Development and Initial Validation of an Instrument to Measure Physician–Pharmacist Collaboration from the Physician Perspective

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ABSTRACT

Objective: Using a conceptual model of collaborative working relationships between pharmacists and physicians, a measure for physician–pharmacist collaboration from the physician perspective was developed. The measure was analyzed for its factor structure, internal consistency, construct validity, and other psychometric properties.

Methods: An initial 27-item Physician–Pharmacist Collaboration Instrument (PPCI) was developed to assess seven themes about professional relationships using Likert scales. The PPCI was mailed to a random sample of 1000 primary care physicians. Principal component analysis was used to assess the structure and uncover underlying dimensions of the initial instrument. Items were evaluated for inclusion or exclusion into a refined instrument. Internal consistency was assessed by calculating Alpha coefficients for each identified factor. Convergent validity was assessed using Spearman correlations between the identified factors and a previous measure of collaborative care. After measure refinement, confirmatory factor analysis was used to evaluate the fit of both versions of the instrument.

Results: Three hundred forty usable surveys were returned for a response rate of 34%. Almost 70% of the respondents were male with a mean age of 45.8. A majority were family practice physicians (72.1%) in private practice (67.3%). Three unique factors were identified during principal component analysis and utilized in a confirmatory factor analysis. Both a full and a 14-item reduced model were constructed and tested. Cronbach's alpha for the three factors of the full model ranged from 0.91 to 0.97, while the reliability for the reduced model ranged from 0.86 to 0.96. Comparative fit indexes of 0.97 and 0.98 were obtained, indicating good fit for the models.

Conclusions: The results indicate good reliability and validity of the refined (14-item) PPCI. This instrument can be useful as a research tool for assessment of the physicians' perspective about a physician–pharmacist relationship. Further research is warranted to examine if the extent of relationship development, as measured with the PPCI, can affect patient care outcomes.

Keywords: collaboration, communication, coordinated care, physician–pharmacist relationship.

Introduction

Collaboration among health care professionals has been defined as a "joint communicating and deci-

sion-making process with the goal of satisfying the patient's wellness and illness needs while respecting the unique qualities and abilities of each professional" [1]. This definition can be reflected in relationships between physicians and pharmacists. Numerous studies have concluded that coordinated care between physicians and pharmacists can improve patient care outcomes [2–9]. Likewise, reports of pharmacists' activities indicate that collaborative practice with physicians is occurring frequently [5,10–14]. In fact, recent position articles by the American College of Physicians—American

Society of Internal Medicine and the American College of Clinical Pharmacy support physician–pharmacist collaboration for managing medication [15].

Nevertheless, the degree of collaboration that occurs between an individual physician and pharmacist can vary greatly. For patients to benefit from physician–pharmacist collaboration, its effect on patient care outcomes needs to be understood. As a research tool, a valid measure of collaborative care may help explain different levels of success among collaborative health-care service interventions. It is possible that patient health-care outcomes are related to the degree of collaboration between health-care providers. To date, there has been no measure to assess the degree of collaboration between a physician and pharmacist. Recently, a theoretical framework of physician–pharmacist collaborative relationships has been developed [16]. Based on this theoretical framework, the objective of the present study was to develop, refine, and test the reliability and validity of a measurement tool for physician–pharmacist collaboration.

In the theoretical framework, collaborative relationships are developed through five progressive stages: Stage 0—Professional Awareness; Stage 1—Professional Recognition; Stage 2—Exploration and Trial; Stage 3—Professional Relationship Expansion; and Stage 4—Commitment to the Collaborative Working Relationship. Contributions of both physician and pharmacist allow the relationship to grow, with higher stages representing an expanded relationship. Certain variables, such as the nature and scope of social exchange drive the development of a collaborative relationship.

Interactions among physicians and pharmacists are viewed as exchanges. At Stage 0, exchange is minimal while Stage 1 exchange is mostly unilateral or driven by one party. As the relationship progresses, the exchanges become bilateral in which both parties are active. Stage 4 represents a committed and sustained relationship characterized by bilateral communication and mutual trust. In this model, delivery of health-care services by a pharmacist expands as the stage of collaboration increases. Consequently, pharmacists may need to operate in higher stages of this model to deliver health care services that affect patient outcomes.

The theoretical framework formed a basis to construct a 27-item questionnaire to measure physicians' views of physician–pharmacist collaborative relationships. The items on the questionnaire were designed to assess the nature and scope of social exchange that drive the relationship. Before employing this questionnaire to evaluate effects on patient care outcomes, the purpose of the current study was to subject the instrument to rigorous validation testing.

