Development and Psychometric Properties of the Occupational Health Service Competency Scale of Nurses Working at Thai Primary Care Units

Suwattana Kerdmuang, Surintorn Kalampakorn, Sunee Lagampan, Ann Jirapongsuwan, Marjorie C. McCullagh

Abstract: The purposes of this study were to develop and examine the psychometric properties of the Occupational Health Service Competency Scale for nurses working at Thai primary care units. The conceptual definition and content domains of the instrument were developed through a comprehensive literature review and in-depth interviews. Spencer's competency concept and the Basic Occupational Health Service activity model were used to guide the research. Content validity was examined by a panel of five experts, and pre-testing of internal consistency was determined by 30 nurses working at primary care units. After a pilot test, the psychometric properties of the instrument were examined by distributing a mailed questionnaire to 750 nurses working in randomly selected Thai primary care units; 68.1% of these were returned.

The Occupational Health Service Competency Scale is composed of three dimensions: occupational health service knowledge, occupational health service skills, and occupational health service traits. Exploratory factor analysis identified 14 subscales distributed among 120 items using a five-point Likert scale. Each subscale accounted for greater than 60% of the total variance. Cronbach's alpha coefficients for the subscales ranged from 0.81 to 0.96. Test-retest analysis of the overall scale was relatively stable over a two week period ($r = 0.76$, $p = .01$). Based on these analyses, the newly-developed Scale demonstrates sound psychometric properties and can be used to assess the occupational health service competencies of nurses working at primary care units. Results can be used to plan professional development and human resources management related to occupational health services.

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Introduction

Most (45% or 3 billion) of the world's population are in the workforce.[1] Occupational injuries, occupational diseases and work-related diseases have a large impact on workers' health, working ability, productivity, and economic development. Occupational health services are an essential function in the prevention and control of occupational injuries and illnesses and in occupational rehabilitation. Therefore, the global strategy for

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"occupational health for all" by the World Health Organization requires governments to prepare policies for providing occupational health (OH) services for all people at work.[1,2]

In Thailand, during the severe shrinkage of the industrial sector in 1997, a large portion of the workforce shifted to home-based employment, agriculture, and small enterprises geographically scattered throughout the community.[2-4] Hence, a greater proportion of businesses now involve small-scale enterprises, contract, or informal employment (as compared to formal employment in large enterprises). Consequently, statistics from Thailand show that the injury rate and prevalence of work-related diseases is higher for small enterprises than for large businesses.[5] However, most OH services are delivered to workers in large industries and businesses because these workers are generally served by workplace health services offered through the employer.[3-6]

While OH services for workers in large industries is required by Thai law, and mostly provided by OH personnel employed by the industry, workers in smaller industries and informal sectors are served by local community-based primary care units (PCUs). An international guideline for providing primary OH services at the community level indicates that these can be integrated into PCU roles or primary healthcare services; this includes surveillance of work environment, assessment of health and safety risks, prevention and control of OH diseases, primary diagnosis and primary medical care for occupational illnesses, and referral services.[1,2,4] To date, OH services have been established in 172 Thai PCUs, with a plan for expansion nationwide. Current difficulties and constraints of OH delivery within the PCUs include a low level of service and limited OH service competencies of PCU staff.[2,5]

At a PCU, nurses are generally the main providers of health care services, including comprehensive and continuous care to all groups of people.[7] Although nurses are considered to be in a key position to perform effective community-based OH services,[1,3,8] specific competencies for providing such services to working populations are not clearly identified.[9-11] OH service competencies, the behavioral characteristics to perform a task accumulated from the integration of knowledge, skills, and traits,[12-14] are considered crucial components of successful provision of such community-based services.[3,4] Assessing the specific competencies of nurses in PCUs may contribute to the quality of their provision of OH services.

A self-assessment tool is a convenient, easy-to-use way to evaluate competency, and assists nurses to maintain and improve their OH nursing practice by identifying the areas for professional development and continuing education. Provision of community-based OH service competence profiles encourages increasing motivation among nurses working at PCUs to commit to continuous self-development.[13] Understanding one's competencies could be a strategy to motivate nurses to provide quality OH services for the working population in the community.

To date, several studies have developed self-assessment tools examining competencies of nurses in PCUs related to nursing leadership, health promotion, healthcare service, and comprehensive care.[11, 14-18] Some attention has focused on defining OH competencies and developing measurement tools for OH nurses working in large industry settings,[19-21] but none specifically addressed nurses in PCUs. Furthermore, these studies mostly focused on identifying requisite skills. The omission of OH service competencies is then particularly problematic because as Forbes et al.[22] pointed out, the independent and autonomous nature of nursing practice, especially in community and remote settings, requires a higher level of knowledge and traits than what would be necessary in an institutionally-based setting. Therefore, Spencer's competency concept[12] was used as the theoretical basis of this study to capture competency as sets of knowledge, skills, and traits necessary for effective OH services.

