

CHAPTER 4

Results and Discussion

4.1 Results

This chapter consists of the results and the discussion of the development of the Nursing Performance in Patient Safety Scale (NPPSS) for nurses in Thailand. The results of this study are presented in the six steps of the scale development: 1) identification of construct, 2) generating an item pool, 3) determining the format for measurement, 4) reviewing for content validity by experts, 5) determining of reliability, clarity, and readability, 6) field testing for evaluating the item by determination of item analysis and constructing validity testing with factor analysis.

4.1.1 Step 1: Identification of construct. Identifying the domains from the integration of patient safety came from an analysis of the concept by the researcher, the nurse role for patient safety and performance concept came from the comprehensive literature review.

The construct of the NPPSS involved two dimensions of nursing performance in patient safety namely; 1) nursing task performance in patient safety, these included protection, prevention, mitigation, and promotion. 2) Nursing contextual performance in patient safety, these included interpersonal facilitation for patient safety and dedication to patient safety. The definitions of six sub-dimensions were described as follows:

1) Protection refers to an individual nurse's behaviors against harm before reaching patient by finding incidents that might occur to patients.

2) Prevention refers to an individual nurse's behaviors that attempts to stop harm before reaching patients.

3) Mitigation refers to an individual nurse's behaviors in reducing the severity of complications after something goes wrong caused by making incidents in patient treatment that could put patients in risky situations.

4) Promotion refers to an individual nurse's behaviors to perform the nurse function and continually enhance patient safety.

5) Interpersonal facilitation for patient safety refers to an individual nurse's behaviors to cooperate and immediately respond to requests from other team members in emergency situations.

6) Dedication to patient safety refers to an individual nurse's behaviors that shows striving for patient safety.

4.1.2 Step 2: Generating an item pool. Items were identified from the operational definition of six sub-dimensions of nursing performance in patient safety. Initially, the researcher generated 141 items for the first draft of items pool with six subscales, item descriptions of the first draft of the NPPSS are shown in table 4-1.

Table 4.1 Subscales of the NPPSS, definitions and number of items of each subscale

Subscales	Definitions	Number of items
Protection	an individual nurses' behavior against harm before reaching patient by finding incidents that might occur to patients.	19
Prevention	an individual nurses' behavior that attempts to stop harm before reaching patients.	56
Mitigation	an individual nurse's behavior in reducing the severity of complications after something goes wrong.	17
Promotion	an individual nurses' behavior to perform the nurse function and continually enhance patient safety.	18
Interpersonal facilitation for patient safety	an individual nurses' behaviors to cooperate and immediately respond to requests from other team members in emergency situations, and ask for help when in an emergency situation, dealing with patient safety problems and participating in safety meeting.	15
Dedication to patient safety	activities that demonstrate effort, initiative to solve the patient safety problem, persistence and self discipline, put in extra hours to receive, training in patient safety.	16
The entire scale		141

4.1.3 Step 3: Determining the format for measurement. Scaling responses were defined with a six point Likert-type scale. The response alternatives range from no practice to highly practice (0 = no practiced, 1 = slightly practiced, 2 = somewhat practiced, 3 = moderately practiced, 4 = most practiced, and 5= highly practiced).

4.1.4 Step 4: Reviewing for content validity by experts. The item pool for the first draft of the NPPSS with 141 items was sent to a panel of five experts to determine the content validity. In this step, five experts reviewed the items in two

rounds. The experts returned the first draft of the NPPSS with their suggestions for the scale format and the relevance of items. The results of first round are as follows:

The expert suggested changing the response alternatives as frequency of practice. Therefore, it would range from no practice (0) to frequently practiced (5) (0 = never done, 1 = scarcely done, 2 = rarely done, 3 = sometimes done, 4 = often done, and 5 = always done). The experts suggested that most of the items needed revision for clarity. Fifty one items were not relevant to the content of the nursing performance in patient safety, therefore they were deleted. Twenty three items were integrated within similar items. Twenty seven items had their wording revised. Seven items were separated because they have two aspects in each item. Twenty nine items, which were relevant to the concept, remained.

The rating of the relevance of each item was computed on the content validity index (CVI) at the item level (I-CVI) ranged from 0.2 to 1.00 and item level- CVI was .88. At the scale level (S-CVI/UA) was .58, which was less than the criteria (1.00). Inter-rater agreement was 0.79, which was less than the criteria (0.90). Thus, sixty two items, which had no relevance to the concept, were ambiguous, and impractical were deleted from the scale. The scale then consisted of; four items in protection, twenty seven items in prevention, five items in mitigation, eight items in promotion, nine items in interpersonal facilitation, and nine items in dedication to patient safety. Therefore, the remaining seventy nine items were utilized in the second draft of the NPPSS and were sent to all experts.

The results of the second round of content validity: the experts suggested that some items (56) that were relevant to the concept also needed minor revisions for clarity. Six items were not relevant to the content of the nursing performance in patient safety, they were deleted. Two items were integrated with a similar item. Eight items were reworded to have a more comprehensive content. The rating of the relevance of each item was computed on the content validity index (CVI) and ranged from 0.8 to 1.00 and item level- CVI was .98. The scale level-CVI/UA was .92, which was less than the criteria. Thus, two items in prevention, two items in mitigation, one item in promotion, and one item in dedication to patient safety, which were ambiguous and impractical, were deleted from the scale and 73 items were retained. The five experts agreed with all 73 items. Therefore, the item level-CVI of 73 items

was 1.00 and the scale-CVI/UA also resulted in 1.00. This meets the criteria regarding item level-CVIs of 1.00 for five experts. Inter-rater agreement was 0.97, which was accepted value (Burns & Grove, 2009).

Seventy three items of the third draft of the NPPSS consist of fifteen items in protection, twenty seven items in prevention, ten items in mitigation, nine items in promotion, six items in interpersonal facilitation, and six items in dedication to patient safety. These items were utilized to construct the NPPSS for the pretesting.

Table 4.2 Subscales of the NPPSS, number of the deleted items of the first draft, the second draft, and the third draft of item reviewing by experts

Subscales	Number of Items				
	First draft	Deleted at the 1 st round review	Second draft	Deleted at the 2 nd round review	Third draft
Protection	19	4	15	-	15
Prevention	56	27	29	2	27
Mitigation	17	5	12	2	10
Promotion	18	8	10	1	9
Interpersonal facilitation for patient safety	15	9	6	-	6
Dedication to patient safety	16	9	7	1	6
The entire scale	141	62	79	6	73

4.1.5 Step 5: Pre-test for determining reliability, face validity and feasibility. Seventy three items of the third draft of the NPPSS were examined for face validity and feasibility and reliability by thirty nurses. The demographic characteristics of the nurses in the pre-testing for reliability consisted of: Ages ranged from 31 to 55 years with a mean age 45.87 years (S.D. = 5.76), and the most of them were female (96.7%). The majority of the participants (73.3%) were married and

90% held bachelor degrees and 10% master degrees. Their experiences in patient care ranged from 4 to 27 years with an average experience of 16.03 years (S.D. = 6.87). Seventy percent of the participants had never attended any training courses on patient safety.