Methods

Items on the Physician–Pharmacist Collaboration Instrument (PPCI) were developed to capture the nature and scope of social exchange which drive a professional relationship. These items were crafted based on seven themes surrounding a professional relationship: collaborative care, commitment, dependence symmetry, bidirectional communication, trust, initiating behavior, and conflict resolution.

Item measures were developed using literature from interpersonal, business, and health-care relationships [17–34].

Six of the seven concepts were measured using a seven-point Likert scale with respondents indicating 1 (very strongly disagree) to 7 (very strongly agree) for each item. The intermediate points on the scale were also defined from strongly disagree to strongly agree. Respondents were asked to consider their relationship with the pharmacist whom they work most often. They were told to respond to each item based on the interactions with this pharmacist over time. The other concept, initiating behavior, was measured on a five-point scale (1 = not at all, 5 = to a great extent). The respondent was asked to indicate the extent to which the pharmacist had performed each of five activities.

An initial draft of the concept definitions and items was distributed to five physicians who were known to have interaction with pharmacists. These physicians were asked to provide comments related to the face validity of the instrument. Subsequent revisions to the items followed the feedback on face validity provided by these physicians.

A pilot test of the 27-item questionnaire was conducted. One hundred and ten physicians affiliated with the University were asked to complete the questionnaire. In addition, the physicians were asked to complete a separate nine-item instrument as an initial test of construct validity. This second instrument (i.e., Baggs) had been originally designed and validated to measure collaboration and satisfaction about care between physicians and nurses [17]. The Baggs measures were modified slightly to reflect a pharmacist perspective rather than a nurse. Sixty-eight surveys (61.8%) were returned. Results from the pilot testing indicated that the items had good internal consistency [35]. Also, the seven concepts were significantly, positively correlated among

each other and between the collaboration scale from Baggs. Therefore, further evaluation focused on identifying latent factors that conceptually comprise physician–pharmacist collaboration.

Using data from the pilot test, minor changes were made to the PPCI. Then, using traditional survey techniques, the 27-item PPCI and the modified Baggs' instrument were mailed to a random sample of 1000 primary care physicians in the state of Iowa. The list of physicians was generated from a database of more than 5000 registered physicians in Iowa maintained by the University of Iowa, Office of Statewide Clinical Education Program. Primary care physicians constituted family medicine, general internal medicine, and pediatrics.

A cover letter described the purpose and procedures of the survey and requested physicians to return the survey in the provided self-addressed, stamped envelop. Each survey was marked with an identification number. The purpose of the ID number was to coordinate follow-up mailings. Physicians could remove the ID number and return the survey anonymously. Respondents were asked to return the survey blank if they did not wish to participate and receive follow-up mailings. A reminder postcard was sent to all nonrespondents after seven days. A final follow-up survey was mailed to nonrespondents 10 days after the postcard. The study was approved by the University of Iowa Human Subjects Institutional Review Board.

First, principal component analysis was applied to the 27-items. Examination of the eigenvalues and scree plotting of the values determined the number of latent factors in the PPCI [36,37]. Then, factor analysis with promax rotation was used to provide information regarding how each item contributed to the measurement of a construct. Using this information, individual items were evaluated for inclusion or exclusion based on the factor loading generated by the final solution of the factor analysis, simple structure, and the logical interpretability of the item in relation to the extracted factor. In addition, items were further examined for inclusion into a shortened version of the instrument. Decisions to remove items were based on item to total correlations and maintaining theoretically meaningful constructs while eliminating potentially redundant questions. Therefore, both an initial and refined/shortened model describing the resulting item structure of the PPCI was constructed.

Reliability and validity of the PPCI was evaluated using several methods. Internal consistency reliability was evaluated using the Cronbach α coefficient [38]. Construct validity was examined with corre-

lations between the factors of the PPCI and the previously validated collaboration and satisfaction scales developed by Baggs [17]. We hypothesized that the PPCI would be positively correlated with both the collaboration scale and the satisfaction scale from the Baggs' instrument [39,40]. Structural equation modeling provided an objective test of the initial and refined models using both the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) [41–43]. All data and factor analytic techniques were conducted using SAS® and AMOS® software.

Results

A total of 394 (39.4%) surveys were returned. There were 340 usable surveys for a response rate of 34%. The most common reasons for an unusable survey were: the physician was no longer in practice (n = 6), the physician declined participation (n = 20), or inability of the physician to identify a single pharmacist whom they worked with regularly (n = 23).

