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Development of performance indicators of nurse practitioners in basic medical care: Applying second order confirmatory factor analysis

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This study aimed to develop the performance indicators of nurse practitioners (NPs) in basic medical care in Thailand. This research was conducted in 2 steps: the 1st step was to establish performance indicators of NPs in basic medical care by interviewing seven experts and six stakeholders about basic medical care; the 2nd step was to validate the basic medical care performance indicators of NPs by questioning NPs across the country. The tested validity of indicator model used second-order confirmatory factor analysis by MPlus program. The sample comprised 510 NPs from 23 provinces in 4 regions of Thailand derived by using multi-stage random sampling. There were 20 indicators in 5 elements: (1) assessment and diagnosis with 5 indicators; (2) caring, providing treatment of common symptoms and doing NP medical procedures with 6 indicators; (3) giving medication to relieve symptoms or treatment according to the guidelines with 3 indicators; (4) a referral and follow up on the treatment with 3 indicators; and (5) continuing patient care with 3 indicators. A model of performance indicators developed was fitted with empirical data. By weight the arranged elements were in this order: 2, 3, 4, 1 and 5; the weights were 0.986, 0.966, 0.945, 0.899, and 0.621, respectively. Performance indicators of the NPs in Basic Medical Care had 20 indicators. The indicators were derived from the person directly involved with the basic medical care; therefore, these indicators can be applied to evaluate the NPs of enhancing performance.

Key words: Indicators, basic medical care, nurse practitioner, second-order confirmatory factor analysis.

INTRODUCTION

Thailand's Ministry of Public Health has a policy to expand health or medical services in rural areas, strengthening primary care services. These primary health care centers require a great number of nurse practitioners (NPs) to do the treatment of diseases. The ministry aims to produce 10,000 NPs in 10 years from 2002 to 2012 (Terathongkum et al., 2009). For this reason, the Thailand Nursing and Midwifery Council (TNC) and nursing education institutions have prepared short 4-month courses to produce NPs. The NPs will be assigned to assess and provide treatment to cure patients, replacing the service of the physicians which are in such a shortage in Thailand. This has resulted in the beginning of standard practice control by the council

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(TNC) for the basic medical care in nursing. It proposed to the Ministry of Public Health a regulation of the nursing profession which duplicates the 2002 regulation of basic medical care. Then, it developed the revised 2008 edition and set a framework on the basic medical care (TNC, 2011) and distribute across the country to be used as a guideline.

However, although trained NPs determined the framework of basic medical care clearly, the basic medical care evaluation of the NPs has not found a clear indicator. For this situation, the researcher became interested in "When we would like to have an indicator for evaluation of the performance of the basic medical care in NPs to determine the level of performance that is sufficient for the safety of patients or not." So, the research question is "What is the indicator for the evaluation of the basic medical care performance of NPs"?

In this study, the framework was used on the basic medical care of TNC as the main framework to set a factor and create basic medical care indicators. This framework consist of: (1) ability to assess the differential diagnosis of any group, then provide appropriate treatment, care and support to imitate the regulation of basic medical care and immunity; (2) providing care, treatment of diseases and common symptoms, referral of complicated or severe symptoms and doing partial medical procedures as defined; (3) giving medication to relieve symptoms or curing the disease which imitates the regulation; (4) following up the treatment; and (5) providing the patient with continuous care (TNC, 2011).

METHODOLOGY

This study was conducted in 2 steps. The first step was to establish performance indicators by creating the primary indicators by reviewing literature and interviewing NP experts, NP preceptors, and stakeholders of basic medical care about a performance indicator evaluation of basic medical care of NPs. The framework for the interviews was based on the Thailand Nursing Council's framework of basic medical care in the five areas earlier shown (TNC, 2011). Thereafter, the interview results were analyzed and synthesized to obtain the factors (element) and the basic indicator and performance of NPs in the basic medical care questionnaire.