The seventy three items in the third draft of the NPPSS were evaluated for face validity and feasibility. The findings revealed that all items were clear (100%) and practical (100%), and 96.7% of the items were understandable. Moreover 100% of nurses agreed that the length of the questionnaire was appropriate. The length of time for filling out the scale ranged from 13 to 80 minutes with a mean time of 43.53 minutes. All participants commented that there are a continuation of all of item. There are the possibility to implementation and Cronbach's alpha coefficient of each subscale of the third draft of the NPPSS as presented in the Table 4.3

Table 4.3 Cronbach's Alpha coefficient of each subscale of the third draft of the NPPSS (N=30)

Subscales	Number of Items (total=73)	Cronbach's Alpha
Protection	15	.90
Prevention	27	.85
Mitigation	10	.76
Promotion	9	.93
Interpersonal facilitation for patient safety	6	.97
Dedication to patient safety	6	.87
Total	73	.95

The total internal consistency reliability of the scale was .95. The internal consistency reliability for the six subscales ranged from .76 to .97. The interpersonal facilitation for patient safety subscales obtained the highest Cronbach's alpha of .97, while the mitigation subscale had the lowest alpha of .76. Then, this scale was used for further examination of construct validity to evaluate of psychometric properties.

4.1.6 Step 6: Field testing for item analysis and construct validity. Field testing was conducted with 759 nurses in order to examine the construct validity of the third draft of the NPPSS which had seventy three items. The findings are presented by describing the participants' characteristics, item analysis, and exploratory factor analysis. The characteristics of the participants are shown in Table 4.4.

Table 4.4 Characteristics of the subjects in construct validity testing.

Characteristics	Number (n = 759)	Percentage (%)
Age (year):		
Range = 22-60, Mean = 43.82 , S.D. = 8.97		
22-30	79	10.41
31-40	207	27.27
41-50	272	35.84
51-60	201	26.48
Sex		
Female	745	98.16
Male	14	1.84
Educational level:		
Bachelor degree	606	79.84
Master degree	152	20.03
Doctoral degree	1	0.13
Working experiences (years)		
Range = 2- 38, Mean = 13.30 , S.D. = 8.56		
2 - 10	319	42.03
11 - 20	296	39.00
21 - 30	126	16.60
31 - 40	18	2.37
Working place		
Regional hospital	396	52.17

Table 4.4 (continued)

Characteristics	Number (n = 759)	Percentage (%)
General hospital	363	47.83
Attended a training course		
Occasionally	411	54.15
Never	348	45.85

The ages of the subjects ranged from 22 to 60 years with a mean age of 43.82 years (S.D. = 8.97), and most of them were female (98.16%) and 79.84% had a bachelor degree. Over half (52.17%) worked in a regional hospital and the rest worked in a general hospital (47.83%). Their experience in patient care varied widely from 2 to 38 years with an average experience of 13.30 years (S.D. = 8.56), while half of the subject (54.15%) had attended a training course in patient safety.

1) Social desirability. The 10 items of the Marlowe - Crowne Social Desirability (10-SDS) was originally written in English. It was translated into Thai and back translation into English to assure that equivalence in meaning occurred during the translation process. Then, the original English versions and translated English version were compared by an American English language teacher at a university to confirm they had the same meaning. Both English versions are synonymous.

The reliability of 10-SDS of Thai version was calculated using Kuder-Richardson (KR-20) since the scale was a binary format. Kuder-Richardson reliability for the entire scale was calculated at 0.70, which was acceptable.

The Spearman's rank-order correlation coefficient between the score of individual items of the protection subscale and 10- SDS ranged from 0.01 to 0.02 which was not significant. However "evaluating patients' knowledge to use it as the data for exploration of possible risks" obtained the correlation of 0.07 ($p < 0.05$). The score of individual items of prevention subscale ranged from 0.00 to 0.06, which was not significant, the score of individual of the mitigation subscale ranged from 0.00 to 0.04, which was not significant, the score of individuals of the promotion subscale ranged from 0.00 to 0.06, which was not significant, the score of individuals of the

interpersonal facilitation subscale ranged from 0.02 to 0.04, which was not significant, and the score of individual of the dedication to patient safety subscale ranged from 0.00 to 0.06 which was not significant.

The correlation between the prevention subscale and 10- SDS was 0.03, the prevention subscale -0.01, the mitigation subscale of 0.01, the promotion subscale of 0.02, the interpersonal facilitation subscale of 0.01, and the dedication to patient safety subscale of 0.03, all subscales were not significant. The correlation between the third draft of the NPPSS and 10- SDS found no significance between the overall of the third draft of the NPPSS and 10- SDS ($r = 0.02, p < 0.05$).

2) Descriptive statistics of items. Field testing of the NPPSS with 73 items was examined for validity and reliability. The results are described using descriptive statistics of items, item analysis, and exploratory factor analysis.

Item mean. Among the 73 items of the NPPSS, the item means ranged from 4.00 to 4.50 with standard deviation ranging from 0.51 to 0.71.

Item variance, the item with a high value for item variances is desirable. For the NPPSS, the results showed that the mean of item variances was .23, which is within the range 0.26 to 0.50.

The Cronbach's alpha of the total NPPSS (73 items) was .98, and for each of the six subscales; ranged from .86 to .94. Among the six subscales, the highest Cronbach's alpha value of .94 was the protection subscale. The lowest Cronbach's alpha value of .88 was the dedication to patient safety.

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Table 4.5 Number of items, Cronbach's alpha, the mean, standard deviation, and variance of the NPPSS with 73 items (n = 759)

Domains	No. of Items	Cronbach's Alpha	Mean	SD	Variance
Protection	15	.94	4.19	.56	.32
Prevention	27	.93	4.37	.51	.26
Mitigation	10	.93	4.49	.55	.31
Promotion	9	.86	4.39	.54	.29
Interpersonal facilitation for patient safety	6	.90	4.50	.53	.28
Dedication to patient safety	6	.88	4.00	.71	.50
The overall scale	73	.98	4.32	.48	.23

Among the 73 items of the NPPSS, the item means was 4.32, close to the centre of the range of possible scores. The mean of item variances was .23, where a high value for item variances is desirable. The Cronbach's alpha value of the overall scales was .98, a Cronbach's alpha value more than .70 is desirable. Therefore, all items were retained in this scale.

3) Inter-item analysis.

Inter-item correlation and item-subscale correlation. The results of inter-item and item-subscale correlation on each subscale are summarized as follows.

In the subscale of protection, the item to item correlation of all 15 items ranged from 0.33 to .79. The ratio of the item to item correlation between .30 and .70 with other items in the scale was 14/14. Among the fifteen items of this subscale, the item to subscale correlation ranged from 0.62 to 0.75. Seven items that correlated over 0.70 were redundant (PT8 = 0.75, PT9 = 0.75, PT10 = 0.73, PT11 = 0.71, PT 12 = 0.71, PT13 = 0.74, and PT14 = 0.71). There were eight items that met the criteria of item to subscale correlation.

In the subscale of prevention, the item to item correlation of all 27 items ranged from 0.18 to 0.82. The ratio of the item to item correlation between .30 and .70 with other items in the scale was 10/26 to 25/26. Among the twenty seven items of

this subscale, all items met the criteria of item to subscale correlation and range from 0.46 to 0.68. Therefore, all items of this subscale were retained.

In the subscale of mitigation, the item to item correlation of all ten items ranged from 0.49 to 0.74. The ratio of the item to item correlation between .30 and .70 with other items in the scale was 8/9 to 9/9. Among the ten items of this subscale, the results of item to subscale correlation were ranged from 0.70 to 0.78. Eight items that correlated over 0.70 are redundant (MT2 = 0.78, MT3 = 0.72, MT4 = 0.71, MT5 = 0.74, MT6 = 0.78, MT7 = 0.78, MT8 = 0.75, MT9 = 0.77). There were two items that met the criteria of item to subscale correlation.

In the subscale of promotion, the item to item correlation of all nine items ranged from 0.22 to 0.78. The ratio of the item to item correlation between .30 and .70 with other items in the scale was 5/8 to 8/8. Among the nine items of this subscale, the results of item to subscale correlation ranged from 0.41 to 0.78. Four items that correlated over 0.70 were made redundant (PM2 = 0.71, PM6 = 0.78, PM7 = 0.78, PM8 = 0.74). There are five items that met the criteria of item to subscale correlation.