The characteristics of the survey respondents are presented in Table 1. The majority of respondents were male (69.7%), family medicine physicians (72.1%) working in a private practice setting (67.3%). This sample is similar to the population of primary care physicians in Iowa: 71.2% male, 67.7% family medicine, and 80.2% in private practice [44]. Slightly less than half of the respondents (43.3%) had some type of academic affiliation while more than 90% were board certified.

The principal component analysis indicated three factors with eigenvalues greater than one. These

Table 1 Characteristics of survey respondents (n = 340)

Variable	Result
Age (year)*	45.8 ± 9.9
Male (%)	69.7
Practice type (%)	
Family medicine	72.1
Internal medicine	16.0
Pediatrics	11.9
Practice setting (%)	
Private practice	67.3
Academic Institution	13.8
Health maintenance organization	3.0
Other publicly funded institution	4.8
Other	11.1
Years in practice*	16.0 ± 10.9
Years of residency training*	2.8 ± 0.9
Academic affiliation (%)	
Full-time faculty	21.0
Part-time/adjunct faculty	22.3
No affiliation	56.7
Board certification (%)	91.3

*Data are mean ± SD.

three factors explained 76% of the variance. Scree plot analyses supported a three-factor solution. A three-factor oblique solution was obtained for entry into a confirmatory factor analysis. In general, Factor 1, termed Trustworthiness, is composed of items from trust, commitment, and bidirectional communication. Factor 2 comprises items from conflict resolution and dependence symmetry and is named Role Specification. Factor 3, termed Relationship Initiation, contained only items from the initiating behavior domain. One of the original 27 items did not achieve a single factor loading greater than 0.5 in the exploratory factor analysis. This item was not included in the confirmatory factor analyses.

Confirmatory factor analysis was performed on both the initial (full) model and a reduced model using the three factors. The 14-item reduced model was constructed in which items were removed based on item to total correlations and maintaining theoretically meaningful constructs while eliminating potentially redundant questions (Appendix 1). The reduced PPCI was developed to provide a more streamlined and less time-consuming instrument.

The level of correlation between the factors, indicated by the double-headed arrows and coefficients, ranges from 0.52 to 0.81 for the full model and 0.52 to 0.79 in the reduced model (Fig. 1). The CFI for the initial model is 0.97 and 0.98 for the refined model. Both indices exceed the 0.95 criteria level used to indicate a close fit [45]. Also, the RMSEA is 0.09 for the initial and refined models. According to Browne and Cudek, an RMSEA of less than 0.05 indicates a close fit, and a value of 0.08 to 0.1 indicates a moderate fit of the models [42].

Internal consistency for the three factors in the initial PPCI ranged from 0.91 to 0.97 (Table 2). The alpha coefficients for the three factors in the refined
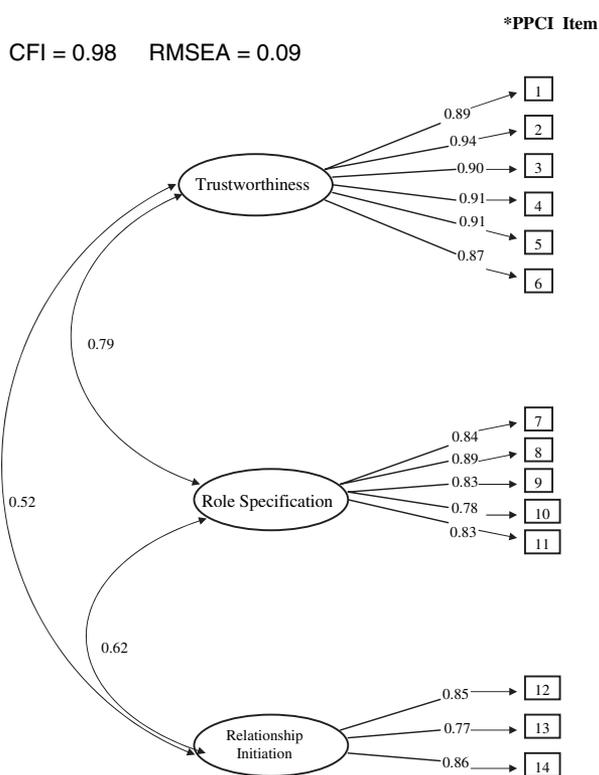

Figure 1 Confirmatory factor analysis of refined PPCI. *See Appendix 1 for items listed by number.

