self-care may be a significant factor in achieving the desired outcome. Additionally, the PMCSMS-4 has promise for use in clinical contexts as a screening tool for identifying those at high risk of nonadherence to recommended self-management behaviors because of low perceived competence. Systematically assessing psychosocial factors in order to identify people at highest risk could be incorporated into screening practices and electronic medical records to improve precision medicine by incorporating psychosocial determinants of risk. A similar approach has been successfully used to identify individuals with low health literacy using the BHLS (Cawthon, Mion, Willens, Roumie, & Kripalani, 2014; Wallston et al., 2014). Health literacy has been tied to self-efficacy, with the latter viewed as the causal pathway through which health literacy affects glycemic control in diabetes (Osborn et al., 2010). Using the PMCSMS-4, possibly in conjunction with the BHLS or other clinical screening measures such as those for depression, would capitalize on the efficiency of the instrument and the demonstrated links between self-efficacy, self-management behaviors, and health outcomes in chronic disease. These links have led to an increased interest in interventions to improve patient self-efficacy and self-management, with current work demonstrating promising effectiveness of such interventions (Jerant et al., 2016; Joboshi & Oka, 2017). The PMCSMS-4 could be an appropriate instrument for identifying patients in greatest need of such interventions and for screening purposes in larger scale studies designed to examine self-efficacy interventions.

Table 3
Correlations of the PMCSMS-8 and PMCSMS-4 With Other Constructs by Sample

Related constructs	PLM sample (n = 1,261)	Dialysis sample (n = 146)	CKD sample (n = 237)
PMCSMS-8			
Perceived social support	.34***	.25**	N/A
Health literacy	.27***	.26***	.14*
Self-rated health status	.50***	.30***	.26***
Medication adherence	.25***	.24**	.20**
PMCSMS-4			
Perceived social support	.32***	.24**	N/A
Health literacy	.22***	.24**	.13*
Self-rated health status	.48***	.29***	.24***
Medication adherence	.24***	.22**	.20**
z score of difference between eight-item and four-item correlations			
Perceived social support	2.38*	.28	N/A
Health literacy	5.80***	.55	.45
Self-rated health status	2.59**	.28	.91
Medication adherence	1.58	.55	.00

Note. PMCSMS = Perceived Medical Condition Self-Management Scale; PLM = PatientsLikeMe; CKD = chronic kidney disease; N/A = not available.
* $p \leq .05$. ** $p < .01$. *** $p < .001$.

One of the major strengths of these analyses is the utilization of IRT along with classical item analysis to reduce the items from the PMCSMS. IRT has been demonstrated to have advantages over traditional item reduction approaches for psychometric evaluations (Fraley, Waller, & Brennan, 2000), and has been used to evaluate measures of generalized self-efficacy (Scherbaum, Cohen-Charash, & Kern, 2006). Combining IRT with traditional approaches offers greater confidence that the four items of the PMCSMS-4 are the most consistent and discriminant items from the original measure. The results of the IRT analysis showing the PMCSMS-4 to be most effective at distinguishing among low-scoring individuals is both psychometrically beneficial and encouraging for identification and characterization of at-risk individuals with the most potential to respond to an intervention.

There are limitations to consider. The data were collected from a wide variety of populations; however, all but one of the samples included in these analyses was cross-sectional, limiting the extent to which causal trends related to health behaviors and outcomes could be compared across the different versions of the PMCSMS. In addition, the majority of participants were women, potentially limiting generalizability across gender, though stratification by gender did not alter results. It is also the case that both samples used for cross-validation of the chronic-disease-specific wording consisted of patients with kidney disease, meaning that the generalizability across chronic diseases of the disease-specific PMCSMS-4 will need confirmation from further work on other chronic conditions. Additionally, test–retest reliability of scores from the abbreviated PMCSMS-4 was only conducted using the generic version of the scale from the PLM sample, though test–retest reliability has been established for scores from the eight-item disease-specific PMCSMS in previous work (Wild et al., 2017). The psychometric properties of the generic version used in the PLM sample were stronger than those demonstrated in the disease-specific version. This may be related to the smaller sample sizes used for the disease-specific versions; however, further work will need to examine these differences in detail.

The PMCSMS-4 demonstrates similar psychometric qualities as the original eight-item scale and offers promise as an exceptionally efficient means of assessing self-care self-efficacy in the context of chronic disease. Future work can elucidate the potential benefits of such a screening tool, which could offer the opportunity to identify individuals who are at high risk of nonadherence to vital self-management behaviors related to low perceived competence. Ef-

ficient early identification, permitting allocation of targeted intervention resources, could substantially mitigate the negative health outcomes associated with nonadherence. The PMCSMS-4, shown in this study to be an effective and versatile tool for measuring self-management self-efficacy in chronic disease, is an important step toward this goal.

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