It also should be noted that the tools measuring the OH service competencies of nurses working in large industry are not well suited to nurses working in smaller PCU settings due to differences in OH services provided. For example, nurses in the PCUs serve a population-focused role, and tend to provide services in smaller enterprises. There is a need to develop instruments to measure the OH competencies of nurses in community-based PCU settings. Measurement of competencies may contribute to the provision of quality OH services for workers in smaller industries. The purposes of this study were to develop and examine the psychometric properties of the Occupational Health Service Competency Scale (OHSC-S) among nurses working in Thai PCUs.

Conceptual Framework

The study was based on Spencer's competency concept,[12] combined with the Basic Occupational Health Services (BOHS) activity model.[1] The latter is a foundation for providing OH services to working people using a primary care approach. In this study, Spencer's competency concept was used as the theoretical lens for examination of the components of OH service competencies in order to accomplish their basic activities. The BOHS activity model includes 1) orientation and planning, 2) surveillance of the work environment, 3) surveillance of worker health, 4) assessment of health and safety risks, 5) information and education on risks and advice on need for preventive and control actions, 6) preventive actions for the management and control of health and safety hazards and risks, 7) prevention of accidents, 8) maintaining first aid preparedness and participation in emergency preparedness, 9) diagnosis of occupational and work-related diseases, 10) general health care, curative and rehabilitation services, 11) record keeping, and 12) evaluation. The identified items of the OHSC-S leading to the achievement of such activities were classified into a set of competency dimensions: knowledge, skills, and traits.

Methods

Design: This instrument development study used modification of techniques employed by several experts.[23,24] This study consisted of two stages: 1) instrument development and 2) psychometric evaluation of the OHSC-S (Figure 1), both explained in more detail below.