In the subscale of interpersonal facilitation for patient safety, the item to item correlation of all six items ranged from 0.43 to 0.74. The ratio of the item to item correlation between .30 and .70 with other items in the scale was 3/5 to 5/5. Among the six items of this subscale, the results of item to subscale correlation ranged from 0.67 to 0.83. Four items that correlated over 0.70 are redundant (IF2 = 0.76, IF3 = 0.83, IF4 = 0.78, IF5 = 0.80). There are two items that met the criteria of item to subscale correlation.

In the subscale of dedication to patient safety, the item to item correlation of all six items ranged from 0.13 to 0.74. The ratio of the item to item correlation between .30 and .70 with other items in the scale was 2/5 to 5/5. Among the six items of this subscale, the results of item to subscale correlation ranged from 0.29 to 0.76. Two items that correlated over 0.70 are redundant (DP3 = 0.76, DP5 = 0.76). One item had correlation less than 0.30 (DP6 = 0.29). There are three items that met the criteria of item to subscale correlation.

Item-total correlation and alpha coefficient if item deleted. The corrected item-total correlation of the 73 items ranged from 0.24 to 0.75. One item had low correlation (DP6 = 0.24). The Cronbach's alpha coefficient of all items was .97. The

alpha coefficient, if items deleted, for all items ranged from 0.972 to 0.974. The results revealed that when three items were dropped from the scale, the Cronbach's alpha increased. Therefore, three items in the NPPSS were dropped from the scale. They included "Provide a reminder of high risk of catheterization or tubing to prevent mistakes" (PV 20) in the subscale of prevention, "Never trace the offender on the incidence of adverse events" (PM1) in the subscale of promotion, and "Strictly follow nursing care plans for patient safety even though the supervisor is absent and no one is around" (DP6) in the subscale of dedication to patient safety. DP6 was item which item to subscale correlation less than 0.30. Thus, 70 items were retained for further factor analysis. The fourth draft of the NPPSS with 70 items was constructed.

Subscale-subscale correlation and subscale-total correlation. The criteria of the subscale-subscale correlation and item-subscale was more than .30 (Mishel, 1998). The correlation between subscales of the third draft of the NPPSS ranged from 0.54 to 0.78, Among six subscales, the subscale of interpersonal facilitation for patient safety and the subscale of promotion for patient safety had the highest correlation coefficient of 0.78, whereas the correlation coefficient between the subscale of dedication to patient safety and the subscale of mitigation for patient safety got the lowest value of 0.54. The subscale-total correlation as the correlation between each subscale to the overall scale of the third draft of the NPPSS ranged from 0.86 to 0.95. The subscale of promotion, mitigation and interpersonal facilitation for patient safety achieved the highest correlation coefficient of 0.95, and the subscale of dedication to patient safety received the lowest correlation of 0.86. The results indicated that the values of subscale-subscale correlation and the values of subscale-total correlation were high to very high. Thus, all items were considered to be related to the concept within the subscale and accepted for retention in the third draft of the NPPSS. The results are displayed in Table 4.6.

Table 4.6 Subscale-subscale correlation and subscale-total correlation of the third draft of the NPPSS (73 items)

subscale	PT	PV	MT	PM	IF	DP
Protection (PT)	1.00					
Prevention (PV)	.70	1.00				
Mitigation (MT)	.64	.74	1.00			
Promotion (PM)	.59	.66	.74	1.00		
Interpersonal Facilitation (IF)	.60	.68	.77	.78	1.00	
Dedication to patient safety (DP)	.57	.57	.54	.60	.62	1.00
The entire scale	.95	.94	.95	.89	.95	.86

4) Exploratory factor analysis

Factor analysis was conducted including testing by Kaiser-Meyer-Olkin (KMO) and Bartlett's test, using several methods of factor extraction and selecting the best method that fits the construction of the fourth draft of the NPPSS with 70 items. The results of the factor analysis are as follows:

Kaiser-Meyer-Olkin and Bartlett's test. The findings revealed that the KMO measure was 0.97 which is acceptable. The Bartlett's test was significant ($\chi^2 = 38113.494$, $p = .000$), indicating overall significance of the correlation matrix. Thus, the findings of KMO and Bartlett's test demonstrate that this set of data was appropriate for factor analysis.

Factor extraction. In this study, to determine the components underlying the set of items of the scale, principal components analysis with oblique rotation by direct oblimin was selected because it yielded the best possibility to interpret the factor solution.

4.1) The results of the first-order factor analysis. The results of exploratory factor analysis with oblique rotation by direct oblimin showed 70 items consisting of ten components that were extracted with eigenvalues more than one, range from 1.08 to 27.64, and accounting for 63.63% of the total of variance. Percent of variance ranged from 1.54% to 39.49%. However, the scree plot indicated that five factors may be appropriate. In viewing the variance for the five factors, it showed a low value (2.30%). Moreover, communalities of all variables were more than .60.

Seventy items retrieved with factor loading ranging from .21 to .88. Thus, five items were deleted. The results of components of the fourth draft of the NPPSS, their eigenvalues, percent of variance accounted for, and cumulative percent of variance for the first-order factor analysis are presented in table 4.7 and six items loaded on two components are presented in table 4.8.

Table 4.7 Ten components of the fourth of the NPPSS, their eigenvalues ,percent of variance accounted for, and cumulative percent of variance for the first-order factor analysis (70 items)

Components	Eigen values	Percent of variance accounted for	Cumulative percent of variance
1	27.64	39.49	39.49
2	3.69	5.27	44.75
3	2.91	4.16	48.91
4	2.33	3.32	52.23
5	1.61	2.30	54.53
6	1.44	2.05	56.58
7	1.40	2.00	58.58
8	1.28	1.82	60.41
9	1.18	1.69	62.09
10	1.08	1.54	63.63

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Table 4.8 Six items loaded on two components of the first-order factor analysis.

Item number	Descriptions	Component Factor	loading
PM8	Apply the concept of security in all nursing practice	1	0.44
		4	0.40
IF4	Mentally support team members who face the incidence of adverse situations	1	0.40
		5	-0.30
IF6	Share ideas at a meeting to target patient safety in both wards and nursing departments	1	0.32
		4	0.49
PV25	Provide nursing care to a patient whose condition changes into crisis immediately	3	0.36
		8	0.39
PT10	Investigate communication predicaments in the multidisciplinary team, which can lead to an adverse event	2	.035
		9	-0.44
PT9	Seek communication problems between nurses and patients, which can lead to an adverse event	2	0.35
		9	0.43

Though all ten factors had eigenvalues more than one and six items in the subscale of prevention received the factor loadings less than 0.30, including PV1, PV2, PV3, PV4, PV15, PV26. The factor seven only had two items, including PV5 and PV6. There were six items loading on two components. They were considered for deletion. However, two of the six items which received the factor loadings less than 0.30 (PV1, PV2), one item of factors seven which only had two items (PV5), and six items loading on two components had to be retained because they indicated the conceptual sound of the NPPSS. Thus, only five items were deleted (PV3, PV4, PV6, PV15, PV26), 65 items were used for a second-order factor analysis. The fifth draft of the NPPSS with 65 items was constructed. The procedures were the same as in the first order.

