CHAPTER 3

METHODOLOGY

This chapter was organized into two phases of instrument development: (1) scale development and (2) psychometric evaluations. During the first phase, the Primary Care Competency Assessment Scale (PC-CAS) for primary care (PC) providers in Thailand was developed by modification of DeVellis guidelines (DeVellis, 1991), which included the following steps: literature review, participants interview (PC providers, PCU directors, public health workers, and health professional experts), domain-specification item generation, and item content validation (Delphi technique). The second phase was to evaluate the validity and reliability of the PC-CAS. The content validity was determined by four panels of experts, and then the content validity index (CVI) was calculated. The internal consistency was estimated by using Cronbach's alpha coefficient. The stability was evaluated with test-retest by using percentage of agreement. The construct validity was evaluated by using item analysis, confirmatory factor analysis (CFA), and hypothesis testing.

Phase 1: Scale development

The first step in scale development was reviewing current literature to determine how the concept of primary care competency had been used in existing instruments. The literature review was developed to be pre-specified domains of primary care competency and then was constructed to be an interview guideline. An interview approach with four-group participants was used before domain specification was developed by including data of interview and literature review. The second step

was items generation from the domain specification and then three rounds of Delphi technique were employed for items validation.

Step 1: Domain specification

This step aimed to explore the attributes of competency required for primary care providers. The primary care competencies were conducted by structured interviews of the PC providers, PCU directors, public health workers, and health professional experts.

Participants

There were four groups of purposively selected participants to represent the experts on primary care competency. The first group consisted of eight PC providers who were professional nurses and had worked in PCU's for more than three years. Four of them were key performers, well-known for their primary care practice in PCU's, whereas the four others were general practitioners who were less renowned for their practice. Other participants were seven physicians of PCU directors and eight public health workers who had more than one year experience, and finally, three health professional experts involved in primary care service, health professional competency, and health care quality control.

Instrument

The interview guideline used in this step was assembled from the pre-specified domains of primary care competencies synthesized from the literature review by posing the following questions, i.e., What should the primary care competency for PC

providers be?, Why should PC providers possess the primary care competencies?, How do PC providers use the primary care competencies?, and How do PC providers apply the primary care competencies such as health assessment, healthcare management, integrated healthcare service, professional responsibility and communication?

Data collection and analysis

After informed consent was given, qualitative data of required primary care competency for the Thai PC providers were obtained through formal interviews. The interviews began by asking the participants to describe work situation of the PC providers. Additionally, they were asked to answer the questions following the interview guidelines concerning their experiences relating to primary care competency for the PC providers. The data from the interviews were then analyzed by using content analysis (Waltz, Strickland, Lenz, 1991). The content of tape recordings was transcribed and then the main ideas were selected and arranged into themes. After that, each theme was synthesized as a domain which was divided into components of the primary care competency.

In order to confirm the validity and reliability of analysis, the themes were discussed in relation to the data with experts in qualitative research. The results of content analysis were used to develop the conceptual structure of primary care competency for the Thai PC providers by integrating with the pre-specified domains to form a matrix for item generation.

Step 2 Item generation

This step aimed to generate items of the PC-CAS. After items generation, they were examined by the experts. Three rounds of Delphi technique were used to obtain expert consensus on item content validity.

Participants

Twenty one experts were recruited from multiple sectors related to primary care provision. Four were PC providers, five were committee members of the Thailand Nursing Council, two were medical directors responsible for contracting units for primary care (CUP), three were physicians responsible for primary care services, three were health professional experts who worked at the Bureau of Nursing and the Hospital Accreditation Institute responsible for healthcare standards and quality control and four others were health professional experts who had been teaching primary care at educational institutes.

Data collection and analysis

Three rounds of Delphi technique were used by having a panel of experts examining the generated items. Then the items were revised based on the experts' suggestions. Each round contained procedures as follows:

1. The first round

1.1 The first draft of the PC-CAS items was sent to the experts who were asked to agree or disagree with each item and its component. If the experts agreed with

those items and their component they would select one in four priority rating (1st to 4th), whereas if they disagreed with other items they would mark in disagreed blank.