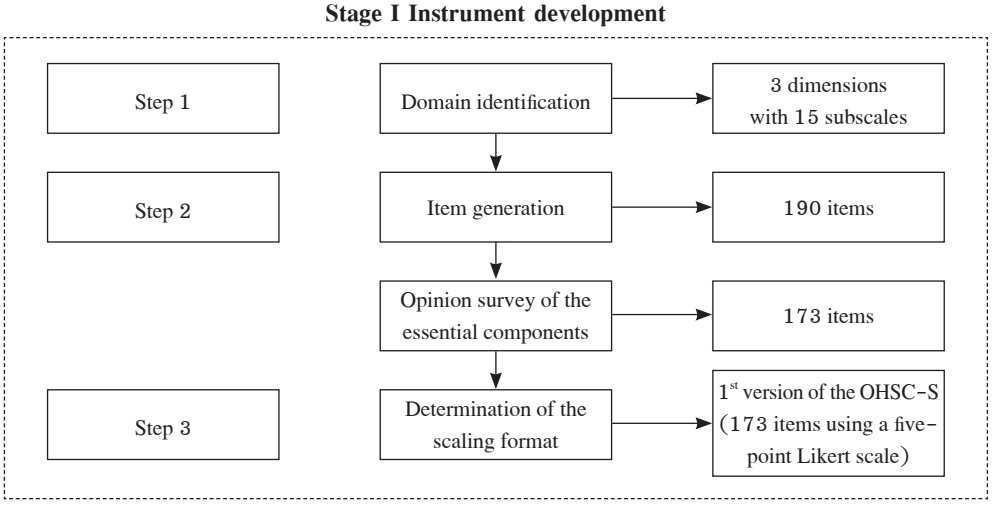

Figure 1 Procedure for creating the OHSC-S of nurses working at Thai PCUs

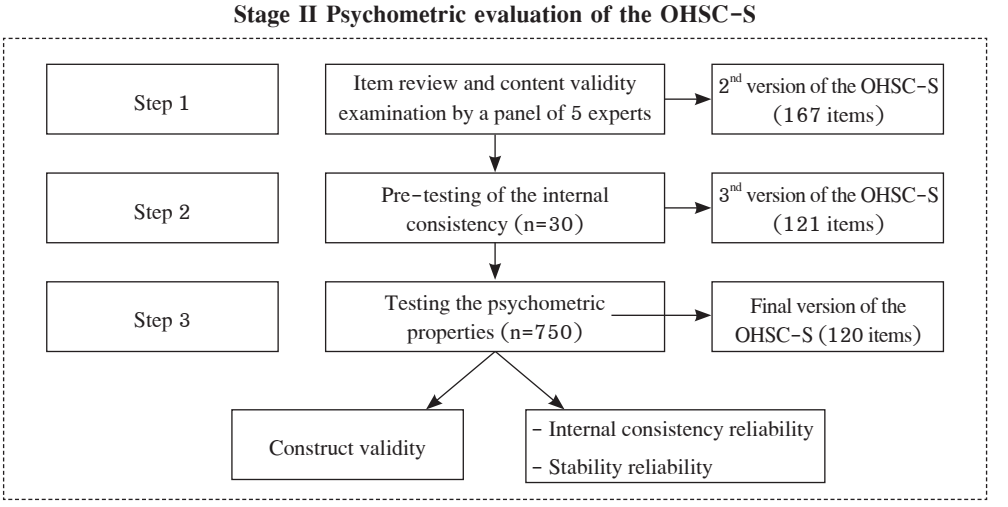

Figure 1 Procedure for creating the OHSC-S of nurses working at Thai PCUs

Ethical considerations: The research protocol was approved by the institutional review board of Mahidol University, Bangkok, Thailand. Prior to data collection, all participants gave informed consent and participant anonymity and rights were assured throughout the study.

Procedure and data analysis

Stage I, Step1: Domain identification. The first step in the instrument development process involved a qualitative exploratory study design.[23] Identification of the instrument's domains were determined by a review of literature and in-depth interviews with key stakeholders. Interviews were conducted by telephone in Thai, as this is considered appropriate when the data being collected are of a non-sensitive nature.[25]

Purposive sampling was used to recruit 20 stakeholders based on: their achievement and expertise in OH services in PCUs for at least one year; and familiarity with the OH service competencies required for nurses working in the PCUs. The stakeholder group was comprised of three policy makers, four academics, four representatives from provincial, district and sub-district health care organizations, two representatives from local governments, three representatives working in PCUs including nurses, and four who were entrepreneurs, local laborers or OH care volunteers. Stakeholders were 15 females (75%) and 5 males (25 %) between the ages of 35 and 60 years (m= 47.1, SD= 6.7). Length of OH-related work experience of informants ranged from 2 to 31 years (m= 12.2, SD=7.7). Stakeholders were recruited based on their expertise in OH services and selected from policy, practice, and consumer representatives.

During in-depth interviews, the components of the OH service competencies of nurses working at PCUs were identified using open-ended questions such as, "What do you think should be the roles of nurses in providing OH services to workers in the community?" and "What essential competencies in terms of OH services knowledge, skills, and traits should nurses working in PCUs possess?" Each interview was audio-recorded, and the interviewer made notes during and immediately following the interview. Interviews lasted between approximately 45-60 minutes.

The content of the literature reviews and in-depth interviews were analyzed by content analysis, using Spencer's competency concepts as the theoretical lens for initial data interpretation.[26] The results of thematic analysis revealed the essential components

of OH service competencies were similar to those identified by the literature, resulting in construction of three dimensions and multiple subscales for the OHSC-S: OH service knowledge (basic OH knowledge, community health knowledge, and health administration knowledge), OH service skills (outreach OH services, on-site OH services, continuous OH services, managing health information, collaboration, communication, evaluation, research, OH in the PCUs), and OH service traits (individual, interaction, professional ethic traits).

Stage I, Step 2: Item generation. Following domain identification, 190 items were generated and divided into 3 dimensions and 15 subscales. Each subscale included between 5 and 23 items. In the OH service knowledge dimension, 36 items were generated: 21 items in the basic OH knowledge subscale, 7 items in the community health knowledge subscale, and 8 items in the health administration knowledge subscale. In the OH service skill dimension, 104 items were generated: 8 items in the outreach OH service subscale, 15 items in the on-site OH service subscale, 5 items in the continuous OH service subscale, 22 items in the managing health information subscale, 9 items in the collaboration subscale, 23 items in the communication subscale, 7 items in the evaluation subscale, 9 items in the research subscale, and 6 items in the OH in PCUs subscale. Finally, for the OH service trait dimension, 33 items were generated: 14 items in the individual trait subscale, 11 items in the interaction trait subscale, and 8 items in the professional ethic trait subscale.

A consensus survey of opinion on the 190 competency items was conducted with 20 stakeholders from previous in-depth interviews. To select and reconfirm the list of core OH service competencies, the stakeholders were asked to rate each of the identified items from 1 to 4 for consistency. The rating score for individual items was first calculated by counting the number of stakeholders who rated the item as three or four (3 =agree with this competency, 4= strongly agree with this competency), and dividing that number by the total number of participants. Only the competencies rated 3 or 4 by 80% or more of stakeholders were selected for inclusion in the list of components of OH service competencies. This resulted in deletion of 17 items, leaving 173 items remaining.