The second step was to validate the basic medical care performance indicators of NPs. A quantitative survey designed to achieve the research objective were sent to the NP sample across all the four regions of Thailand: North, Central, Northeastern, and South. Then, the data obtained from the questionnaires were analyzed with second-order confirmatory factor analysis technique toconfirm whether or not the factors and performance indicators of the basic medical care from the initial interviews are consistent with empirical data.

Samples

In the first step, the samples used in the interviews were purposive sampling in two subgroups; one comprised 7 experts in basic medical care (5 NP experts and 2 NP preceptors). The other comprised 6 stakeholders involved in basic medical care (2 NPs, 2 patients and 2 relatives).

In the second step, the total sample comprised 510 NPs who were not in the interview samples, from 23 provinces across the country with experience of at least two years of working and worked at a primary health care unit. They graduated from 4 nursing colleges under Praboromarajchanok Institutes in 4 regions of Thailand: Boromarajonani College of Nursing Lampang, the samples consisted of 103 NPs; Prachomklao College of Nursing, the samples consisted of 86 NPs; Srimahasarakham Nursing College, the samples consisted of 162 NPs; and Boromarajonani College of Nursing Surat Thani, the samples consisted of 159 NPs. The sample was selected by multi-stage random sampling and the sample size was determined with a ratio of 10 respondents per parameter which was considered as the most appropriate (Hair et al., 2010). As the proposed model was relatively complex (estimation of approximately 51 parameters), the study required 510 respondents.

Instrument

Structured interview form: Performance indicator treating primary care practice

This instrument was used to interview experts and stakeholders to create useful performance indicators. A structured interview was created for 10 items by reviewing literature. Item, such as the TNC, set one performance of Basic Medical Care of NP as assessment and diagnosis, what should the indicator be to evaluate this performance? Then, the content validity was checked by 5 experts, considering the issue of consistency between the questions in the interview and the purpose or desired information. The data were analyzed for Index of Item Objective Congruence (IOC) of Rovinelli and Hambleton. The results showed that the item had the IOC between 0.80 and 1.00, and the suggestions of experts were used to improve the interview.

Performance indicators of the NPs in the Basic Medical Care questionnaire

This questionnaire was used to survey NPs across the 4 regions of Thailand. A draft 5-level rating scale questionnaire with 110 items was constructed, using the information from the interview. "The NP that has to do with a patient physical examination correctly and completely" is an example of the item. Then, the content validity was checked by 5 experts and the data were analyzed for IOC. The results showed that the items have the IOC between 0.60 and 1.00, and the information from the experts was used to improve the questionnaire. Then, the questionnaire was tried out with 40 non sample NPs in Mahasarakham. The discrimination power of the item was analyzed, it was found that the discrimination power ranged from 0.51 to 0.73. The Cronbach's alpha coefficient was used to find the total reliability, and the result was 0.89.

Procedure

In the first step, collecting data by interviewing 2 subgroups; the first group consisted of experts in basic medical care and NPs, the other group consisted of patients and relatives.

Experts and NPs interview: The experts and NPs were requested through correspondent to be interviewed after which date of interview was set through telephone conversation. The participants' rights were provided to voluntarily participation, and confidentiality of the information or data obtained was guaranteed. The interview was carried out in the private area and tape record was allowed by

the interviewee.

Patients and relatives: All steps of the aforementioned procedures were carried out with the interview of patients and relatives. However, the venue was at primary health care center of the respective interviewee. In second step, the name and address of NP curriculum graduates who were not in the interview group were collected from each sample college. Then, the questionnaires and empty mailing envelopes were sent to each NP. The participants received a composite questionnaire which included a cover letter and demographics. The cover letter provided the rationale of the study, instructions, and information concerning the participants' rights to voluntarily participate, and confidentiality of the information or data obtained was guaranteed.

Data analysis

In the first step, content analysis was used to analyze data from document, open-ended questionnaire and interviews.

