Cross-validation of an Instrument Measuring Students Attitudes Toward Pharmaceutical Care

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The purpose of this study was to further validate the construct validity, reliability, and scaling properties of a previously developed 13-item instrument that measures pharmacy students attitudes toward pharmaceutical care, the Pharmaceutical Care Attitudes Survey (PCAS). The PCAS was distributed to 115 second-year professional pharmacy students at the University of Georgia in the Disease Management I course during November 1997. Eighty-nine students (77 percent) completed and returned the survey. Means and standard deviations for each of the 13-items and the three scales of the PCAS were calculated. The distribution of item responses, item to intended scale total correlations, inter-scale correlations, item to competing scale correlations, item discriminant validity tests, and Cronbach's alpha were calculated. Overall, students have positive attitudes toward pharmaceutical care demonstrated by transformed scores of 84.38, 82.02, and 72.50 for the "professional benefit", "professional duty", and "return on effort" scales, respectively (transformed scores ranged from 0 to 100 with higher scores representing more positive attitudes toward pharmaceutical care). The reliability estimates (Cronbach's alphas) of the three scales of the PCAS range from 0.69 to 0.93 and all item to scale correlations are greater than 0.40. Results of this investigation provide additional evidence that the PCAS is a reliable instrument and suggests that the PCAS is a valid instrument with three separate constructs.

INTRODUCTION

Although the philosophy of pharmaceutical care has been adapted by several professional pharmacy organizations and the Commission to Implement Change in Pharmaceutical Education stated that the mission of pharmacy practice is to render pharmaceutical care, several barriers have interfered with its practice(1-6). Common barriers identified include lack of time to provide pharmaceutical care due to pharmacists' time being occupied by predefined tasks such as drug order entry, deficient clinical knowledge and communication skills of personnel, pharmacists lacking self-confidence, deficient number of pharmacy technicians to help with dispensing duties, and pharmacists being physically distant from patient care areas hindering pharmacist-patient interaction. Additionally, negative attitudes of pharmacy practitioners toward performing pharmaceutical care have been identified as one of the most significant barriers interfering with its practice(6-9).

Many studies have been published describing the important role that pharmacy educators and practitioners have in fostering the development of pharmaceutical caring practitioners(10-19). In 1992, Adamcik stated that adequate knowledge, skills, and a set of values and attitudes which support the assumption of enhanced responsibility for performing pharmaceutical care is needed in pharmacy education(10). In support of this, Berardo expressed that faculty at colleges of pharmacy should develop a teaching methodology that encourages the development of pharmacists who have the desire to practice pharmaceutical care(11). It is clear that the challenge for pharmacy educators is to not only instill in their students a strong clinical knowledge base, excellent communication skills, and self-confidence to assume responsibility for pharmacotherapy outcomes, but also to instill a high level of motivation and commitment to performing pharmaceutical care(12-14). By promoting and monitoring attitudes toward pharmaceutical care of students who will become future practitioners, educators may be able to expand the provision of pharmaceutical care in the future. A literature search revealed many studies describing teaching pharmacy students' knowledge and skills necessary to perform pharmaceutical care activities(15-18). However, the literature is scarce describing studies that foster the development of positive pharmaceutical care attitudes among pharmacy students and practicing pharmacists(19). One explanation for the limited literature describing students' pharmaceutical care attitudes may have to do with the limited research available on valid and reliable instruments that measure pharmaceutical care attitudes(20).

In 1996 the investigators of this study developed a 13-item instrument assessing pharmacy students' attitudes towards providing pharmaceutical care activities. This instrument is referred to as the Pharmaceutical Care Attitudes Survey (PCAS)(20). As part of the initial instrument development and validation phase of the study published in 1997, survey items were generated, exploratory factor analyses of the items were conducted, and reliability (internal consistency) of the PCAS was assessed. The results of the first phase of the study identified three constructs ("professional benefit", "professional duty", and "return on effort") and found those constructs to be reliable (see Appendix for scale items, scale labels, and item scale labels)(20). Although exploratory factor analysis is a good tool to construct measurement models, it should be

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followed by a cross-validation with a confirmatory factor analysis on new data(21).