4.2) The results of the second-order exploratory factor

Analysis. The result of exploratory factor analysis indicated 65 items consisting of nine components were extracted with eigenvalues more than one, and ranged from 1.12 to 25.72, and accounted for 63.24% of the total of variance. Percent of variance ranged from 1.72% to 39.56%. However, the scree plot indicated that five factors may be appropriate. In viewing the variance for the five factors, it was a low value (2.43%). Moreover, communalities of most of variables were more than .60. Sixty five items retrieved with factor loading ranging from .29 to .90. Thus, one item was deleted. The results of components of the fifth draft of the NPPSS, their eigenvalues, percent of variance accounted for, and cumulative percent of variance for the second-order factor analysis are presented in table 4.9 and six items loaded on two components are presented in table 4.10.

Table 4.9 Nine components of the fifth draft of the NPPSS, their eigenvalues, percent of variance accounted for, and cumulative percent of variance for the second-order factor analysis (65 items)

Components	Eigen values	Percent of variance accounted for	Cumulative percent of variance
1	25.72	39.56	39.56
2	3.61	5.55	45.11
3	2.80	4.31	49.42
4	2.29	3.52	52.94
5	1.58	2.44	55.37
6	1.41	2.17	57.54
7	1.35	2.07	59.61
8	1.24	1.91	61.52
9	1.12	1.72	63.24

Table 4.10 Six items loaded on two components of the second-order exploratory factor analysis.

Item number	Descriptions	Component Factor	loading
PM3	Apply the concept of security in all nursing practice	1	0.50
		4	0.37
IF6	Share ideas at a meeting to target patient safety in both wards and nursing departments	1	0.33
		4	0.48
PV25	Provide nursing care to a patient whose condition changes into crisis immediately	3	0.37
		7	-0.40
PV27	Explain to patients and relatives about possible risks and prevention of incidence	7	-0.35
		8	0.33
PT10	Investigate communication predicaments in the multidisciplinary team, which can lead to an adverse event	2	.034
		9	0.44
PT9	Seek communication problems between nurses and patients, which can lead to an adverse event	2	0.35
		9	0.42

Though all nine factors had eigenvalues more than one and only one item received the factor loadings less than 0.3. It was PV2 in the subscale of prevention and this was considered for deletion. Six items loading on two components had to be retained because they indicated the conceptual soundness of the NPPSS. Thus, one item was deleted; the sixth draft of the NPPSS was constructed. Sixty four items were used for a third-order factor analysis. The procedures were the same as in the first order.

4.3) The results of the third-order exploratory factor analysis. The result of exploratory factor analysis indicated 64 items consisting of nine components were extracted with eigenvalues more than one, ranging from 1.12 to 25.33, and accounting for 63.54% of the total of variance. Percent of variance ranged from 1.74% to 39.58%. However, the scree plot indicated that five factors may be appropriate. In viewing the variance for the five factors, it was a low value (2.46%). Moreover, communalities of most of variables were more than .60. Sixty four items retrieved with factor loading ranging from .34 to .90. Thus, 64 items were retained. The results of components of the sixth draft of the NPPSS, their eigenvalues, percent of variance accounted for, and cumulative percent of variance for the third-order factor analysis are presented in table 4.11 and six items loaded on two components are presented in table 4.12.

Table 4.11 Nine components of the sixth draft of the NPPSS, their eigenvalues, percent of variance accounted for, and cumulative percent of variance for the third-order factor analysis (64 items)

Components	Eigen values	Percent of variance accounted for	Cumulative percent of variance
1	25.33	39.58	39.58
2	3.60	5.63	45.20
3	2.79	4.36	49.57
4	2.27	3.55	53.12
5	1.57	2.46	55.58
6	1.41	2.20	57.78
7	1.34	2.09	59.87
8	1.24	1.93	61.80
9	1.12	1.74	63.54

Table 4.12 Six items loaded on two components of the third-order exploratory factor analysis.

Item number	Descriptions	Component Factor	loading
PM3	Do not predict the incidence of adverse	1	0.50
	information unknowingly	4	0.37
IF6	Share ideas at a meeting to target patient	1	0.33
	safety in both words and nursing departments	4	0.48
PV25	Provide nursing care to a patient whose	3	0.37
	condition changes into crisis immediately	7	-0.40
PV27	Explain to patients and relatives about	7	-0.35
	possible risks and prevention of incidence	8	0.33
PT10	Investigate communication predicaments in	2	.034
	the multidisciplinary team, which can lead to an adverse event	9	0.44
PT9	Seek communication problems between	2	0.35
	nurses and patients, which can lead to an adverse event	9	0.42

All nine factors had eigenvalues of more than one and all items received the factor loadings of more than 0.3. However six items loading on two components had to be retained because they indicated the conceptual soundness of the sixth draft of the NPPSS. Thus, the final draft of the NPPSS was summarized based on the result of third-order factor analysis. The final draft of the NPPSS consisted of nine components with 64 items. Nine components of the scale could explain 63.54% of variance. The nine components, number of items, description of items, and factor loading of the final draft of the NPPSS are summarized in Table 4.13 to 4.23.

Table 4.13 Component 1 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (12 items)

Item	Description of item	Factor loading
PM4	Be aware that nursing practice that focuses on patient safety is a core value of nursing organizations	0.63
PM6	Practice nursing as an example to the team members to work with an emphasis on the safety of patients	.063
PM2	Explain the details of an adverse event for a common understanding within the team.	0.59
IF3	Coordinate with team members to enhance the safety of patients	0.55
PM7	Propose the development of practices to enhance safety	0.53
IF2	Volunteer to help team members work to promote the safety of patients	0.53
PM5	Comply with safety practice guidelines that units jointly prepared	0.52
PM3	Do not predict the incidence of adverse information unknowingly	0.51
PM8	Apply the concept of safety in all nursing practice	0.50
IF1	Provide immediate assistance to team members in any emergency situation	0.48
IF5	Join activities in wards or hospitals, organized to enhance the safety of patients	0.47
IF4	Mentally support team members who face the incidence of adverse situations	0.42
Eigenvalue = 25.33		
Percent of variance = 39.58		

The first component was composed of twelve items with factor loadings ranging from 0.42 to 0.63 with an eigenvalue of 23.55, accounting for 39.58% of variance. Seven items came from the subscale of promotion for patient safety, five items related to interpersonal facilitation for patient safety. There was one item loading on two component (C) 1 and 4, consisting of PM8 (C1 = 0.50, C4 = 0.37),

However, when considering the meaning of items and the highest loading, this item was determined to retain component one. Thus, the first component was named **“Promotion through team and responsibility”**.

Table 4.14 Component 2 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (5 items)

Item	Description of item	Factor loading
PT12	Estimate patients’ cooperation to use it as the data for exploration of plausible risks	0.81
PT13	Promote communication between nurses and patients via many channels to enhance patients’ safety	0.78
PT15	Spend time explaining self-management to the patients to promote cooperation in nursing care	0.75
PT11	Evaluate patients’ knowledge to use it as the data for exploration of possible risks	0.73
PT14	Promote communication in the multidisciplinary team through many channels to enhance patients’ safety	0.57
Eigenvalue = 3.60		
Percent of variance = 5.63		

The second component was made up of five items with factor loadings ranging from 0.57 to 0.81 with an eigenvalue of 3.60, accounting for 5.63% of variance. All items came from the subscale of protection. Thus, the second component was named **“Protection through communication”**.

Table 4.15 Component 3 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (4 items)

Item	Description of item	Factor loading
PV7	Use a tool for controlling the solution quantity in patients with high intake of concentrated solution	0.76
PV8	Check the doctor's prescription before giving medication to patients	0.61
PV9	Check the quantity of concentrated solution in patients every hour and every time before nursing care.	0.57
PV14	Report the abnormal results of any laboratory examination directly to the responsible physician immediately.	0.54
Eigenvalue = 2.79 Percent of variance = 4.36		

The third component was composed of four items with factor loadings ranging from 0.54 to 0.76 with an eigenvalue of 2.79, accounting for 4.36% of variance. All items came from the subscale of prevention. Thus, the third component was named **“Prevention through right drug and solution administration”**.