   1.2 The experts' recommendations and suggestions on the first draft of the item pool were taken into account.

   1.3 The first draft of the PC-CAS items was revised based on the experts' suggestions, and then the second draft of PC-CAS item was developed.

  The consensus was determined by using 51% agreement amongst respondents (Loughlin & Moore, 1979 cited in McKenna, 1994). The consensus with a 70% response rate was considered acceptable in this case (Sumsion, 1998 cited in Hasson, Keeney, & McKenna, 2000). In addition, items of the 3rd and 4th priority were selected and items of the 1st and 2nd priority were dropped because it did not meet the gain that was accepted more than 51 %.

  2. The second round

   2.1 The second draft of PC-CAS items was resent to the same group of experts. The domains and components of primary care competency were ranked for their priority by the experts.

   2.2 The retained items from the second draft were revised based on the experts' suggestions and were ranked the priority of each domain and each component, then they would be sent back to the investigators.

   2.3 The ranked priority of the second draft were calculated by using mode, median, mean, percentage, standard deviation (SD), and interquartile range (IRQ).

2.4 The results of the ranked priority calculation from the returned second draft were ranked based on three criteria, i.e., (1) the highest mode was selected when mode was more than 50% of the participants, (2) if the highest mode with the mode was less than 50% of the participants, the median and IQR being closed to mode were considered, and (3) if median and mode of the second criterion were not close, the mean and SD were included for consideration. The best ranked position is the value of mode, median, and mean when they are the same or close value (Munro, 2001).

2.5 Each total score of the domain and component of primary care competency was ranked the priority based on those three criteria. The retained and revised items would be formed to the third draft of the PC-CAS items.

3. The third round

3.1 The results from experts' response on the second draft and the third draft of the PC-CAS items were sent back to the previous group of experts.

3.2 The retained items and their ranked priority rating in the third draft and the results from experts' response on the second draft were reconfirmed by the experts.

3.3 The experts' reconfirmation responses were then considered to keep and delete the PC-CAS items and to rank the domains and components of the PC-CAS based on their consensus score.

3.4 The results from experts' response on the third draft of the PC-CAS items was summarized based on the experts' consensus to form the fourth draft or pre-final draft of the PC-CAS items.

The pre-final draft of the PC-CAS was in a rating scale format having a 6-point range of scoring to measure the extent of knowledge, skill, and trait relating to primary care competency of the PC providers. There were three sets of scale descriptors depending on types of item sets, i. e., disagree VS strongly agree, not true at all VS extremely true, and never performed VS always performed. The scoring range was from "0" to "5"

Phase 2: Psychometric evaluation

This phase was designed to evaluate reliability and validity of the PC-CAS. The stability reliability of PC-CAS was determined by test-retest using percentage of agreement. While, internal consistency reliability was testes by using Cronbach's alpha coefficient. Three health professional experts in primary care, health professional competency, and healthcare quality control and one physician responsible for primary care provision were asked to examine the content validity from which the Content of Validity Index (CVI) was calculated. Item analysis, Confirmatory Factor Analysis (CFA), and hypothesis testing were used to evaluate the construct validity.

Participants

There were three groups of participants in the psychometric evaluation as follows:

1. Three health professional experts in primary care, health professional competency, and healthcare quality control and one physician responsible for primary care provision were purposively recruited to represent the experts on primary care

competency in order to examine the content validity of the pre-final draft of the PC-CAS. And then it would be formed to the final draft of the PC-CAS.

2. Fourteen PC providers similar to the target population of this study were used to test reliability, i.e., internal consistency and stability in the final draft of the PC-CAS. Cronbach's alpha coefficient (α) and percentage of agreement were calculated (Munro, 2001; Waltz, Strickland, & Lenz, 1991). In addition, 23 other PC providers were used to test reliability of the final version of the PC-CAS (after CFA).