In the second steps, after the elements and performance indicators from the first step were obtained, the goodness and appropriateness of the indicators had to be confirmed. Therefore, the second-order confirmatory factor analysis (second CFA) technique was used to analyze the data collected from nationwide survey questionnaires which were sent back from NPs through MPlus program version 6.12. This technique was used to confirm whether or not the factors and performance indicators of the basic medical care from the initial interviews were consistent with empirical data. In this research, the second CFA of performance indicator in basic medical care latent variable analysis to check model validation or the consistency of the developed model that are consistent with any particular level of the empirical data. The cutoff values for assessing model fit indexes are shown in Table 1. The results of analysis also enable us to weigh the importance of each indicator which would be used to determine the weight of further evaluation.

Ethical consideration

Ethical approval of the study was obtained from the Institutional Review Board of Mahasarakham University (IRB-182/2014) and board of Srimahasarakham Nursing College (IRB SNC-002/2014). the participants' rights to voluntarily participate were prioritized, and confidentiality of the information or data obtained were maintained. The study results will be presented as a whole and will be used for the purposes of education only.

RESULTS

The results from the first step: to establish primary performance indicators of the NPs in basic medical care revealed that there were 20 indicators in 5 elements as detailed subsequently.

Element 1 is the assessment and diagnosis, composing of 5 indicators: (1) has a needed history, health history, chief complaint, present illness, (2) complete for all principle in patients physical examination, (3) do laboratory investigation according to the level of the hospital and symptomatic indicator, (4) knowledge of basic medical care, (5) diagnosis ability.

Element 2 is caring, provide treatment of diseases and common symptoms, and doing NP medical procedures, composing of 6 indicators: (1) treated exactly as the disease and symptoms appear, (2) treatment according to the guidelines, (3) caring help, (4) patients get well or better, (5) skills to do the medical procedure, and (6) complications after surgery must not exist.

Element 3 is giving medication to relieve symptoms or giving treatment according to the guidelines and basic immunization, composing of 3 indicators: (1) medication appropriate for diseases or symptoms, and administered within medication framework, (2) giving appropriate immunization, (3) providing advice on the use of medication or immunization.

Element 4 is referral and follow up the treatment, composing of 3 indicators; (1) follow up and support system, (2) building data base system, (3) referral system.

Element 5 is continuing patient care, composing of 3 indicators: (1) home visits, (2) ability to organize and maintain a continuous care, (3) specialized clinical services.

The result from nationwide surveys on the basic medical care performance indicators of NPs are as shown in Table 2. A shown in Table 2, the results show that the basic medical care performance indicators of NPs in total were in the high level ($\overline{X}$ = 4.32). In each indicator, the highest were caring help ($\overline{X}$ = 4.64), giving appropriate immunization ($\overline{X}$ = 4.68), and providing advice on the use of medication ($\overline{X}$ = 4.59).

The result from the second step, validate the basic medical care performance indicators of NPs by the second CFA from nationwide survey to examine the empirical data showed that the model of performance indicator to assess basic medical care (BMC) of NPs was fitted with the empirical data. Model fitted indexes at the significance level of .01 were χ^2 = 192.307, df = 165, p = 0.0716, CFI = 0.996, TLI = 0.996, RMSEA = 0.018, SRMR = 0.053 and χ^2, df = 1.17, all of which were related to cutoff values criteria (Figure 1).

The weight of each indicator of each element had statistical significance level of .01 ranging from 0.424 to 0.915, and prediction coefficients (R^2) ranging from 0.180 to 0.838.

All the 5 element's weight of performance of basic medical care have positive values ranging from 0.621 to 0.986 at statistically significance level of 0.01, and arranged elements' weight were the following elements: caring, provide treatment of common symptom and medical procedures; medication to relieve symptoms or treatment according to the guidelines and basic immunization; a follow up and support system; assessment and diagnosis; and continuing patient care. The weights were 0.986, 0.966, 0.945, 0.899, and 0.621, respectively.

These show that all elements' weights were important in performance indicators of the NP in basic medical care and Rx element was the most important, while continue element was the least important as detailed (Table 3).

Table 1. Goodness of fit indixes and and cutoff values criteria for assessing model fit indexes (Hooper et al., 2008; Hox, 2010; Goffin 2007; Sharma et al., 2005; Steiger, 2007).