Since the 1997 publication of the instrument, the investigators have received numerous communications about the importance of such an instrument as the PCAS to measure students' attitudes toward pharmaceutical care(20). Due to the value and need for an instrument to measure pharmacy students' attitudes toward pharmaceutical care, the investigators believed that cross-validation of this instrument was important and necessary. Therefore, the purpose of this study was to assess the construct validity, reliability and scaling properties of the PCAS on a new set of student subjects. Specific study objectives included assessing the construct validity and reliability and determining whether the scale items of the PCAS can be summed to composite scale scores.

METHODS

Study Population and Survey Administration

Since the 1996 data (which was used to develop the PCAS) was based on 135 first and fourth-year professional pharmacy students, the investigators wanted to determine the instruments' viability on other professional year students other than first and fourth-year pharmacy students. Therefore, second-year professional pharmacy students were selected as the study population for the validation phase of the PCAS. Second-year pharmacy students were also selected because by November 1997 all pharmacy students at the University of Georgia College of Pharmacy, with the exception of first and second-year professional pharmacy students, had prior exposure to the PCAS in its initial development phase.

Second-year professional pharmacy students at the University of Georgia College of Pharmacy were taught in the Disease Management I course (PHRM 4850) that pharmaceutical care is the responsible provision of medication therapy for achieving definite outcomes that improve a patient's quality of life and involves pharmacists working with patients and other health care professionals in designing, implementing, and monitoring a therapeutic plan for achieving definite outcomes (8,14,22). After teaching basic pharmaceutical care principles, all second-year pharmacy students enrolled in PHRM 4850 (n=115) were given the PCAS in November 1997. Participation in the study was voluntary and the identity of each student respondent was anonymous. Each student was asked to respond to each of the 13-items of the PCAS by using a five-point Likert scale ranging from 1 = "strongly disagree" to 5 = "strongly agree."

Psychometric and Statistical Analyses

Data were entered in Microsoft Excel Version 5.0 and then downloaded into SAS Version 6.12 for analyses. The Multi-trait/Multi-item Analysis Program (MAP-R) was used to generate item level descriptive statistics, item discriminant validity tests, and to generate a multi-attribute monomethod correlation matrix(23).

Of the 13 items in the PCAS, one item was designed to assess attitudes concerning the provision of pharmaceutical care services while students are on clerkships as part of their pharmacy education. Since this item may not be relevant to all pharmacy students (in particular those students who have not yet been exposed to clerkship experiences such as the case with this study population), previous research with the PCAS suggested the use of a reduced 12-item (PCAS-reduced) instrument without the clerkship item(20). Since there are two forms of the instrument (one including the clerkship item and one without the clerkship item), psychometric analyses were performed for both the full PCAS and the PCAS-reduced instruments. When the results for the PCAS-reduced instrument differ substantially from the full PCAS instrument, those results are reported.

Means and standard deviations for each of the 13-items and three scales were calculated. Two negatively worded items ("Time" and "Add Work") were reversed scored so that higher scores represent more positive attitudes towards pharmaceutical care. Summated total scales were transformed to a 0-100 scale to ease the ability of interpretation across the three scales of the survey. The variability (range and standard deviation) of summated scale scores was determined. To insure that the items within the scale adequately represent the continuum of possible values for each construct and to assess the ability of the scale to detect cross sectional or longitudinal differences, the percentage of respondents scoring at the floor and ceiling was documented.

In performing the psychometric analysis, the following item scaling assumptions were assessed: (*i*) item means should be roughly equivalent within a scale; (*ii*) items within a scale should have roughly equal variances with standard deviations near 1.0; (iii) items should be linearly related to the scale corrected for overlap with correlations to scale total greater than 0.30; (*iv*) items should have roughly symmetrical distributions; and (*v*) all items responses should be used(23). If the five conditions above are met, the PCAS meets the generally accepted criteria for summated rating scales.