3. The target population of this study was Thai PC providers. The sample was 650 subjects representing the PC providers from five regions of Thailand (north, northeast, east, central, and south). The participating PC providers were selected by using cluster plus multimethod random sampling of provinces. (Appendix C). Responses of 65% (419 PC providers; full-time = 360, part-time = 59) were used for the following purposes:

3.1 Item analysis: All respondent subjects (419 PC providers) were used in this process.

3.2 Confirmatory Factor Analysis (CFA): Both full-time PC providers (n = 360) and part-time group (n = 59) were used to evaluate the construct of PC-CAS by CFA.

3.3 Hypothesis testing: Two hypotheses were tested with the PC providers: (1) The 419 PC providers were used to test the hypothesis of "the duration of relevant PCU experience has a positive correlation with the PC-CAS scores." (2) Fifty nine part-time PC providers and 360 full-time PC providers were used to test the hypothesis of "full-time PC providers would have a higher level of primary care competency scores as measured by PC-CAS than part-time PC providers."

Instruments

The Demographic Data Form, the Primary Care Competency Assessment Scale (PC-CAS) for the PC providers in Thailand and the Marlowe-Crowne Social Desirability Scale were used.

a) The Demographic Data Form is designed to provide a description of the subjects on their gender, age, religion, marital status, education, position, duration of primary care experience, duration of employment at PCU, courses of primary care training/seminars attended and clinical experience.

b) The PC-CAS is a newly developed instrument which is asked for primary competency of the PC providers. This scale consists of essential knowledge, skill, and trait of PC providers to perform and provide primary care at the PCU. The new instrument needs to be tested for psychometric properties. The reliability: stability and internal, content and construct validity had to be determined. Internal consistency was tested by using Cronbach's alpha coefficient, while stability was determined by using a test-retest procedure. Moreover, content validity was achieved through expert review of the PC-CAS and construct validity was assessed by using item analysis, confirmatory factor analysis (CFA), and hypothesis testing.

c) The Marlowe-Crowne Social Desirability Scale-Form C (Reynolds, 1982) is the instrument used to determine the degree to which the respondents answered questions of the PC-CAS in a socially desirable manner. This scale was developed in 1960 (Crowne & Marlow, 1960), and was based on the premise that people describe themselves in favorable or socially desirable terms in order to achieve the approval of others. Reynolds (1982) proposed and developed six short forms with substantially fewer items than the original scale. The six short forms of the Marlowe-Crowne

Social Desirability Scale-Form (M-C Form) have 10 – 20 items. The M-C Form C

with 13 items was used in this study because it demonstrated an acceptable level of

reliability (r $_{KR-20}$ = 0.76) and compared favorably with the reliability of the standard

form. Furthermore, it demonstrated the construct validity by significant correlation

with the standard form (r = 0.93, p < .001), and significant correlation with the

Edwards Social Desirability Scale (r = 0.41, p < .001). Before using the M-C Form C,

it was translated into Thai language by using back translation technique by Chaowalit

(1997).

Data collection and analyses

Data collection and analysis in this phase were based on each procedure, i.e.,

validity and reliability evaluation.

Validity evaluation

In this step, content and construct validity were considered. The content

validity was tested with four experts on primary care competency. While, construct

validity was evaluated by the PC providers through five regions of Thailand in the field

study.

Content validity

PC-CAS, the pre-final draft of item after Delphi technique was sent to the four

experts. The conceptual structure of primary care competency, its development, and the

items generation and validation were also sent to clarify the experts. The Content

Validity Index (CVI) was used to evaluate the content validity. The experts were

requested to determine the accuracy and relevancy of each PC-CAS item's content including its relevancy, clarity, and conciseness. The experts decided and gave the scores, i.e., (1) relevancy on a scale of 1 – 4 (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant and 4 = exactly relevant), (2) clarity on descriptor scale of yes and no (*yes* = clear and *no* = unclear), and (3) conciseness with descriptor scale of yes and no (*yes* = concise and *no* = redundant). In addition, the experts provided recommendations or suggestions for each item. The CVI was calculated. Furthermore, the items with quite and exactly relevant scores were selected and reconsidered to be clearer and more concise than the original. The selected items were revised based on the experts' recommendations and suggestions to be sound items which would be the final draft of the PC-CAS.

Reliability evaluation

Two types of reliability, i.e., stability and internal consistency were tested in pre-test study of the final draft and in the final version of the PC-CAS.