Stage I, Step 3: Determination of the scaling format. A 5-point Likert scale format with responses ranging from 0 to 4 (4= possessed the competency at the highest level, 3= possessed the competency at high level, 2= possessed the competency at low level, 1= possessed the competency at the lowest level, and 0= did not possess the competency) was used. To assist the respondents to clearly determine their level of competencies, the moderate level of competency was not used in the scaling format.[13]

Stage II, Step 1: Item review and content validity examination. The first version of the OHSC-S (173 items) was evaluated by five experts from multidisciplinary fields based on their expertise in OH services in PCUs. The panel of experts, purposively recruited from both non-nurse experts and nurse experts, were invited to rate the validity of each proposed item. A content validity index (CVI) was calculated; items with CVI less than 0.80 were deleted.[27,28,29] Of the original 173, 6 items were omitted, leaving 167 items.

Stage II, Step 2: Pre-testing of internal consistency. Pre-testing of the second version of OHSC-S (167 items) was conducted to determine the initial internal consistency reliability of subscales and the total instrument. The instrument was administered to a sample of 30 nurses working at PCUs whose characteristics were similar to the target population. The sampling groups for pre-testing of the instrument were purposively selected from two separate provinces in central Thailand, Suphanburi and Chacheongsao.

The corrected item-total correlations were examined and indicated that all items (167items) had acceptable item-total correlation above 0.30, the usual cutoff.[30,31] However, the inter-item correlations of

46 items were greater than 0.90, indicating redundancy.[30,31] These items were then eliminated, resulting in 121 items. Cronbach's alpha coefficient for the 121- item OHSC-S was 0.98; 0.97 for the OH service knowledge dimension, 0.98 for the OH service skill dimension, and 0.97 for the OH service trait dimension. Subscale scores ranged from 0.70 to 0.97, indicating an achieved minimum reliability of 0.70 for the new instrument.[29,31]

Stage II, Step 3: Testing the psychometric properties. After a pilot test, a multistage random sampling technique was used to select a sample for psychometric evaluation. The target number of subjects was calculated based on the rule of 5 or 10 subjects per item, or 500 subjects.[32] In this stage, 50% of the calculated sample size was added to compensate for incomplete, lost, and non-responses, resulting in a target sample size of 750.[33,34] Self-administered questionnaires (n=750) were then mailed to nurses who had worked in PCUs for at least 1 year. About 68% of questionnaires (n=511) were returned and used to test the construct validity, internal consistency, and stability reliability of the final version of the OHSC-S.

The majority (93.7%) of respondents were female, and aged between 22 and 63 years (*m*=39.0, *SD*=7.4). Nearly all (93.0%) held bachelor degrees in nursing, while 36 (7.0%) held master degrees. The reported work experience was 1-36 years in the PCU setting, with an average of 11.8 (*SD*= 7.9) years. Regarding formal academic or informal training for providing services in the PCUs, most (80.6%) had attended a nurse practitioner course. Almost half of the sample (44%) had experience in OH. The length of experience in work related to OH ranged from 1 to 30 years with an average of 6.1 (*SD*= 6.0) years (*median* =5.0). Most (85.4%) had not attended training related to OH services (Table1).

Table 1 Personal characteristics of nurses working at PCU (n=511)

Personal Characteristics	Number	Percent
Gender		
Female	479	93.7
Male	32	6.3
Age (years) (n=510)		
20-30	58	11.4
31-40	246	48.1
41-50	181	35.4
>50	25	5.1
Min= 22 Max = 63 Mean = 39.0 SD = 7.4		
Marital status		
Married	114	22.3
Single	351	68.7
Widowed/ Divorced/ Separated	46	9.0
Highest educational level in nursing		
Bachelor degree or equivalent	475	93.0
Master degree	36	7.0

Table 1 Personal characteristics of nurses working at PCU (n=511) (Continued)

Personal Characteristics	Number	Percent
Current position (n=510)		
Registered Nurse, practitioner level	82	16.1
Registered Nurse, professional level	368	72.2
Registered Nurse, senior professional Level	35	6.8
Employed as public health officer	25	4.9
Length of work experience in PCU(years)		
1-10	403	78.9
11-20	86	16.8
> 20	22	4.3
Min= 1 Max = 36 Mean = 11.8 SD = 7.9		
Academic or workshop training for providing services in PCU (n=510)		
No	48	9.4
Yes**	462	90.6
- Program of nursing specialty in nurse practitioner (primary medical care) 4 months	411	80.6
- Nursing specialty short course Program	18	3.6
- Other curriculum	24	12.5
Experience in occupational health		
No	286	56.0
Yes (n=225)	225	44.0
- 1-5 years	78	34.6
- 6-10 years	90	40.0
- > 10 years	57	25.4
Min= 1 Max = 30 Mean = 6.1 SD = 6.0 Median = 5.0		
Academic or workshop training for providing OHS (n=508)		
No	434	85.4
Yes**	74	14.6
- Basic occupational health nursing program (60 hours)	28	5.5
- Occupational health nursing specialty program (4 months)	9	1.8
- Other curriculum	49	9.6