Table 4.16 Component 4 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (7 items)

Item	Description of item	Factor loading
DP2	Attend quality development activities even on off-duty days	0.76
DP1	Spend personal off-duty time attending the training on the safety of patients	0.75
DP4	Develop innovations to enhance the patient safety	0.70
DP3	Develop methods to prevent adverse incidents and to suit patients under care.	0.65
DP5	Be eager to find a practice that focuses on patient safety even though the task is complicated and complex	0.63
PM9	Receive ongoing training on the patient safety	0.56
IF6	Share ideas at a meeting to target patient safety in both wards and nursing departments	0.48
Eigenvalue = 2.27		
Percent of variance = 3.35		

The fourth component was made up of seven items with factor loadings ranging from 0.48 to 0.76 with an eigenvalue of 2.47, accounting for 3.35% of variance. Five items came from the subscale of dedication to patient safety, one item relate to promotion, and one item related to interpersonal facilitation for patient safety. There was one item loading on two component (C) 1 and 4, consisting of IF6 (C1 = 0.34, C4 = 0.48). However, when considering the meaning of items and the highest loading, it was determined to retain component four. Thus, the fourth component was named “**Dedication to patient safety**” which was the original name of pre-sub dimension.

Table 4.17 Component 5 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (10 items)

Item	Description of item	Factor loading
	Provide feasible care instructions to patients and relatives	
MT7	affected by adverse event under the mutual agreement of the multidisciplinary team	-0.87
MT8	Listen to patients and relatives expressing frustration by adverse event	-0.84
MT6	Provide information of any adverse incident to patients or relatives, together with the multidisciplinary team, using the hospital's information report guidelines	-0.83
MT9	Spend time listening to feeling expressions of patients and relatives, who have been affected by adverse event	-0.80
MT5	Honestly provide information of any adverse incident to patients or relatives, together with the multidisciplinary team, using the hospital's information report guidelines	-0.61
MT10	Use error information as a lesson in finding ways to prevent recurrence	-0.51
MT3	Interpret unwanted changes in the patient's condition affected by the incidence once found	-0.45
MT2	Evaluate symptoms of patients who have been affected by the incidence of hospital-based practices	-0.44
MT4	Give first aid immediately to minimize loss following an adverse event	-0.41
MT1	Understand the hospital practices stipulated to reduce adverse outcome	-0.35

Eigenvalue = 1.57

Percent of variance = 2.46

The fifth component was composed of ten items with factor loadings ranging from -0.35 to -0.87 with an eigenvalue of 1.57, accounting for 2.46% of variance. All items came from the subscale of mitigation. Thus, the fifth component was named “**Mitigation**” which was the original name of pre-sub dimension.

Table 4.18 Component 6 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (5 items)

Item	Description of item	Factor loading
PV17	Follow the hospital’s guidelines to prevent bedsores	-0.84
PV16	Examine the skin of the patient under responsibility with the risk of bedsores	-0.80
PV18	Evaluate the patient’s risk of falling from falling history, age, and use of antidepressant drugs prior to nursing care	-0.77
PV19	Follow the hospital’s guidelines to prevent falling	-0.57
PV21	Check every catheterization or tubing from the finale to its source before practice and every treatment provision	-0.39
Eigenvalue = 1.41 Percent of variance = 2.20		

The sixth component was composed of five items with factor loadings ranging from -0.39 to -0.84 with an eigenvalue of 1.41, accounting for 2.20% of variance. All five items came from the subscale of prevention. Thus, the sixth component was named “**Prevention through the implementation of practice guideline**”.

Table 4.19 Component 7 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (5 items)

Item	Description of item	Factor loading
PV24	Call for help from the rapid response team once a patient's condition changes into crisis	-0.90
PV22	Study guidelines of assistance requesting from the team or the rapid response team once a patient's condition changes into crisis.	-0.78
PV23	Evaluate the patient's deteriorated symptoms, using the criterion set by the hospital	-0.46
PV25	Provide nursing care to a patient whose condition changes into crisis immediately	-0.40
PV27	Explain to patients and relatives about possible risks and prevention of incidence	-0.35
Eigenvalue = 1.33 Percent of variance = 2.09		

The seventh component was composed of five items with factor loadings ranging from -0.35 to -0.90 with an eigenvalue of 1.33, accounting for 2.09% of variance. All five items came from the subscale of prevention. There were two items loading on two component (C), consisting of PV25 (C3 = 0.37, C7 = -0.40), PV27 (C7 = 0.35, C8 = 0.33). However, when considering the meaning of items and the highest loading, there were determined to retain component seven. Thus, the seventh component was named “**Prevention emergency adverse events through critical care**”.

Table 4.20 Component 8 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (5 items)

Item	Description of item	Factor loading
PV12	Never use the bed or room number to identify the patient under nursing care	0.72
PV11	Always verify the patient's identity in two ways as a minimum, i.e., asking for his name and hospital ID number, prior to nursing care	0.62
PV10	Advise patients or relatives about the medication and its side effects.	0.56
PV13	Allocate the patient's data to the team via SBAR (situation, background, assessment, recommendation)	0.46
PV5	Effectively clean hands as required by a hospital before and after a nursing care procedure	0.40
Eigenvalue = 1.24 Percent of variance = 1.93		

The eighth component was composed of five items with factor loadings ranging from 0.40 to 0.72 with an eigenvalue of 1.24, accounting for 1.93% of variance. All five items came from the subscale of prevention. Thus, the eighth component was named “**Prevention through effective patient care process**”.

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Table 4.21 Component 9 of the third-order exploratory factor analysis, item, description of item, eigenvalue, factor loading and percent of variance (11 items)

Item	Description of item	Factor loading
PT1	Explore the risks of patients individually.	-0.78
PT2	Classify risks at work.	-0.75
PT3	Evaluate risk strengths likely associated with responsible patients.	-0.75
PT4	Use the data of risk assessment to set a health plan in order to protect patients.	-0.73
PT5	Reduce all kinds of risks once they are found.	-0.63
PT6	Provide treatments suitable for each patient's risk.	-0.62
PT8	Use the results from the risk evaluation of personal information in prior planning to prevent an adverse event	-0.52
PT7	Profoundly evaluate each patient's personal information for any potential risks	-0.44
PT10	Investigate communication predicaments in the multidisciplinary team, which can lead to an adverse event	-0.44
PT9	Seek communication problems between nurses and patients, which can lead to an adverse event	-0.42
PV1	Comprehend how to write a report proceeding of the unit's incidence	-0.34

Eigenvalue = 1.12
Percent of variance = 1.74

The ninth component was composed of eleven items with factor loadings ranging from -0.34 to -0.78 with an eigenvalue of 1.12, accounting for 1.74% of variance. Ten items came from the subscale of protection and one item related to the subscale of prevention. There were two items loading on two component (C), consisting of PT10 (C2 = 0.34, C9 = -0.48), PT9 (C2 = 0.35, C9 = 0.42). However, when considering the meaning of items and the highest loading, there were

determined to retain component nine. Thus, the ninth component was named “**Protection through risk management**”.

4.4) Testing reliability. The Cronbach’s alpha internal consistency reliability coefficient was computed for the final draft of the NPPSS after exploratory factor analysis. The internal consistency on the 64 items of the NPPSS was 0.91, which was high for a new scale. All the subscale reported sufficient correlation. Moreover, all items revealed sufficient item-total correlation ranging from 0.40 to 0.81. The details of internal consistency reliability of the resulting factors, is shown in Table 4.22.