Item discriminant validity was assessed by determining if item to intended scale total correlations are significantly greater than item to competing scale correlations. Evidence of construct validity was obtained using the item discriminant validity approach when all or nearly all items within a scale are more substantially correlated with the intended hypothesized scale than competing scales. Operationally, significant differences were defined as correlation coefficients that are at least two standard errors apart which is based upon Stepper's t-test for two dependent correlations(24). Additional evidence of construct validity was assessed by constructing a multi-trait monomethod correlation matrix conceptualized by Campbell and Fiske(25). Scale-scale correlations should be less than their reliability coefficients (diagonals of the multi-trait monomethod correlation matrix). These item discriminant validity tests and multi-trait monomethod correlation matrix approaches are confirmatory as the hypothesized relationships of items to scales were identified a priori. Reliability was assessed by calculating Cronbach's alphas for each scale.

RESULTS

A total of 89 students completed and returned the survey (77 percent response rate). The mean age of the students was 23.22 (SD=3.49), 59 percent were female, 79 percent were single (never married), and 85 percent had some pharmacy work experience. There was no difference in

Table I. PCAS scale descriptive statistics

Scale	Raw mean (SD)	Standardized Mean (SD)	Minimum score: Maximum score[a]	Range[a]	Percent at ceiling[b]
Professional Duty (PD)	12.84 (1.85)	82.02 (15.38)	42 :100	58	19.1
Return on Effort (ROE)	7.80 (1.71)	72.47 (21.42)	0 :100	100	20.2
Professional Benefit (PB)	35.00 (4.66)	84.38 (14.57)	25 :100	75	20.2

[a]Applies to transformed scores.
[b]Percent of students responding at the ceiling of scales (transformed scale scores = 100).

Table II. PCAS item descriptive statistics

			Response values frequency				
Item name	Scale name	Scale mean (SD)	1	2	3	4	5
Should	Professional Duty	4.47 (0.72)	0	3	3	32	51
Pre_Solv	Professional Duty	4.31 (0.76)	0	3	7	38	41
Practice	Professional Duty	4.06 (0.82)	0	4	15	42	28
Time	Return on Effort	3.70 (1.06)	2	14	13	40	20
Add_Work	Return on Effort	4.10 (0.89)	2	3	10	43	31
Value	Professional Benefit	4.56 (0.62)	0	1	3	30	55
Like	Professional Benefit	4.36 (0.73)	1	0	7	39	42
Clerk	Professional Benefit	4.12 (0.81)	1	3	9	47	29
Reward	Professional Benefit	4.40 (0.69)	0	2	4	39	44
Direction	Professional Benefit	4.42 (0.67)	0	1	6	37	45
Benefit	Professional Benefit	4.28 (0.80)	1	1	10	37	40
Improve	Professional Benefit	4.52 (0.66)	1	0	2	35	51
Career	Professional Benefit	4.34 (0.64)	0	0	8	43	38
		Grand Totals	8	35	97	502	515

gender between the sample completing the survey and the second-year class, however those completing the survey were 1.3 years younger ($P<0.05$). The wording for each of the PCAS items is found in Appendix A. The raw scale scores are 12.84, 7.80, and 35.00 for professional duty (PD), return on effort (ROE), and professional benefit (PB) scales, respectively. Transforming scores to a 0-100 scale correspond to means of 82.01, 72.47, and 84.38 for the PD, ROE, and PB scales, respectively. Higher scale scores represent more positive attitudes toward pharmaceutical care. See Table I for scale descriptive statistics.