**more than 1 answer is acceptable

Construct validity testing. Exploratory factor analysis (EFA) with oblique rotation was used to validate the construct validity and examine the factor structure of the OHSC-S. Principal component analysis with Promax rotation was conducted to examine construct validity. Oblique rotation is used when there was evidence showing that the underlying factors are correlated.[31] It is reasonable to hypothesize that these factors interact and are correlated to some extent. Factors were extracted based on the results of 1) Bartlett's test of sphericity for the hypothesis that the correlation matrix is an identity matrix, 2) Kaiser-Meyer-Olkin test (KMO) for measuring sampling adequacy, 3) Eigenvalue greater than 1.0 representing the amount of variance in all of the items that can be explained by a given factor, 4) factor loading cut point of ≥ .40 for retaining items; and 5) the conceptual or theoretical meaningfulness of the resulting factors.[24,32,35]

After conducting EFA, the outcome of the construct validity analysis resulted in elimination of only one item from the OH service knowledge dimension, with a subsequent 120 items comprising the final version of the OHSC-S. As a result of factor loading, 14 subscales were generated.

Reliability testing: Internal consistency of the final version of OHSC-S (120 items) was examined using the results of the administration to the 511 nurses who were the participants of the construct validity evaluation. The overall alpha coefficient was 0.98, indicating an excellent internal consistency for the final version of the OHSC-S. After two to four weeks following administration of the psychometric property survey, a test-retest study was undertaken with a subsample (n=100) to estimate instrument stability using Pearson's correlation coefficients. A resulting coefficient of 0.76 indicated instrument test-retest stability.

Results

Validity

Content validity: The OHSC-S was reviewed and revised based on an experts' rating. The CVI of the total scale was 0.962 and the CVI of each item of the OHSC-S ranged from 0.952 to 0.970, indicating good content validity.

Construct validity: Within three dimensions (knowledge, skills, and traits), the results of the EFA showed a scale containing 14 subscales with 120 total items. Each dimension revealed that the KMO measure of sampling adequacy was small and close to zero, indicating the data were legitimately factored. Bartlett's test of sphericity was significant, which indicated that the correlation matrix was not an identity matrix, and Eigenvalues were greater than 1. Therefore, factorability is assumed.

The OH service knowledge dimension was composed of 4 subscales and 29 items, explaining 69.88% of the total variance. These 4-subscales were named Integration of OH and Community Health, Principles of OH Services, Primary Medical Care for Occupational Illnesses, and Health Risk Assessment and Legislation. The OH service skill dimension was composed of 7 subscales and 66 items, explaining 73.03% of the total variance. These 7 subscales were named: On-site OH Services, OH Communication, Collaboration, Managing Health Information, Research and Research Utilization, Outreach OH Services, and Continuous OH Services. The OH service trait dimension comprised 3 subscales and 25 items, explaining 67.60% of the total variance. These 3 subscales were named Individual Traits, Professional Ethics, and Interaction Traits (Table 2).

Table 2 Exploratory factor analysis of the OHSC-S (n=511)

Subscale / Item		Factor Loading
1. OH service knowledge (4 subscales: 29 items with Cronbach's alpha coefficients = 0.96)		
Subscale 1: Integration of OH and community health (12 items with Eigenvalue = 15.57, % of total variance = 53.69, Cronbach's alpha coefficients = 0.95)		
k27	Coordinating the provision of OH services in community	0.971
k26	Management and administration of OH services project	0.900
k25	Health information management to facilitate use	0.891
k24	Recordkeeping system in relation to work-related diseases, and occupational injuries	0.800
Subscale 2: Principles of OH services (7 items with Eigenvalue =1.87, % of total variance =6.46, Cronbach's alpha coefficients = 0.93)		
k3	Identification of OH hazards	0.917
k5	Analysis of the effects of hazard on workers	0.905
k4	Surveillance of the work environment and worker's health	0.896
k2	Work-related diseases and occupational injuries and their impacts on workers in community	0.848
Subscale 3: Primary medical care for occupational illnesses (7 items with Eigenvalue =1.66, % of total variance =5.73, Cronbach's alpha coefficients = 0.92)		
k13	Primary medical care including assessment, diagnosis for occupational illnesses and injuries	0.956
k12	First-aid preparedness for handling occupational illnesses and injuries	0.952
k16	Referral service for ill or injured patients to appropriate medical or community resources	0.788
k14	Health promotion and disease prevention strategies to solving general and occupational problems	0.769
Subscale 4: Health risk assessment and Legislation (3 items with Eigenvalue =1.16, Percent of total variance =4.00, Cronbach's alpha coefficients = 0.81)		
k8	Using the biometric measurements (e.g. spirometer, audiometer) for general health and job-specific health assessment	0.967
k9	Interpreting the results of general health and job-specific examination	0.794
2. OH service skills (7 subscales: 66 items with Cronbach's alpha coefficients = 0.98)		
Subscale 1: On-site OH services (13 items with Eigenvalue = 36.71, % of total variance = 55.62, Cronbach's alpha coefficients = 0.95)		
s43	Provides nursing care plan based on nursing and medical scientific knowledge	0.809
s42	Implements nursing care and primary medical care for work-related diseases and occupational injuries	0.787