PPCI ranged from 0.86 to 0.96. Each of the three factors was positively and significantly correlated with the collaborative care scale and the satisfaction scale developed by Baggs, indicating appropriate nomological and construct validity (Table 3) [17]. The correlation coefficients from our domains are expected to be higher with the Baggs collaboration scale because they measure very similar constructs. Likewise, the correlation coefficients with the Baggs

Table 2 Descriptive statistics and reliabilities for the initial and refined Physician–Pharmacist Collaboration Instrument (PPCI)

Latent factor	Scale mean ± SD	Item mean	Coefficient α
Initial PPCI			
Trustworthiness (10 items)	58.1 ± 11.4	5.8	0.97
Role specification (11 items)	53.9 ± 13.5	4.9	0.96
Relationship initiation (5 items)	18.0 ± 4.7	3.6	0.91
Refined PPCI			
Trustworthiness (6 items)	35.0 ± 6.8	5.8	0.96
Role specification (5 items)	24.6 ± 6.3	4.9	0.91
Relationship initiation (3 items)	10.9 ± 2.8	3.5	0.86

Table 3 Spearman's correlation coefficients between latent factors of PPCI and Baggs collaboration and satisfaction scale*

PPCI latent factor	Baggs collaboration scale	Baggs satisfaction scale
Initial PPCI		
Trustworthiness (10 items)	0.68	0.40
Role specification (11 items)	0.84	0.25
Initiating behavior (5 items)	0.61	0.33
Refined PPCI		
Trustworthiness (6 items)	0.64	0.40
Role specification (5 items)	0.77	0.25
Initiating behavior (3 items)	0.62	0.32

*All correlations are significant at P < 0.01.

satisfaction scale should be positively correlated but to a less degree than the collaboration scale because satisfaction is a related construct. Previous research has shown that collaboration and satisfaction are correlated [39,40].

Discussion

The results support validity arguments related to the interpretation of both the initial and the refined PPCI. Based on principal component analysis, we hypothesized that there are three factors describing the model. Then, confirmatory factor analysis examined the factor structure to develop a refined and conceptually meaningful description of the factors. The validity of a 14-item refined model was supported using a confirmatory factor analysis. As a test of convergent validity, we examined the correlations between the PPCI and scales of collaboration and satisfaction previously validated with data from physician-nurse relations [17]. Both the initial and refined PPCI were significantly positively correlated with Baggs's scales. The 14-item refined PPCI is preferred over the 26-item measure because it is shorter yet possesses similar psychometric properties.

The refined PPCI contains three meaningful factors. One factor focuses on relationship initiation behaviors. This behavior refers to the actions of one party to determine the needs of another party; thereby facilitating relationship development. For example, suppose that a pharmacist is consistently answering questions about anticoagulation from a particular physician. To initiate a collaborative relationship, the pharmacist asks to meet with the physician to discuss mutual interest in a pharmacist-run anticoagulation service.

The second factor is a composite of items from trust, commitment, and communication. We label this factor trustworthiness. Conceptually, this factor encompasses a physician's ability to trust a pharmacist's word and expertise. That is, a high rating on this dimension means that if a pharmacist says he/she will be able to perform a particular task or role, then the physician will trust that the job will be done as expected. Also in the trustworthiness factor are single items on commitment and two-way communication. Previous research has reported a positive association between trust and commitment [34,46] as well as trust and two-way communication [47]. Trust, or confidence in another's abilities, can result in greater dialogue about problems encountered during patient care. Similarly, once a physician has developed trust in a pharmacist, he or she is more likely to be committed to interact with that pharmacist in the future [34].

The third factor is a mix of items representing dependence of practitioners on each other and negotiating acceptable activities for the practitioners. We labeled this factor role specification. This factor addresses the interactions between pharmacists and physicians in which they reach agreement on roles and responsibilities for each other in caring for mutual patients. The more equitably the roles are assigned, the more balanced will be the dependence of the practitioners on each other.

As a validated measure of the physicians' view of their collaboration with a pharmacist, the PPCI can be used in various situations. As a research tool, the instrument can measure the "strength" of collaboration. A growing literature documents the effects of physician–pharmacist collaboration on managing drug therapy [2–9]. Study results vary widely in the absolute benefit derived from such collaborative efforts. An important component underlying successful cooperative drug therapy management is the relationship between the physician and the pharmacist. It is possible that the variability reported in the outcomes generated by collaborative care is directly related to the "strength" of the collaborative relationship between the physician and pharmacist. Some successful interventions may have operated in higher stages of collaboration while unsuccessful interventions may have operated in lower stages. Naturally, one could hypothesize that a strong physician–pharmacist collaborative relationship would be a positive influence on patient care outcomes. The PPCI can be used in research studies to test this hypothesis and to evaluate methods/interventions for improving these relationships.