Pre-test study

The pre-test study involved 14 PC providers who completed the questionnaire (PC-CAS) after content validity evaluation. This step was conducted to determine reliability: stability and internal consistency of the instrument before using it in the field study.

1. The stability of the PC-CAS was examined by test-retest through repeated administrations that might yield consistent results. The final draft of the PC-CAS was administered to 30 PC providers who have worked at the PCU on two separate

occasions at a two-week interval. The questionnaires were sent by mail to the participants and were returned to the investigator in two-week and four-week intervals of the first and the second time. The percentage of agreement was used to analyze the two sets of those data.

In the first time, 24 (80%) responses were returned and completed with 22 (73.33%). While, in the second time, 18 (81.82%) responses were returned and 14 (63.64%) were completed. After that, the percentage of agreement was used to analyze these two data sets.

In addition, the final version of the PC-CAS (after CFA) was tested for confirming its stability with 30 others PC providers. In the first time, 26 (86.67%) responses were returned and completed with 24 (80%). In the second time, 23 (95.83%) responses were returned and completed. And then, the percentage of agreement was used to analyze these data.

2. Internal consistency or homogeneity of examined item and total correlations by using the PC providers who were the participants of the stability evaluation. Thus, two time of internal consistency testing were conducted with 22 and 14 PC providers. Cronbach's alpha coefficients were used to analyze the two sets of those data.

Furthermore, the final version of the PC-CAS (after CFA) was tested for confirming its internal consistency with the PC providers who tested the stability of the final version of the PC-CAS. The two times of internal consistency evaluation were conducted with 24 and 23 others PC providers. The two data sets were analyzed by using Cronbach's alpha coefficients.

Field study

This study: construct validity and social desirability testing were conducted in field study.

Construct validity evaluation

This test consisted of item analysis, Confirmatory Factor Analysis (CFA), and hypothesis testing. All respondents of PC providers were used to test the construct of the testing version of the PC-CAS.

Item analysis

This procedure was used to describe the extent to which item probability of response alpha correlates with attribute. The item-total correlation score was not independent because the proportion of alpha responses places limits on item-total correlation. In this study, all respondent participants (419 PC providers) who were representatives of the target populations were selected because they were recruited by using cluster plus multistage random sampling from five regions of Thailand. The questionnaires (the final draft of the PC-CAS) were sent to the participants by mail. The alpha correlation coefficiency was used to analyze their responses. The alpha correlations between item and items, items and component, component and component, and component and domain indicated that the items were best selected for keeping within those components and domains. The item analysis was a preliminary method of the CFA and others of construct testing.

Confirmatory Factor Analysis (CFA)

In this study, the Confirmatory Factor Analysis (CFA) was used to evaluate the internal structure of the PC-CAS. It would confirm that the data of its results were belonging to its conceptual structure which was derived to develop the PC-CAS. The testing version of the PC-CAS was sent by mail to 650 PC providers who have worked at the PCU in the five regions of Thailand. Those participants were recruited by using cluster plus multistage random sampling. A response rate of 65% (419 subjects) was returned. The data were analyzed by using LISREL (Diamantopoulos & Siguaw, 2000). Before conducting CFA, assumptions of multivariate statistic and applications LISREL were tested.

Preliminary data analysis was performed to examine the assumptions for multivariate analysis. General statistical assumptions in the CFA, e. g., missing data, normal distribution, homoscedasticity, and linear relationships were conducted. The assumptions of application LISREL was analyzed by using absence of outliers and absence of multicollinearity. In this study, those assumptions were detected before performing CFA by using multivariate statistic (multiple regressions) to analyze the data (Appendix F).

Missing data. List-wise deletion was used to delete the missing data. The missing across all variables were 12 (2.90%). In this study, 407 cases (from 419) were used to perform CFA.

Normality. Normal distribution was detected by the inspection of outliers, and distribution of error variance. In this study, skewness and kurtosis statistics tested the normality. The negative skewness values and range from 0.14 -1.24 were found, while its kurtosis was in range from – 0.65 to 2.92.