Table 4.22 The Cronbach’s alpha coefficient of the final draft of the NPPSS after factor analysis (64 items)

Subscale	Number of items	Item-total correlation	Cronbach’s alpha
Promotion through team and responsibility	12	0.68-0.81	0.94
Protection through communication	5	0.67-0.80	0.89
Prevention through right drug and solution administration	4	0.59-0.67	0.81
Dedication to patient safety	7	0.56-0.78	0.89
Mitigation	10	0.69-0.78	0.93
Prevention through the implementation of practice guideline	5	0.51-0.75	0.85
Prevention emergency adverse events through critical care	5	0.55-0.71	0.82
Prevention through effective patient care process	5	0.40-0.53	0.72
Protection through risk management	11	0.60-0.74	0.92
The entire scale	64		0.91

Table 4.23 Subscale-Subscale and Subscale- total correlation of the final draft of the NPPSS after factor analysis (64 items)

scale	Com 1	Com 2	Com 3	Com 4	Com 5	Com 6	Com 7	Com 8	Com 9
Promotion through team and responsibility (Com1)	1.00								
Protection through communication (Com2)	0.52	1.00							
Prevention through right drug and solution administration (Com3)	0.52	0.38	1.00						
Dedication to patient safety (Com4)	0.67	0.55	0.38	1.00					
Mitigation (Com5)	0.82	0.55	0.54	0.61	1.00				
Prevention through the implementation of practice guideline (Com6)	0.56	0.48	0.58	0.49	0.58	1.00			
Prevention emergency adverse events through critical care (Com7)	0.61	0.52	0.56	0.48	0.65	0.61	1.00		
Prevention through effective patient care process (Com8)	0.56	0.51	0.57	0.50	0.59	0.56	0.56	1.00	
Protection through risk management (Com9)	0.64	0.73	0.45	0.58	0.63	0.49	0.56	0.58	1.00

In conclusion, the Nursing Performance in Patient Safety Scale (NPPSS) was developed and tested the psychometric properties following the six steps based on the instrument development of DeVellis (2003). The identification of construct was derived from comprehensive literature review and concept analysis by researcher. The item pool was generated from the operational definition of six sub-dimension of nursing performance in patient safety which were obtained in the step of the identification of construct. The content validity was conducted by five panel experts rating the scale with an average S-CVI = 1.00. The Cronbach's alpha coefficient of six sub-domains with 73 items was .98. Then, an item analysis was performed. Three

items were dropped from the scale. Seventy items were retained for further factor analysis.

The exploratory factor analysis with principal components analysis with oblique rotation by direct oblimin was selected. The final draft of the NPPSS was summarized based on the result of third-order factor analysis. The NNPPS consisted of nine components with 64 items. Nine components of the scale could explain 63.54% of variance. After factor solution, the overall Cronbach's alpha was .91.

4.2 Discussion

The discussion is described in two parts, namely the characteristics of the Nursing Performance in Patient Safety Scale (NPPSS), and the psychometric properties of the NPPSS as follows.

4.2.1 The Characteristics of the NPPSS

The NPPSS was designed to evaluate the nursing performance in patient safety of nurses in Thailand based on guidelines for developing a measurement scale of DeVellis (2003). The construct of the NPPSS was identified from the integration of patient safety analysis of the concept and performance concept by the researcher. In this study, there are two dimension and six sub-dimensions. The operational definitions of two dimensions and six sub-dimensions of the first draft of the NPPSS were described as follows:

Dimension 1 “nursing task performance in patient safety” refers to an individual nurse's behavior that contributes to patient safety and accomplishes patient safety goals.

Sub-dimension 1 “Protection”, this dimension focuses on an individual nurse's behavior preventing harm before reaching the patient by finding incidents that might occur to patients. This dimension consists of 19 items.

Sub-dimension 2 “Prevention”, this dimension focuses on an individual nurse's behavior that attempts to stop harm before to reaches the patients. This dimension consists of 56 items.

Sub-dimension 3 “Mitigation”, this dimension focuses an individual nurse’s behavior in reducing the severity of complications after something goes wrong which caused by making incidents in patient treatment that could put patients in risky situations. This dimension consists of 17 items.

Sub-dimension 4 “Promotion”, this dimension focuses an an individual nurse’s behavior to perform the nurse function and continually enhance patient safety. This dimension consists of 15 items.

Dimension 2 nursing contextual performance in patient safety refers to an individual nurses’ behavior in cooperative work with other healthcare providers to care for patients and enhance patient safety.

Sub-dimension 5 “Interpersonal facilitation for patient safety”, this dimension focuses on an individual nurses’ behavior to cooperate and immediately respond to requests from other team members in emergency situations. This dimension consists of 15 items.

Sub-dimension 6 “Dedication to patient safety”, this dimension focuses on an individual nurses’ behavior that shows striving for patient safety and consists of activities that demonstrate effort, initiative to solve patient safety problems, persistence and self discipline. This dimension consists of 16 items.

In this study, combining the concept of performance and concept of patient safety and the nurses’ role for patient safety into the concept of nursing performance in patient safety is appropriate to reflect what nurses actually do for patient safety. They include actions or behaviors that are relevant to patient safety, which is the nursing organization’s goals and can be measured in terms of each individual’s proficiency of staff nurse in Thailand. This corresponds to Burns and Grove (2009) who attest that concept analysis is a strategy that identifies a set of characteristics essential to the connotative meaning of concept. The conceptual definition, which has been drawn from concept analysis, leads to theories and methods for measuring the concept.

Initially, the researcher generated 141 items with six subscales for the draft NPPSS. The item pool was more than two times as large as the final scale. The number of the initial item pool was appropriate for the study. Nunnally (1978) recommend developing an item pool at least twice the size of that desired for the final

scale as there should be a sufficient number of items available to discard and still retain an adequate number of items in the instrument.

Format of the NPPSS (141 items)

A Likert scale format was used for the NPPSS. This scale format has a six-point response choice which can be used for a self-assessment scale. The scale format included response alternatives ranging from no practice to frequently practice. The response options of Likert-type scale has roughly equal intervals, as a result, the parametric statistic analysis can be applied (DeVellis, 2003). The selection of a six point set of responses allows more response alternatives, and provides more precise information about the individual's performance on the subscale as referred to by the given item (Mishel, 1998).

4.2.2 The psychometric properties of the NPPSS

1) **Content validity**, the first draft of the NPPSS was reviewed by five experts. This is consistent with a report by Devis (1992) and Waltz et al., (2005) who indicated that a panel of experts should have at least two reviewers who are experts in the content area to be measured. However Lynn (1986) advised that a minimum of three experts be included. A panel of experts who are experts in the content area are asked to review the item pool regarding the relevance of each item that is being measured, evaluate the items' clarity and conciseness (DeVellis, 2003) appropriateness, accuracy, readability and representative of individual item (Burns & Grove, 2001), and the adequacy of items on the tool that reflect the content in the domain of interest (Waltz et al., 2005). The suggestions obtained from the five experts included: The scale should be shortened, integrating similar items, and revising the wording of items. The I-CVI of 141 items ranged from 0.2 to 1.00 and I- CVI was .88. The S-CVI/UA was .58, which was less than the criteria (1.00). Inter-rater agreement was 0.79, which was less than the criteria (0.90). Thus, 62 items were deleted and 79 items were retained. The second draft of the NPPSS was constructed with 79 items. The second round the I-CVI of 79 items ranged from 0.8 to 1.00 and I-CVI was .98. The S-CVI/UA was .92, which was less than the criteria (1.00). Thus, six items were deleted and 73 items were retained because the five experts agrees with

all items. The third draft of the NPPSS was constructed with 73 items. The I-CVI of 73 items was 1.00 and the S-CVI/UA also resulted in 1.00, which meet the criteria about I-CVIs should be 1.00 with five experts. This is consistent with a report by Lynn (1986) which recommended that when there are fewer than six experts, the CVI should be 1.00. Therefore, the third draft of the NPPSS met an acceptable content validity index, and proceeded to the pre-testing phase.