Goodness of fit indixes	Cutoff values criteria for assessing model fit indexes
Relative Chi square (χ/df)	<2 or <5 (Complex Model) model fit
Comparative fit index (CFI)	≥0.95 good fit (closer to 1.0 indicating good fit)
Tucker-ewis index (TLI) or non-norm fit index (NNFI)	≥0.95 good fit , 1 perfect fit
Weighted root mean square residual (WRMR)	0.80 to 0.90 good fit, 0.90 - 1.00 mediocre fit
Root Mean Square Error of Approximation (RMSEA)	Less than 0.05 close fit, 0.05 to 0.08 reasonable fit more than 0.10 unacceptable fit
Standardized root mean square residual (SRMR)	Less than 0.05 good fit, 0.05 to 0.08 mediocre fit more than 0.08 unacceptable fit

Table 2. Mean and standard deviation of the basic medical care performance indicators of NPs.

Element/Indicator	$\overline{X}$	SD	Interpretative
Element 1: **Assessment and diagnosis**	**4.20**	**0.390**	**High**
1 Has a needed history, health history	4.46	0.374	High
2 Complete for all principle in patients physical examined	4.20	0.482	High
3 Do laboratory investigation according to the level of the hospital and symptomatic indicator	4.09	0.704	High
4 Knowledge of basic medical care	4.07	0.503	High
5 Diagnosis ability	4.17	0.488	High
Element 2: Caring, provide treatment of common symptoms, and doing NP medical procedures	**4.39**	**0.376**	**High**
1 Treated exactly as the disease and symptoms	4.21	0.484	High
2 Treatment according to the guidelines	4.42	0.472	High
3 Caring help	4.64	0.431	Highest
4 Patients get well or better	4.22	0.461	High
5 Skills to do the medical procedure	4.39	0.514	High
6 Complications after surgery must not exist	4.47	0.470	High
Element 3: Giving medication to relieve symptoms or giving treatment which imitate the regulation	**4.57**	**0.388**	**Highest**
1 Medication appropriate with diseases or symptoms, and administered within medication framework	4.43	0.434	High
2 Giving appropriate immunization	4.68	0.413	Highest
3 Providing advice on the use of medication immunizations. (Adv)	4.59	0.480	Highest
Element 4: **Referral and follow up the treatment**	**4.34**	**0.434**	**High**
1 Follow up and support system	4.18	0.527	High
2 Building data base system	4.45	0.495	High
3 Referral system	4.41	0.485	High

Table 2. Cont'd

Elements 5: Continuing patient care	**4.09**	**0.541**	**High**
1 Home visits	4.04	0.609	High
2 Ability to organize and maintain a continuous care	4.00	0.604	High
3 Specialized clinical services	4.24	0.609	High
Total	4.32	0.341	High

Table 3. Results of the second CFA of the performance indicators of the NP in basic medical care.

Element/Indicator	Elements' weight	R^2
Element 1 Assessment and diagnosis (PEDX)	0.899**	0.807
1.1 Has a needed history, health history,Chief complaint, present illness (Hx)	0.424**	0.180
1.2 Complete for all principle in patients physical examined (PE)	0.663**	0.440
1.3 Do laboratory investigation according to the level of the hospital and symptomatic indicator (Lab)	0.522**	0.272
1.4 Knowledge of basic medical care (K)	0.798**	0.637
1.5 Diagnosis ability (Dx)	0.849**	0.720
Element 2 Caring, provide treatment of common symptoms, and doing NP medical procedures (Rx)	0.986**	0.973
2.1 Treated exactly as the disease and symptoms (Sym)	0.854**	0.729
2.2 Treatment according to the guidelines (Guide)	0.772**	0.597
2.3 Caring help (Caring)	0.568**	0.322
2.4 Patients get well or better (Well)	0.648**	0.420
2.5 Skills to do the medical procedure (Skill)	0.826**	0.682
2.6 Complications after surgery must not exist (Com)	0.781**	0.610
Element 3 Giving medication to relieve symptoms or giving treatment which imitate the regulation (Treat)	0.966**	0.934
3.1 Medication appropriate with diseases or symptoms, and administered by medication framework (Med)	0.915**	0.838
3.2 Giving appropriate immunizations (immu)	0.629**	0.395
3.3 Providing advice on the use of medication or immunization. (Adv)	0.675**	0.456
Element 4 **Referral and follow up the treatment (Follow)**	0.945**	0.894
4.1 Follow up and support system (FU)	0.740**	0.548
4.2 Building data base system (Dbase)	0.705**	0.497
4.3 Referral system (Refer)	0.791**	0.626

Table 3. Cont'd.