Student responses for each item are listed in Table II. The means of the individual items are fairly homogeneous within each scale with values ranging from 4.12 to 4.52 for the PB scale, 4.06 to 4.47 for the PD scale, and 3.70 to 4.10 for the ROE scale (scale ranges from 1 to 5 with higher scores indicating more positive attitudes). The standard deviations are also fairly homogenous within each of the scales. Although the item standard deviations for the PB and PD are consistently less than 1.0, they are approximating 1.0. For six of the 13 items, respondents used the full range of possible responses; for six items, respondents used four of the five possible responses; and for one item, respondents used three of the five possible responses. The item response "1= strongly disagree" was least likely to be used by the students for items in each of the three scales, especially for items of the PD scale. Generally, the distribution of item responses for each of the three scales are positively skewed, as the most frequently selected response over the entire scale was "5 = strongly agree", with exceptions noted for the two items of the ROE scale, "Time" and "Add_Work," and two items of PB scale, "Career" and "Clerk." See Table II for the PCAS item descriptive statistics.

The item to intended and competing scale correlations are reported in Table III. All the items had correlation coefficients greater than 0.30 with their intended scale, and nearly all items had correlation coefficients greater than 0.50 with their intended scale. With two exceptions ("Should" and "Add__Work"), all of the thirteen items had higher correlations with their intended scale than the two other competing scales. Although the item "Should" had a higher correlation with the PB scale than it's intended scale (PD scale) and "Add_Work" item had a higher correlation with the PB scale than it's intended scale (ROE scale), the correlations are not significantly different for the competing scale and the intended scale (Table III). For all but two items in the PB scale, "Clerk" and "Like," the correlations were significantly greater for the intended scale than the two other competing scales. Items in the PD scale generally had significantly greater correlations with their intended scale than the ROE scale, but none of the items of the PD scale had significantly higher correlations with the intended scale compared to the PB scale. In addition to the finding that "Add_Work" item was more correlated to the PB scale then its intended ROE scale (although it was not significantly different), the other item ("Time") in the ROE scale had a significantly higher correlation with it's intended scale than the PD scale, but was not significantly higher than the PB scale. See Table III for Pearson item-scale correlations.

The multi-trait monomethod correlation matrix for the three scales is reported in Table IV. The diagonal of the matrix contains the internal consistency coefficients (Cronbach's alphas). The scale correlation between the PD and the ROE scales is 0.34, while the scale correlation of the PD and the ROE scales is 0.57 and the scale correlation

Table III. Item descriptive statistics and Pearson item-scale correlations corrected for overlap

Item	Scale	Pearson item-scale correlations		
		PD	ROE	PB
Should	Professional Duty (PD)	0.51*	0.34	0.55
Pre_Solv	Professional Duty (PD)	0.43*	0.09	0.31
Practice	Professional Duty (PD)	0.70*	0.37	0.66
Time	Return on Effort (ROE)	0.24	0.54*	0.42
Add_Work	Return on Effort (ROE)	0.37	0.54*	0.58
Value	Professional Benefit (PB)	0.51	0.54	0.80*
Like	Professional Benefit (PB)	0.54	0.59	0.79*
Clerk	Professional Benefit (PB)	0.52	0.35	0.63*
Reward	Professional Benefit (PB)	0.54	0.38	0.75*
Direction	Professional Benefit (PB)	0.64	0.44	0.86*
Benefit	Professional Benefit (PB)	0.54	0.53	0.85*
Improve	Professional Benefit (PB)	0.43	0.49	0.79*
Career	Professional Benefit (PB)	0.50	0.47	0.73*

Item-scale correlation corrected for overlap (relevant item removed from its scale for correlation).
Starred (*) correlations are hypothesized to be highest for intended scale.

Table IV. Reliability coefficients and inter-scale correlations

Scale	PD	ROE	PB
Professional Duty (PD)	(0.72)		
Return on Effort (ROE)	0.34	(0.69)	
Professional Benefit (PB)	0.64	0.57	(0.93)

of the PD and the PB scales is 0.64. The impact of deleting the item "Clerk" (PCAS-reduced instrument) had no significant affect on the results. The reliability estimates (Cronbach's alphas) of the three scales range from 0.69 to 0.93. Only the ROE scale has a Cronbach's alpha of less than 0.70. Results of the tests performed in the psychometric analysis are summarized in Table V.