Table 2 Exploratory factor analysis of the OHSC-S (n=511) (Continued)

Subscale / Item		Factor Loading
s46	Records and updates information related to work-related diseases and occupational injuries	0.764
s41	Provides first-aid when there are work-related diseases and occupational injuries	0.763
Subscale 2: OH communication (13 items with Eigenvalue =3.31, Percent of total variance =5.04, Cronbach's alpha coefficients = 0.95)		
s85	Uses persuasion skills to promote health among workers	0.740
s86	Communicates health information to workers and related parties	0.732
s84	Uses motivational techniques to encourage self-care among workers	0.731
s87	Uses risk communication skills with workers, both individually and in groups, for taking care of their health	0.709
Subscale 3: Collaboration (9 items with Eigenvalue =2.56, Percent of total variance =3.88, Cronbach's alpha coefficients = 0.96)		
s71	Collaborates with related organizations in OH service provision	0.753
s72	Encourages collaboration with the community, organizations and other sectors	0.749
s76	Shares knowledge and collaborates with experts from different disciplines and other organizations	0.561
Subscale 4:Managing health information (13 items with Eigenvalue =1.76, Percent of total variance =2.68, Cronbach's alpha coefficients = 0.95)		
s67	Uses basic statistical programs to manage information on occupational and injuries	0.633
s56	Records worker's health information in Form 506/2	0.610
s62	Analyses the data on work environment surveillance, risk exposures, results of health examinations in the catchment area	0.595
s65	Uses information technology to recording health information of workers in the community	0.592
Subscale 5:Researchand research utilization (7 items with Eigenvalue =1.58, Percent of total variance =2.20, Cronbach's alpha coefficients = 0.93)		
s95	Prepares short, medium, and long term program/service plans based on results of the community assessment	0.732
s92	Contributes to research aimed at improving OH and injuries	0.695
s93	Applies occupational and environmental research results to clinical practice	0.687
s96	Establishes policies on health and safety of PCUs	0.655

Table 2 Exploratory factor analysis of the OHSC-S (n=511) (Continued)

Subscale / Item		Factor Loading
Subscale 6: Outreach OH services (8 items with Eigenvalue =1.18, Percent of total variance =1.79, Cronbach's alpha coefficients = 0.93)		
s33	Provides surveillance on working condition and the health of workers in community	0.663
s32	Takes action on the workplace and environment that are expected to have impact on workers and/or the community	0.645
s34	Provides health surveillance for workers at- risk, both in terms of general health and OH examinations	0.623
s31	Identifies community problems/needs related to OH services based on community diagnosis and local way-of-life	0.593
Subscale 7: Continuous OH services (3 items with Eigenvalue =1.08, Percent of total variance =1.64, Cronbach's alpha coefficients = 0.87)		
s51	Assists workers with occupational and environmental diseases and injuries to early return to work	0.639
s50	Follows up on recommendations for improvement of working conditions and evaluates working condition for safety and health	0.611
3. OH service traits (3 subscales: 25 items with Cronbach's alpha coefficients = 0.96)		
Subscale 1: Individual traits (12 items with Eigenvalue = 13.70, Percent of total variance = 54.82, Cronbach's alpha coefficients = 0.94)		
t105	Demonstrates patience in OH service provision	0.826
t104	Demonstrates enthusiasm in work and is open to new knowledge	0.761
t97	Is passionate and holds a positive attitude towards OH	0.730
t103	Demonstrates leadership in OH	0.715
Subscale 2: Professional ethics (7 items with Eigenvalue = 1.72, % of total variance = 6.88, Cronbach's alpha coefficients = 0.90)		
t117	Demonstrates human respect	0.883
t118	Provides nursing care in accordance with Thai nursing and midwifery council guidelines	0.863
t107	Demonstrates accountability	0.642
Subscale 3: Interaction traits (6 items with Eigenvalue = 1.48, % of total variance = 5.90, Cronbach's alpha coefficients = 0.91)		
t115	Presents the nurse's role regarding OH service provision	0.777
t121	Serves as a mentor in OH service provision	0.773
t116	Recognizes a sense of awareness regarding occupational impact on health in the community	0.701

Reliability

Internal consistency: The internal consistency reliability of the new subscales derived from factor analysis ranged from 0.81 to 0.96, with an overall alpha coefficient of 0.98; 0.96 for OH service knowledge, 0.98 for OH service skills, and 0.96 for OH service traits, respectively (Table 2).