Element 5 Continuing patient care (Continued)	0.621**	0.386
5.1 Home visits (Home)	0.820**	0.672
5.2 Ability to organize and maintain a continuous care (organiz)	0.822**	0.676
5.3 Specialized clinical services (Clinic)	0.784**	0.615

**Statistically significant as 0.01.

DISCUSSION

There are 20 indicators in 5 elements of the performance indicators of NP in basic medical care, and arrange elements' weights were the following elements: caring, provide treatment of common symptoms and medical procedures; medication to relieve symptoms or treatment base on the guidelines and basic immunization; a follow up to maintain and referral, assessment and diagnosis, and continuing patient care. The weights were 0.986, 0.966, 0.945, 0.899, and 0.621, respectively. These show all elements' weights were important in performance indicators of the NPs in basic medical care. These correspond with Rhoads (2006). The health history lays the foundation for care. It guides the relative emphasis placed on each system in the physical examination and formulation of differential diagnosis and treatment decision. A weak foundation places the patient at risk for misdiagnosis and inadequate or erroneous treatment; it also identifies the clinician as one who does not practice within acceptable standard of care, making him vulnerable to legal action. It also correspond with Fenstermacher and Hudson (2014) who mentioned that history and physical examination, for history data must find chief complaint, present illness, family history, past medical history and systematically investigate the various body systems to obtain any additional information that would be helpful in arriving at an accurate diagnosis. It is the responsibility of practitioners, relying on their experience and knowledge of their patients, to make diagnoses, to determine drug dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. In addition, it corresponds with Stanhope and Lancaster (2014) who said that NPs receive advance training. Training emphasizes clinical medical skills (history, physical examination, and diagnosis), in addition to the traditional psychosocial and prevention-focused skills that are normally thought of as nursing (Nies and McEwen, 2011).

Nurses from clinics or health departments often conduct home visits as a part of patient follow-up. The focus of all home visits is on the individual for whom the referral is received. In addition, the nurse assesses the individual-family interaction and provides education and interventions for the family and client. Furthermore, these correspond with Gardner et al. (2006) who found that theperformance indicators of NP competencies in Australia and New Zealand demonstrates advanced knowledge of human sciences and extended skills in diagnostic reasoning, give ability to synthesis and interpret assessment information including client, patient history, physical findings and diagnostic data, decisions about preventive, diagnostic and therapeutic responses and interventions that are based on clinical judgment, establishes therapeutic links with the patient/client/community, and relationships with other health professionals. Moreover, Klemenc-Ketis et al. (2014) who found that evaluation of nurse practitioners in primary care settings whose the clinical approach, comprehensive approach and patient-centered approach were used as very good. Finally, from research findings, this can give concerned idea of how to find the performance of basic medical care of NP evaluations in 20 earlier indicators.

Conclusion

The performance indicators of the NP in basic medical care had 20 indicators in 5 elements. The indicators were derived from these NPs, NP experts, patients and relatives who were directly involved with the basic medical care. Collecting data was carried out in actual conditions. Therefore, these indicators can be applied to evaluate the NPs for enhancement of their performance in basic medical care.