2) The face validity of the third draft of the NPPSS with 73 items was evaluated by 30 nurses. Burns and Grove (2009) indicated that pretesting should include 15 to 30 participants. The findings from this pretesting revealed that all items were clear (100%) and practical (100%), most were understandable (96.7%), and all nurses agreed that the length of the questionnaire was appropriate. The length of time for filling out the scale ranged from 13 to 80 minutes with a mean time of 43.53 minutes. A few participants reported not understanding the instructions and items clearly, but they did not specify the problem. Therefore, the format and items from the first draft of the NPPSS were retained to study.

3) The internal consistency reliability for the six subscales ranged from .76 to .97 and overall was .95, as Burns and Grove (2009) advised the Cronbach's alpha coefficient value should be .80 to .90 or .70 for a new scale. The results of this study indicated a strong relationship to their latent variable, and concerned with the homogeneity of the items within a scale as result to a strong relationship to each other (DeVellis, 2003). Thus, the third draft of the NPPSS with 73 items was determined for further field-testing.

The field-testing participants consisted of 876 nurses. The third draft of the NPPSS with 73 items was distributed to the 876 participants, and 831 were returned (94.86%). Among the 831 returned questionnaires, 72 were incomplete (13.67%). Therefore, 759 (86.33%) were used for analysis, this is more than the most conservative ratio of ten participants per item (Burns & Grove, 2009; Hair et al., 2006, Nunnally, 1978), and was considered sufficient for the subsequent data analysis. Therefore, they represent a more than adequate response rate.

4) Social desirability. The Spearman's rank-order correlation coefficient between the score of individual items of the third draft of the NPPSS and 10- SDS ranged from 0.00 to 0.06, which no significantly. Exceptionally "evaluating

patients' knowledge to use it as the data for exploration of possible risks" obtained the correlation of 0.07 ($p < 0.05$). It came from the subscale of protection. Although, this item had a significant correlation, it was low. Munro (2001) categorizes that correlation coefficient between 0.00-0.25 was low. Therefore, the nurses provided truthful data for nursing performance in patient safety. Nunnally (1978) indicated that when the SDS had strong correlations with scales intended to measure the tendency to fake good on self inventory. No significant correlation was found between the score of individual items of the third draft of the NPPSS and 10- SDS. This means that the nurses provided accurate information for nursing performance in patient safety. Patient safety however, became a major issue which was used describe the activities for patient care.

5) **Item analysis** is supportive in obtaining a reliable and valid scale and helpful to drop unqualified items. The items have to correlate with one another which means a high correlation of an item with the true score of the underlying construct (Polit & Beck, 2008). The criteria for retaining items include inter-item correlation value between 0.30 and 0.70 (Ferketich, 1991), item-scale correlation value above 0.30, and item that have the best inter-item correlation was retained. An item with a high correlation is more desirable than an item with a low value (DeVellis, 2003). Among 73 items of the third draft of the NPPSS, an item mean was 4.32 which is between 3-5, therefore desirable. The criterion for item variances is a high value and the mean of item variances for this study was .23 which was less than the criteria. Nevertheless, Nunnally (1978) indicates that statements that are very extreme in either direction tend to create less variance than statements that are less extreme. The cronbach's coefficient alpha of total the NPPSS were 0.98 which met an acceptable value.

The correlation of inter-item and item-subscale of item ranged from 0.29-0.90. One item had a correlation of less than 0.30. It was deleted from the scale (DP6). However, an item with a high correlation is more desirable than an item with a low value (DeVellis, 2003). Freketich (1991) recommended that there is no hard and fast criterion for level of correlation. But Knapp and Brown (1998) asserted that inter-item correlation should be between 0.3 to 0.7, whether inter-item correlations depends upon the number of items and the number of underlying dimension. Additional, the

items that indicated redundancy were generated based on concept analysis of patient safety. They were expected to be highly interrelated. However, if these items were deleted, the conceptual soundness of the NPPSS was not complete. Although inter-item correlation was high and indicated redundant, most of items of this subscale were retained. However, the correlation of item-total correlation and Cronbach's alpha if items deleted three items were dropped from the scale (PV20, PM1, DP6), Cronbach's alpha was increased. Therefore, three items in the third draft of the NPPSS were dropped. Seventy items were retained. The fourth draft of the NPPSS was constructed.

6) Construct validity of the fourth draft of the NPPSS.

Exploratory factor analysis with principle components analysis with oblique rotation by direct oblimin was selected because it yielded the best possibility to interpret the factor solution used to test construct validity. The exploratory factor analysis in this study was performed three times.

The first-order factor analysis, the results demonstrate that the fourth draft of the NPPSS was composed of ten components with 70 items, the scales accounted for 63.63% of variance, six items had a factor loading less than .30, six items loading on two components, and factor seven only had two items. These were unacceptable to interpret the structure. Hair et al. (2006), and Polit and Beck (2008) suggested the factor loading of less than .30 and each factor should have at least four items considered to delete it. However, two of the six items had a factor loading less than .30, one item of factors seven which only had two items, and six items which loading on two components indicated the conceptual sound of the NPPSS. Thus, only five items were deleted. Sixty five were retained.

The second-order factor analysis, the results demonstrated that the fifth draft of the NPPSS was composed of nine components with 65 items, the scales accounted for 63.24% of variance, one item received the factor loading less than 0.3, six items loading on two components. Polit and Beck (2008) suggested the factor loading less than .30 should be considered for deletion. However, Nunnally and Bernstein (1994) suggested that no or few cross loading items should be retained. Therefore, six items which loaded on two components were retained. One item was deleted. A total of sixty four items were retained.

The third-order factor analysis, the results demonstrated that the seventh draft of the NPPSS was composed of nine components with 64 items, the scales accounted for 63.54% of variance, and all of items received the factor loading more than 0.3, six items loading on two components. Though items with a few cross loading items should be retained (Nunnally & Bernstein, 1994). Furthermore, Hair et al. (2006) indicated the analysis should be considered for the conceptual underlying. These items were considered to be retained for a conceptual soundness of scale. Therefore, six items loaded on two components were retained. Sixty four items were retained.

The final draft of the NPPSS was summarized based on the result of third-order factor analysis. Nine components of the scale with 64 items could explain 63.54% of variance. All items included in the components with eigenvalues greater than 1 and item loading above .30 on each factor. Therefore, the final draft of the NPPSS was adequate to capture the main features of a phenomenon.

The results from factor analysis, the nine components were associated with nursing performance in patient safety. The nine components were reorganizing of the pre-sub dimension in construct of nursing performance in patient safety and are similar to the pre-sub dimension. All of the nine components also covered the nine groups of nursing role for patient safety based on WHO (2009), JCAHO (2010, 2012), and HAI (2008) in Thailand. They indicate that specific nurse's behaviors for patient safety were better than the pre- dimension. They provide a better understanding of patient safety performance along with the nursing role for patient safety. They are described as follows.

Component one is "promotion through team and responsibility". Seven items came from the subscale of promotion for patient safety and five items relate to interpersonal facilitation for patient safety. However, when considering the meaning of items, they focus on the nurses' behavior to perform the nurse function and continually promote patient safety through teamwork. As mentioned in the literature review, lack of team work is an important contributing factor towards adverse events (Manser, 2009) and independent work rather than working as a team is the cause of the miss care (Kalisch, 2009).