Stability: The instrument was also examined by test-retest through repeated administrations that yielded statistically significant positive relationships at high levels ($p<0.001$). Overall, the OHSC-S reached an acceptable level of stability ($r=0.76$), as did subscales (OH service knowledge, $r=0.68$; OH service skills, $r=0.80$; OH service traits, $r=0.71$) after two to four weeks.

Discussion

This multi-stage study resulted in the development of a three-part OHSC-S for nurses working in Thai PCUs. The three dimensions (OH service knowledge, skills, and traits) corresponded with a factor analysis of items, made conceptual sense, and were consistent with previous studies [4,8,10,19-21] and concepts of the BOHS activity model.[1] The findings of the extracted components of the OHSC-S revealed that the 4 subscales of the OH service knowledge dimension more appropriately represented the underlying structure of the framework of BOHS which indicated that nurses working in the community must possess knowledge in OH areas such as community health, OH science, epidemiology, management, and law. Specific knowledge of primary medical care for OH clients with an emphasis on diagnosis, screening, treatment, health promotion and disease prevention, referral, follow-up, rehabilitation, and illness/injury management, was also crucial to OH service delivery. In addition, understanding of work processes and related hazards, work-related illnesses and occupational and environmental injuries, risk management, and occupational regulation are indispensable for OH practice.[4, 8,10,19,36,37]

The OH service skill dimension comprised 7 subscales. All subscales were congruent with prior studies of OH service competencies, including on-site OH services,[1,4,8,19-21,38] outreach OH services,[1,3,4,8,38] continuous OH services including appropriate referral, follow-up and continuity of treatment,[1,4,8,10,19,20] communication,[1,8,20,21] collaboration,[1,4,8,10,19-21] managing health information including recordkeeping systems in relation to work-related illnesses and injuries,[1,4,8] and research and research utilization.[8,19,21,37]

However, a subscale related to research and research utilization identified in this study is not included in the BOHS framework. It is possible that the BOHS activity model was designed for use with multidisciplinary teams, who are generally not responsible for conducting research. However, according to the national nursing standard in Thailand, research competencies are considered a component of professional nursing practice.[39]

The OH service trait dimension is composed of 3 subscales and made conceptual sense because OH service traits, including patience, enthusiasm, holistic thinking, systematic thinking, creative thinking, flexibility, accountability, mentorship, leadership, lifelong learning, human respect, code of ethics, and professionalism were included in the lists of OH services of previous studies.[8,10,19,36]

The three dimensions, including the 14 subscales of the OHSC-S, are consistent with the proposed structural conceptualization and demonstrate construct validity in terms meeting the criteria for EFA, conceptual or theoretical meaningfulness of the resulting factors, and classification. In addition, each subscale explained more than 60% of the variance, which is considered satisfactory.[31,35] The number of items in each subscale ranged from 3 to 13. This number is acceptable according to Hair and colleagues,[35] who suggested that each subscale should contain at least three items. Thus, the final version of the OHSC-S satisfied the criteria for EFA.

The Cronbach's alpha coefficient for the overall OHSC-S was 0.98 and each subscale derived from factor analysis had a Cronbach's alpha ranging from 0.81 to 0.96, indicating high reliability. Although a high alpha coefficient (>0.90) could indicate redundancy,[29,31] some researchers mention that longer instruments tend to be more reliable than shorter ones and the high Cronbach's alpha coefficient may be influenced by a large instrument size.[18,29,40] Therefore, the length (120-items) of the OHSC-S may contribute to the high alpha coefficient. Reliability testing of each subscale of the instrument found Cronbach's alpha coefficients exceeding 0.70, a level considered satisfactory for a new scale,[31] indicating good internal consistency. In addition, the test-retest stability was also examined, revealing relative stability of the instrument over a 2-week period. This short-term stability is consistent with Spencer and Spencer,[12] who report that personal performance competency (knowledge, skills, and traits), are believed to change only very slowly over a long period of time.