LIMITATIONS AND FUTURE IMPLICATION OF WORK

In this study, only basic medical care indicators which are a part of multi-sided job of NPs were developed. So, the next study should deal with development of other aspects of NP performance. The indicators created were created in the context

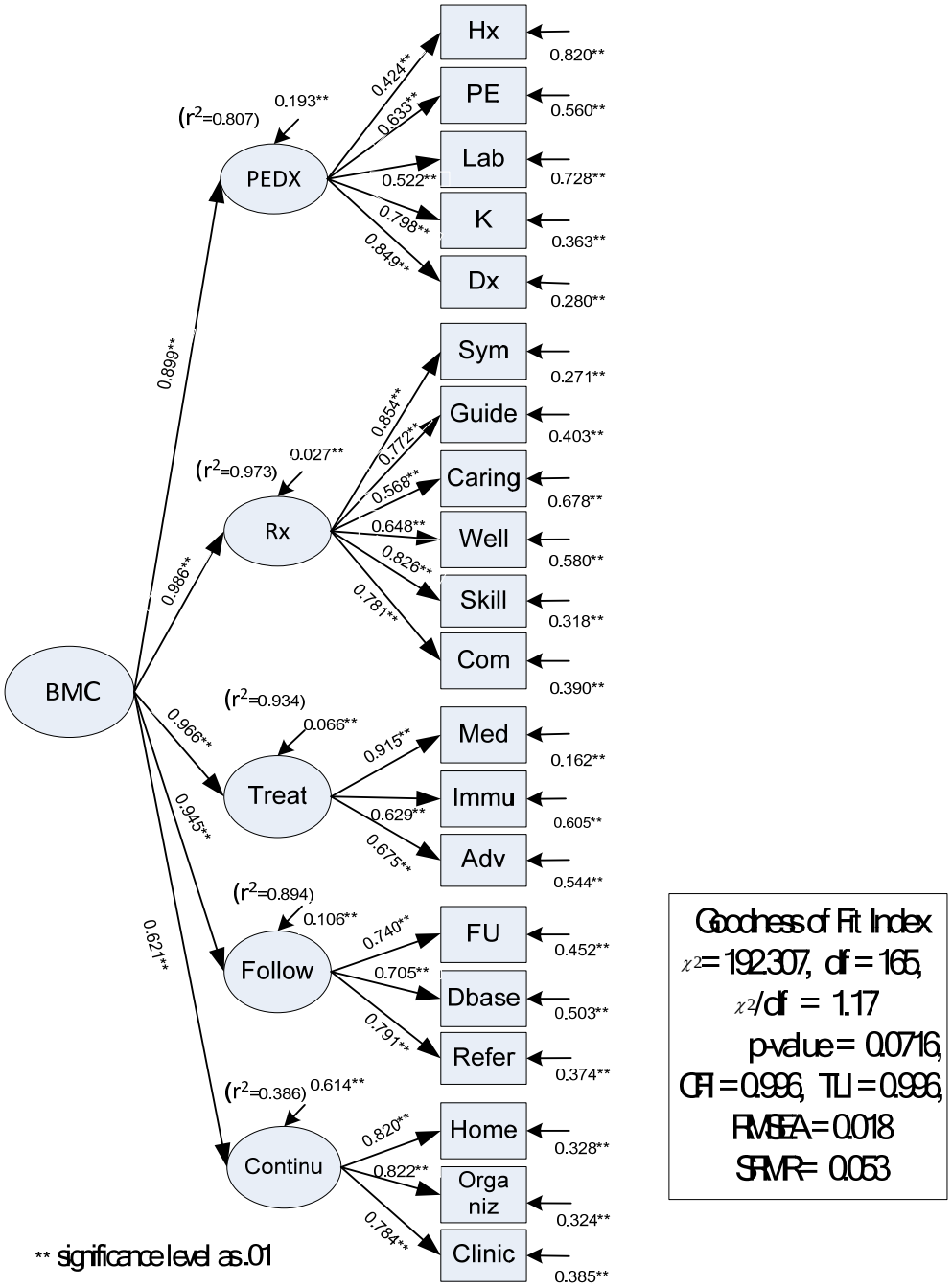

Figure 1. The 2nd CFA model of the performance indicators of the NP in basic medical care.

of NPs in Thailand; therefore, further implication of these indicators should be carried out after the detail of the indicator has been thoroughly studied.

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Conflict of interest

The authors declare that they have no conflict of interest.

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