Linearity. Scatter plots were used to detect linear relationships. The scatter plots of predicted values of dependent variable against residuals showed linear relationship. In this study, the scatter plots showed positive linear relationship with all linearity correlation.

Outliers. Mahalanobis distance and Studentized Deleted Residuals were used to analyze for detection outlier data. In addition, Cook's Distance and Mahalanobis distance were also used to analyze the outliers of data. In this study, outliers of case # 122,123, 124, 381, and 387 were found.

Homoscedasticity. A scatter plot of the Studentized Deleted Residuals (Y axis) and the Standardized Predicted scores (X axis) were used to detect the homoscedasticity of data. The finding was not a clear trend indicating heteroscedasticity.

Multicollinearity. The value of tolerance and VIF in multiple regression statistics were used to detect the multicollinearity in this study. In present study, there was not multicollinearity predictors, the tolerance ranged from 22 to 41% while the VIF was 1.67 – 4.53.

There are five steps to conduct the CFA by using the LISREL program, i.e. (1) model specification, (2) identification, (3) estimating the parameters of the measurement model, (4) evaluating the data - model fit, and (5) model modification or respecification to improve the fit (Munro, 2001).

Hypothesis testing

Hypothesis testing was used to evaluate construct validity of the PC-CAS. Benner's model was applied to the hypothesis that the duration of primary care

experience, duration of employment at PCU and educational level of PC providers would be related to their competency. The hypotheses were tested with 360 full-time PC providers and 59 part-time groups as following.

1. The first hypothesis was "the mean of PC-CAS score of full-time PC providers would be higher than the part-time group" The participants were 360 full-time PC providers and 59 part-time group. The testing version of the PC-CAS was sent by mail to the participants. The significant difference tested by t-test would be used to claim as evidence supporting for the construct validity of the PC-CAS.

2. The second hypothesis was "the duration of primary care experience, duration of employment at the PCU and educational level of the PC providers would be positively correlated with the PC-CAS score." The participants were 419 PC providers (full-time and part-time) to whom the PC-CAS was sent by mail. Pearson's product moment correlation coefficient was used to examine the relationships between the duration of primary care experience, duration of employment at that PCU and educational level of the PC providers and their PC-CAS scores. The significant correlations were used to claim that evidence supporting for its hypothesis.

In conclusion, the steps of the PC-CAS development and its psychometric testing used in this study were summarized as in Figure 1. The first phase consisted of domain specification and item generation. The domain specification comprised of interviewing four groups of participants. The major components of the pre-specified primary care competencies which established the interview guidelines were sought from the literature review. Content analysis was used to analyze the data of interviews. Then, the main specification of primary care competencies were developed by merging the interviewing data and literature review. After that, item