Although the study accomplished its aims, and results demonstrated that the new OHSC-S was a good multidimensional instrument for assessing OH service competency level among nurses working in Thai PCUs, some limitations need to be taken into consideration. First, The OHSC-S was somewhat long (120-items) and required approximately 30 to 60 minutes to complete. Therefore, further studies should be conducted to reduce the number of scale items. Second, the interaction and correlation between OH service knowledge, skill, and trait dimensions might contribute to the high alpha coefficient (>0.90). Repeated administration of the OHSC-S using similar samples may be completed in an effort to shorten the scale and reduce the high alpha coefficient.

In summary, the newly-developed OHSC-S demonstrates sound psychometric properties through testing and using a theory-based approach to construct the measurement of OH service competency. For clinicians, the OHSC-S could assist in assessing the quality of their services, which could be used as a basis for professional skill development and quality assurance. For health administrators and mentors, the scale could be applied as a criterion for assessing the suitability of candidates for job placement, advancement, and recognition. For mentors and trainers of nurses working in PCUs, the OHSC-S can be used to assess staff educational needs and effectiveness of professional development programs.

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การพัฒนาและคุณสมบัติการวัดทางจิตวิทยาของเครื่องมือวัดสมรรถนะการบริการอาชีวอนามัยของพยาบาลที่ปฏิบัติงานในหน่วยบริการปฐมภูมิของไทย

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บทคัดย่อ: การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาและทดสอบคุณสมบัติการวัดทางจิตวิทยาของเครื่องมือวัดสมรรถนะการบริการอาชีวอนามัยของพยาบาลที่ปฏิบัติงานในหน่วยบริการปฐมภูมิ โดยความหมายและองค์ประกอบของเครื่องมือในการศึกษาครั้งนี้พัฒนามาจากการวิเคราะห์เนื้อหา การสัมภาษณ์เชิงลึกและการทบทวนวรรณกรรมที่เกี่ยวข้อง โดยมีกรอบทฤษฎีในการศึกษาคือ แนวคิดสมรรถนะของ Spencer และแนวคิดการจัดบริการอาชีวอนามัยขั้นพื้นฐาน ตรวจสอบความตรงเชิงเนื้อหาของเครื่องมือโดยการพิจารณาของผู้เชี่ยวชาญ 5 ท่านและทดสอบความเชื่อมั่นชนิดความสอดคล้องภายในเบื้องต้นกับพยาบาลที่ปฏิบัติงานในหน่วยบริการปฐมภูมิ จำนวน 30 คน หลังจากนั้นนำเครื่องมือไปทดสอบคุณสมบัติการวัดทางจิตวิทยาโดยส่งแบบสอบถามทางไปรษณีย์ให้พยาบาลที่ปฏิบัติงานในหน่วยบริการปฐมภูมิที่ได้จากการสุ่มตัวอย่าง จำนวน 750 คน (ได้รับแบบสอบถามกลับร้อยละ 68.1)

เครื่องมือวัดสมรรถนะการบริการอาชีวอนามัยของพยาบาลที่ปฏิบัติงานในหน่วยบริการปฐมภูมิประกอบด้วย 3 องค์ประกอบ ได้แก่ ความรู้ในการบริการอาชีวอนามัย ทักษะในการบริการอาชีวอนามัยและคุณลักษณะเฉพาะของบุคคลในการบริการอาชีวอนามัย จากการวิเคราะห์องค์ประกอบเชิงสำรวจ พบว่า เครื่องมือดังกล่าวประกอบด้วย 14 องค์ประกอบย่อย จำนวน 120 ข้อคำถาม เป็นมาตรวัดแบบประมาณค่า 5 ระดับ โดยในแต่ละองค์ประกอบย่อยคิดเป็นร้อยละมากกว่า 60 ของความแปรปรวนทั้งหมด เครื่องมือนี้มีความเชื่อมั่นชนิดความสอดคล้องภายในของแต่ละองค์ประกอบย่อย 0.81 ถึง 0.96 ค่าความเชื่อมั่นด้วยการทดสอบซ้ำมีค่าสัมประสิทธิ์สหสัมพันธ์ เท่ากับ 0.76 ดังนั้นเครื่องมือที่พัฒนาใหม่นี้มีคุณสมบัติการวัดเชิงจิตวิทยาที่เหมาะสม เครื่องมือนี้จึงสามารถนำไปประเมินสมรรถนะการบริการอาชีวอนามัยของพยาบาลที่ปฏิบัติงานในหน่วยบริการปฐมภูมิเพื่อใช้ในการวางแผนการพัฒนาวิชาชีพพยาบาลและบริหารจัดการทรัพยากรบุคคลที่เกี่ยวข้องกับการบริการอาชีวอนามัยต่อไป

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