DISCUSSION

It is important to realize that validity and reliability are not attributes with absolute interpretation. That is, scales or measures can not be labeled valid or not valid, reliable or not reliable, but rather investigators can introduce studies that adds to the evidence of validity and reliability of a measure(26). The terms valid and reliable are used in this text to indicate the addition of evidence supporting the notion of validity and reliability for the PCAS. The tests performed and results of the psychometric analysis are summarized in Table V. The following paragraphs explain the implications of the results found in assessing the PCAS.

Since the scales inception, the scaling assumptions have not been formally investigated. Therefore, the investigators believed that it was necessary for the scaling assumptions to be formally evaluated in the cross-validation phase of the study. Based on the relatively homogeneous item means, item standard deviations, and the item to scale total correlations being greater than 0.30, the items within each of the three scales can be summed without weights into summated total scale scores. For the ease of interpretation, the investigators transformed the students' pharmaceutical care attitude scores to a 0 to 100 scale using a simple linear transformation method.

All three scales appear to be reliable based on measures of internal consistency. The Cronbach's alphas reported in this study of 0.72, 0.69, and 0.93 mirror the previously reported Cronbach's alphas of 0.75, 0.73, and 0.92

Table V. Summary of psychometric analyses

Psychometric property	Criteria met, partially met, or not met
Criteria for Summated Rating Scale	
1. Equal item means and variances within scales	Met
2. Item standard deviations approximating 1.0	Partially met
3. Items should be linearly related to the scale with correlations to scale total greater than 0.30	Met
4. Items response distributions should be roughly symmetrical	Not met
Reliability	
Internal consistency coefficients (Cronbach's alpha) should be greater than 0.70	Met for 2 of the 3 scales[a]
Item Discriminant Validity	
1. Items should be more correlated with intended scale than competing scales	Met for 11 of 13 items
2. Items should be significantly more correlated at a minimum of two standard errors with intended scale than the competing scale	Met for 17 of 26 comparisons
Construct Validity	
Inter-scale correlations should be less than internal consistency coefficients	Met for all 3 scales

[a]The ROE scale has a Cronbach's alpha of 0.69. The homogeneity reliability estimate, r10, for the ROE scale is 0.92.

for the PD, the ROE, and for the PB scales, respectively. The finding that the Cronbach's alpha for the ROE scale is just under the generally accepted criteria of 0.70 warranted further investigation since the scale has only two items. A homogeneity reliability estimate, the r10, is an adjusted internal consistency coefficient based on adjusting the Cronbach's alpha if the scale had 10 items (23). The r10 for the ROE scale is 0.92, which provides evidence of the scale's reliability.

To seek additional evidence of the construct validity of the scales, a confirmatory approach that tests item level discriminant validity and identifies the relationship between scales using the multi-trait monomethod correlation matrix was used. All items of the PB scale are more linearly related to that scale than competing scales and, in most instances, the correlations are significantly greater with the PB scale than with competing scales. However, items of the PD scale are nearly equally correlated with the PB scale as they are to the PD scale, as none of the correlations between the two scales are significantly different from each other by a minimum of two standard errors. Similarly, items of the ROE scale also correlate with the PB scale. The lack of significantly different correlations between item to competing scales and intended scales is greatly influenced by sample size and it is suggested that sample sizes of 300 should be used for item discriminant validity tests (23). Therefore, using a population of less than 300 students is a limitation of item discriminant validity testing in this study. Although the evidence provided by the item discriminant validity tests are not conclusive, given that 11 of the 13 items are more highly correlated with their intended scale than the competing scale and that nearly all of the PB scale items are more significantly related to the PB scale than competing scales suggest that there are three unique constructs within the PCAS. Furthermore, additional evidence suggestive of three constructs within the PCAS includes the high reliability coefficients relative to inter-scale correlation coefficients demonstrated in the multi-trait monomethod matrix (Table IV). Ideally, the multi-trait multimethod approach should be used to assess construct validity, but given the absence of a different means (scale) to ascertain student attitudes towards pharmaceutical care, this is not possible.