pool draft #1 was generated from the main specification of primary care competencies. Three rounds of Delphi technique were used to examine and validate the item pool draft #1 which became to draft # 4 by the panel experts. The pre-final draft of PC-CAS (draft # 4) came from the expert opinion consensus on item pool draft # 2 & 3. The second phase was a psychometric evaluation which tested the validity and reliability of the PC-CAS. A newly sound instrument has to have standard psychometric properties evaluation. Consequently, the reliability was test stability and internal consistency while the validity evaluation consisted of content and construct validity. In this study, at first the content validity was tested. Its result, the pre-final draft of the PC-CAS was formed to be the final draft of the PC-CAS. Then, the final draft of the PC-CAS was tested its construct validity by using item analysis, CFA, and hypothesis testing. In addition, social desirability tool was used to test with the same subjects who were involved with the psychometric properties evaluation. After CFA, the final draft of the PC-CAS was completed and accepted as the final version of the PC-CAS. Furthermore, the final version of the PC-CAS was tested to confirm its reliability and social desirability. Finally, the sound PC-CAS would be revealed.
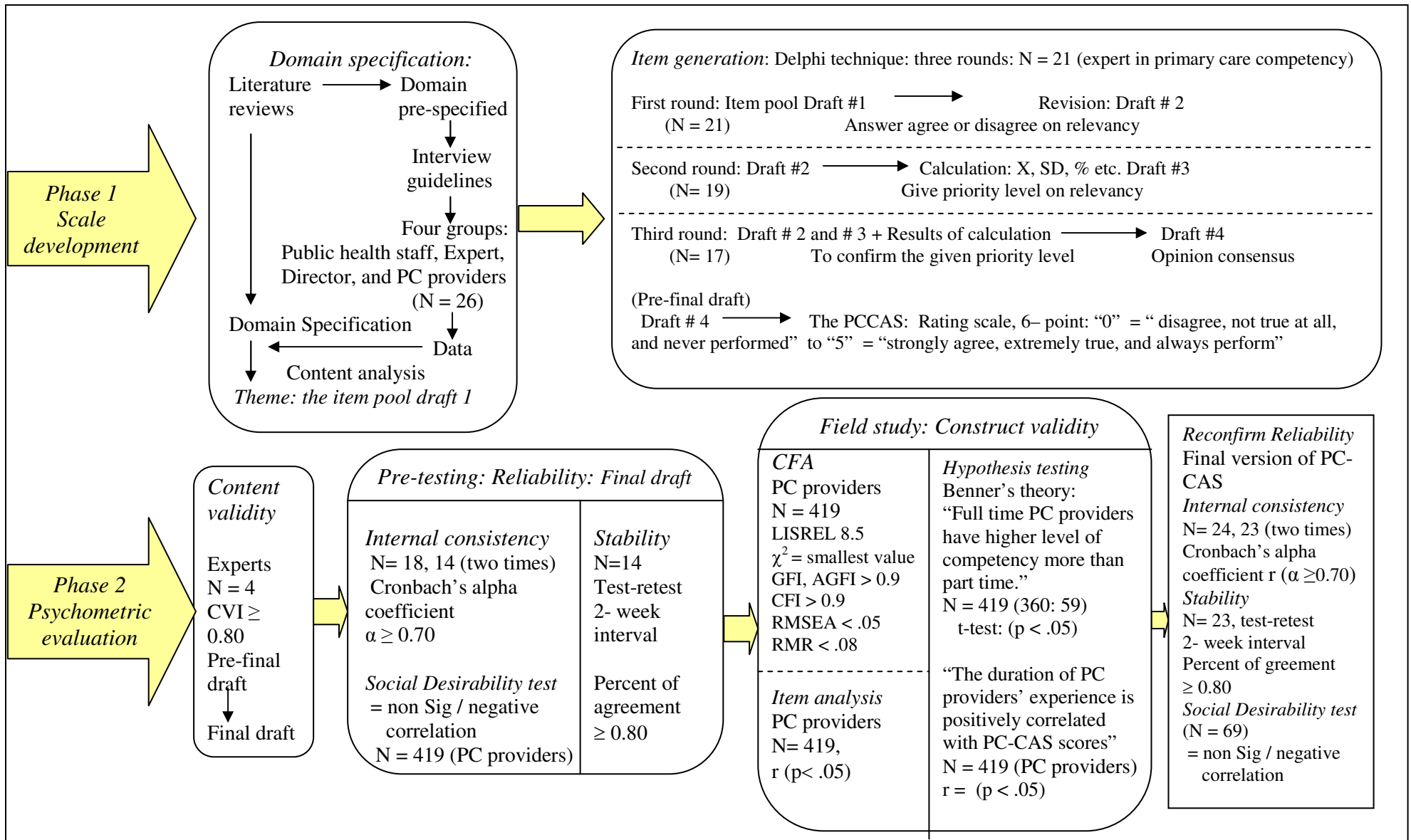
Phase 1 Scale development

Domain specification:

Literature reviews → Domain pre-specified

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Interview guidelines

↓

Four groups:
Public health staff, Expert, Director, and PC providers
(N = 26)

Domain Specification ← Data

↓

Content analysis
Theme: the item pool draft 1

Item generation: Delphi technique: three rounds: N = 21 (expert in primary care competency)

First round: Item pool Draft #1 → Revision: Draft # 2
(N = 21)   Answer agree or disagree on relevancy

- -

Second round: Draft #2 → Calculation: X, SD, % etc. Draft #3
(N= 19)   Give priority level on relevancy