Component two, “protection through communication” is composed of five items. All items came from the subscale of protection. When considering the meaning of the five items of component two, they focused on evaluated patient cooperation and patient knowledge to use it as the data for exploration of possible risk and communication in the team, since, communication breakdowns within the nursing team were a factor which could be cause of error (Kalisch, 2009; Kalisch & Williams, 2009). The important roles of nurses for patient safety were communication by giving information and education about the patient’s condition and treatment (Greenslade & Jimmieson, 2007).

Component three, “prevention through right drug and solution administration” four items came from the subscale of prevention. The findings indicate that the prevention of medication errors and high concentration is important in nurses’ role for patient safety. Nurses involved in medication errors pose a serious risk to patients. Moreover, medication errors negatively affect to both patient and nurses. The literature review founded that, on average, nurses make 2 to 5 medication errors over their career (Mayo & Duncan, 2004). Concentrated electrolyte has been identified as a high risk medication by healthcare organizations (WHO, 2007). It is common to find concentrated electrolyte solutions in the unit. Therefore prevention risk associated with this medication emphasizes the need to carefully follow all steps prior to medication or solution administration.

Component four, “dedication to patient safety” is composed of seven items. Five items came from the subscale of dedication to patient safety, one item came from the subscale of promotion, and one item came from the subscale of interpersonal facilitation. When considering the meaning of items, the focus is on nurses’ behavior that shows striving for patient safety by developing innovations or methods to enhance patient safety through attending quality development activities. Nurses have to undergo ongoing training on patient safety and share ideas of patient safety. Patient safety solutions are needed that tackle the underlying causes of unsafe care. Therefore, nurses should explain how to design solutions and implement them (WHO, 2010). Dedication to patient safety through continuous learning for patient safety will improve patient safety and improve nursing performance in patient safety.

Component five, “mitigation” is composed of ten items. All items came from the subscale of mitigation. These items explain nurse’s behaviors in reducing the severity of complications after something goes wrong. Nurses attempt to stop harm or prevent harm from reaching patients. Moreover, the adverse events can occur due to the complex nature of medical practice and a multitude of interventions, which is the cause of high error rates (Leape, 1994). Therefore, nurse behavior for patient safety includes mitigation of harm to patients from unsafe acts within the healthcare system (Cooper et al, 2000; National Quality Forum, 2006).

Component six, “prevention through the implementation of practice guidelines” is composed of five items. All items came from the subscale of prevention. When considering the meaning of items, patient harm prevention focuses on nurses’ behavior in preventing harm to patients by adhering to guidelines for patient safety. These guidelines were explicitly defined in the patient safety goal and patient safety solution (HAI, 2008; JCAHO, 2010, 2012; WHO, 2008). Nursing organizations urge all nurses to comply with patient safety practice guidelines in order to save patients from harm. WHO (2005) asserted that compliance with the process of care is a safe practice for improving patient safety. The non compliance to patient safety procedures was a factor which could be the cause of errors resulting in harm to patient (Dias, 2008).

Component seven, “prevention of emergency adverse events through critical care” is composed of five items. All items came from the subscale of prevention. The results indicate that the role of nurses for patient safety include responses to errors and solves the problem to reduce losses after errors. Nurses should assess changes in patient conditions to help immediately (WHO, 2009) and learn from the guideline for the immediate care base on the role of nurses (HAI, 2008).

Component eight, “prevention through effective patient care process” is composed of five items. All items came from the subscale of prevention. The results indicate that the prevention of harm in the patient care process involves patient identification. Nurses should consider checking the identity of patients and match the correct patients with the correct care before starting on the administration of care (WHO, 2007). In addition, patients and families should be encouraged to participate in procedures for patient safety including ensuring that effective communication is

used of situation, as well as background, assessment, and recommendation (SAR) which are activities that enhance the effective process of care (HAI, 2008).

Component nine, “protection through risk management” is composed of eleven items. Ten items came from the subscale of protection. One item came from the subscale of prevention. When considering the meaning of items, they focus on the nurses’ behavior in deflecting harm before reaching patients by using risk management such as exploring the risk, reducing risk and providing treatment suitable for each patient’s risk. JCAHO (2002) define risk management as clinical and administrative activities undertaken to identify, evaluate, and reduce the risk of injury to patients, staff, and visitors and the risk of loss to the organization itself.

When considering the meaning of nine components with the construct of the NPPSS, there were six sub-dimension of nursing performance in patient safety. These include protection, prevention, mitigation, promotion, interpersonal facilitation for patient safety and dedication to patient safety. The results indicate that they were associated and were similar but they were reorganized in order to the more specific.

The pre-sub dimension “protection”; component “protection through communication” and “protection through risk management” came from reorganizing the pre- sub dimension “protection”. These were nurses’ behavior in preventing harm before it reaches the patients and they are important nursing roles in protecting patients from harm through communication and through risk management (JACHO, 2002). Therefore, protection through communication and through risk management was specific and was needed for nursing performance in patient safety.

The pre- sub dimension “prevention”; component “prevention through right drug and solution administration”, “prevention through implementation of practice guideline”, “prevention emergency adverse events through critical care”, and “prevention through effective patient care process” came from the reorganizing of the pre- sub dimension “prevention”. The meaning of the prevention was an individual nurse’s behavior that attempts to stop harm before reaching patients. The meaning of items of each component focuses on protection from; drug and solution error, common complication, adverse event from emergency situation, and error from process of care. Therefore, nurse role for patient safety was adherences to practice

guidelines. The result of reorganizing of the pre- sub dimension “prevention” was specific nurses’ behavior to prevent harm to patient.

The pre- sub dimension “mitigation”; component “mitigation”, all items came from the pre- sub dimension of mitigation. These behaviors consist of providing immediate care based on the role of nurses, communicating hazards and incidents to other team members, patients and their families, and asking for help immediately. Therefore, another nurse role for patient safety is mitigation.

The pre- sub dimension “promotion component “promotion through team and responsibility” is a combined pre-sub dimension of promotion with the pre- sub dimension of interpersonal facilitation for patient safety. They focus on teamwork. Thus, promotion of patients from harm has to be based on teamwork and is needed for nursing performance in patient safety.

The pre- sub dimension “dedication to patient safety”; component, “dedication to patient safety” is a combined pre- sub dimension of dedication to patient safety, the pre- sub dimension of promotion, and the pre- sub dimension of interpersonal facilitation. Another nursing role for patient safety is where nurses should explain how to design solutions and implement them, this is based on the knowledge, skills, and attitudes necessary for quality and safety (Cronenwett et al., 2007). Dedication to patient safety through continuous learning for patient safety will improve nursing performance in patient safety.

7) Reliability of the NPPSS. Internal consistency reliability refers to the extent to which all items in a scale consistently measure the same concept (Burns & Grove, 2001). After factor solution, the Cronbach’s alpha coefficient of the 64 items of the final draft of the NPPSS was 0.91 and the alpha coefficients of nine dimensions were high for the new scale. All items revealed sufficient item-total correlation. All of the subscale reported sufficient correlation. The NPPSS showed acceptable reliability both in the overall scale and in each dimension, which met expectable value for a newly-developed instrument of 0.70 (Burns & Grove, 2001, Hair et al., 2008).

In summary, considering all of the psychometric properties, the NPPSS can be supported as a new scale which showed an adequate reliability and validity for measuring nursing performance in patient safety for nurses in Thailand. The NPPSS

will provided information which show frequency of patient safety performance of individual nurses. The obtained information is useful for nurse managers to design interventions which enable nurses to strictly adhere to patient safety guidelines.



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