Additional evidence of the PCAS scales' validity may be found by comparing the mean scale scores of the second-year pharmacy students in this study to those of the first-year and PharmD. (fourth-year) students of the previously published study (20). It might be expected that student attitudes would increase as they have greater exposure to pharmaceutical care throughout the curriculum and hence have higher scores as they progressed from first-year pharmacy students to fourth- year students. The untransformed raw mean scores for the PD scale are 11.85, 12.84, and 13.66 for first-year, second-year, and fourth-year pharmacy students, respectively (20). Similarly, scores for PB scale are 33.33, 35.00, and 38.44 for first-year, second-year, and fourth-year pharmacy students, respectively(20). Although scores for the ROE scale were not ascertained for fourth-year pharmacy students' in the previous investigation, a similar pattern was observed when comparing the first-year pharmacy students' score of 7.50 on the ROE scale to the second-year pharmacy students' score of 7.80(20). Clearly, there is a stepwise trend observed for students progressing through the curriculum where the most senior students have the highest attitudes providing at least some evidence of the predictive validity of the PCAS.

One area of concern regarding the psychometric properties of the PCAS is the relatively low variability of scale scores (relatively narrow ranges and small standard deviations) and the high percentage of students scoring at the ceiling of the scales. These findings may be a result of either the failure of the items to adequately assess the full range of values of the constructs, or that, in general, students in this study uniformly have positive attitudes towards pharmaceutical care. As faculty of the University of Georgia, the investigators interjecting their bias would like to believe the latter phenomena is true, but without further investigation using an entirely different population, it is impossible to confidently know if the items adequately assess the constructs. Ceiling effects with various well known and accepted scales occur and are dependent upon the population sampled. For example, in assessing the quality of life (QOL) of healthy persons it is expected that healthy persons score near or at the ceiling and have less variability for any QOL instrument than if there were a mix (both healthy and non-healthy) of persons sampled(27). Similarly, one might hypothesize that fewer persons would score at the ceiling if a practitioner population was administered the PCAS, however, additional studies need to be performed to support or refute such a hypothesis. Whatever the underlying phenomena contributing to the lack of variability of the PCAS scale scores, the PCAS may require larger sample sizes to be used as an evaluative instrument in this student population.

CONCLUSION

This study describes the psychometric process and results associated with further validating the PCAS, a 13-item scale that measures pharmacy students' attitudes toward pharmaceutical care. The results of this investigation indicate that the PCAS is a reliable instrument and evidence suggests that the PCAS is a valid instrument with three separate constructs. Additional studies using the PCAS in different populations are needed. Specifically, studies utilizing pharmacist practitioners and longitudinal studies of cohorts of students evolving to practitioners would especially be useful. Studies are also needed using the PCAS or modified versions of this instrument to measure the influence of educational programs on students' pharmaceutical care attitudes.

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APPENDIX. PCAS SCALES AND DESCRIPTION OF ITEMS

Professional Duty (PD)

Should: All pharmacists should perform pharmaceutical care.

Pre_Solv: Pharmacists in all health care settings primary responsibility should be to prevent and solve medication-related problems.

Practice: Pharmacists primary responsibility should be to practice pharmaceutical care.

Return on Effort (ROE)

Time: Providing pharmaceutical care takes too much time and effort.

Add_Work: Providing pharmaceutical care is not worth the additional workload that it places on the pharmacist.

Professional Benefit (PB)

Clerk: Pharmacy students can perform pharmaceutical care during their clerkships.

Value: I think the practice of pharmaceutical care is valuable.

Like: I would like to perform pharmaceutical care as a pharmacist practitioner.

Reward: Providing pharmaceutical care is professionally rewarding.

Direction: I feel that pharmaceutical care is the right direction for the profession to be headed.

Benefit: I feel that the pharmaceutical care movement will benefit pharmacists.

Improve: I feel that the pharmaceutical care movement will improve patient health.

Career: I feel that practicing pharmaceutical care would benefit my professional career as a pharmacy practitioner.

Scale: 1 = Strongly disagree; 2 =Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.