- -

Third round: Draft # 2 and # 3 + Results of calculation → Draft #4
(N= 17)   To confirm the given priority level   Opinion consensus

(Pre-final draft)
Draft # 4 → The PCCAS: Rating scale, 6– point: "0" = " disagree, not true at all, and never performed" to "5" = "strongly agree, extremely true, and always perform"

Phase 2 Psychometric evaluation

Content validity

Experts
N = 4
CVI ≥ 0.80
Pre-final draft

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Final draft

Pre-testing: Reliability: Final draft

Internal consistency
N= 18, 14 (two times)
Cronbach's alpha coefficient
$\alpha \geq 0.70$

Social Desirability test
= non Sig / negative correlation
N = 419 (PC providers)

Stability
N=14
Test-retest
2- week interval

Percent of agreement
≥ 0.80

Field study: Construct validity

CFA
PC providers
N = 419
LISREL 8.5
χ^2 = smallest value
GFI, AGFI > 0.9
CFI > 0.9
RMSEA < .05
RMR < .08

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Item analysis
PC providers
N= 419,
r (p< .05)

Hypothesis testing
Benner's theory:
"Full time PC providers have higher level of competency more than part time."
N = 419 (360: 59)
t-test: (p < .05)

"The duration of PC providers' experience is positively correlated with PC-CAS scores"
N = 419 (PC providers)
r = (p < .05)

Reconfirm Reliability
Final version of PC-CAS
Internal consistency
N= 24, 23 (two times)
Cronbach's alpha coefficient r (α ≥0.70)
Stability
N= 23, test-retest
2- week interval
Percent of greement
≥ 0.80
Social Desirability test
(N = 69)
= non Sig / negative correlation

Figure 3 Development of Primary Care Competency Assessment Scale (PC-CAS) for PC Providers in Thailand

Protection of human subjects

Upon approval from the Ethical Committee of the Faculty of Nursing, Prince of Songkla University, primary care providers who had been working at PCUs, directors of the CUPs, health professional experts and public health workers were contacted for their permission to take part in the study. The protection of their rights was assured by providing (1) the title of the study, (2) the purpose of the study, (3) the methodology of the study, (4) the assurance of the subject's anonymity, (5) the assurance of voluntary participation and possible withdrawal from the study at any time, (6) the name and address of the researcher, and (7) others, such as all the data with questionnaires, after analysis, would be destroyed. Subjects were informed on all aspects before they consented to participate in this research by using the Inform Consent Form (Appendix A).

Social desirability

This test was used to examine social desirability of the subjects who answered the psychometric testing of the PC-CAS. In this study, the Marlowe-Crowne Social Desirability Scale-Form C (M-C Form C) with Thai version was used to determine the degree of social desirability to the respondents' manners (Chaowalit, 1997). The M-C Form C was added to the testing draft of the PC-CAS. The respondents were the PC providers who were the subjects of the psychometric evaluation. The Pearson's product moment coefficient was used to analyze correlation of the PC-CAS scores and the M-C Form C score. The non significant correlations or negative significant correlations between those scores indicated that the respondents were in a real situation; they were not influenced by someone and something to answer the questionnaires.

Summary

The objective of this study was to develop the Primary Care Competency Assessment Scale (PC-CAS) for the PC providers in Thailand for which the development of the scales and evaluation of its psychometric properties had been conducted. First, interview guidelines were developed from pre-specified domains which were derived from the literature review. Data of interviews with PC providers, CUP directors, health professional experts, and public health workers were analyzed by using content analysis. The pre-specified domain and themes of content analysis were used to develop the specified domains. After that, the item pool was generated by the investigators. And then, item generation and item examination processes were conducted by using health professional experts who participated in three rounds of Delphi technique. Second, the psychometric testing of PC-CAS was conducted. The content validity was evaluated and then its reliability was tested. The internal consistency and stability were initially evaluated and were later revised until acceptable. The field study, construct validity and social desirability were tested. The item analysis, CFA, and hypotheses testing approach were used to evaluate the construct validity. In addition, the final version of the PC-CAS was reconfirmed by the testing of its reliability and social desirability. The sound PC-CAS was revealed.