Similarly, the PPCI could be used as a practice assessment tool. Practitioners can use the PPCI as a measure of their collaborative relationship with a particular colleague. Over time, as the relationship develops, the score on the PPCI should increase, indicating advancement in the collaborative relationship and a higher stage in the theoretical model proposed by McDonough and Doucette [16]. Pharmacists who are looking to establish a collaborative relationship may use the PPCI as an initial gauge of physician's view of their relationship. The PPCI could be provided to the physician again at a later time to see if the collaborative relationship has grown.

The PPCI may also be used by administrators as part of performance assessment. For instance, there may be an expectation for a pharmacist to develop a medication management service in a

particular setting. As part of that pharmacist's performance, the PPCI could measure the physician's view of the collaborative relationships developed between the pharmacist and the physicians. Also, when looking to implement medication management services, administrators could use the PPCI to identify which physician(s) are likely to best form a collaborative relationship with a given pharmacist.

Limitations and Future Research

Although the reliability and validity of the PPCI are favorable, there are some limitations. The response rate of the survey was modest at 34%. Nevertheless, the 340 respondents provided an adequate sample for purposes of validation testing. Also, the wording of the PPCI may encourage some response bias. The instrument asks respondents to consider their answers based on "a pharmacist with whom you work the most." Physician respondents who do not have a particular pharmacist as a reference may not complete the PPCI. Therefore, the results may reflect physicians who more often work with a pharmacist. Similarly, there was no method to ascertain which pharmacist served as the reference point. Possibly, one pharmacist may have been the reference point for several physicians and could influence the responses. It is also possible that a physician may work equally among pharmacists from a particular pharmacy. As such, the pharmacy may have been the reference rather than one particular pharmacist. Perhaps in future use of the PPCI, the specific pharmacist could be indicated on the instrument for the physician's reference.

In addition, this validation testing was conducted on the measure from the physician's perspective. Future work is ongoing to also examine input from pharmacists to assess their perceptions of a collaborative relationship with a given physician [48,49]. Future research is also needed to elucidate interpretation of the PPCI scores. For example, what score would translate into a meaningful change in a professional relationship? Also, is there a range of scores that are associated with a given relationship stage from the theoretical model? At this time, it is not clear what score from the PPCI translates into a particular relationship stage. Finally, the current validation study was conducted using ambulatory/primary care physicians. Validity testing of this instrument for hospital-based or specialty physicians may be different and requires further research.

Conclusions

The results support the validity of the PPCI as a measure of collaboration between physician and pharmacist. In the factor analyses, three latent factors emerged as domains of physician–pharmacist collaboration: trustworthiness, role specification, and initiating behavior. The PPCI may be useful as a research measure, a clinical assessment tool, or as a performance assessment instrument. Further research is warranted to continue validation of this instrument.

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Appendix 1   Reduced Physician–Pharmacist Collaboration Instrument (PPCI) Items

*Trustworthiness**

1) The pharmacist is credible.
2) I trust this pharmacist's drug expertise.
3) I can count on this pharmacist to do what he/she says.
4) Communication between this pharmacist and myself is two-way.
5) I intend to keep working together with this pharmacist.
6) My interactions with this pharmacist are characterized by open communication of both parties.

*Role Specification**

7) This pharmacist and I negotiate to come to agreement on our activities in managing drug therapy.
8) This pharmacist and I are mutually dependent on each other in caring for patients.
9) I will work with this pharmacist to overcome disagreements on his/her role in managing drug therapy.
10) In providing patient care, I need this pharmacist as much as this pharmacist needs me.
11) This pharmacist depends on me as much as I depend on him/her.

Relationship Initiation[†]

12) Spent time trying to learn how he/she can help you provide better care.
13) Showed an interest in helping you improve your practice.
14) Provided information to you about a specific patient.

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*Measured on a seven-point Likert scale from 1—Very Strongly Disagree to 7—Very Strongly Agree.

[†]Measure on a five-point scale for 1—Not at all to 5—To a great extent. The stem is phrased as "Please indicate the extent to which this pharmacist has."