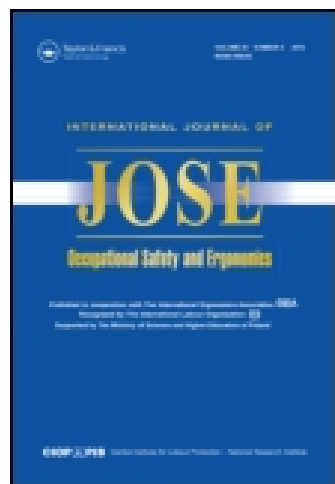


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# Development of PAOT Tool Kit for Work Improvements in Clinical Nursing

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*The aim of this study was to develop an action checklist for educational training of clinical nurses. The study used qualitative and quantitative methods. Questionnaire items were extracted through in-depth interviews and a questionnaire survey. PASW version 19 and AMOS version 19 were used for data analyses. Reliability and validity were tested with both exploratory and confirmative factor analysis. The levels of the indicators related to goodness-of-fit were acceptable. Thus, a model kit of work improvements in clinical nursing was developed. It comprises 5 domains (16 action points): health promotion (5 action points), work management (3 action points), ergonomic work methods (3 action points), managerial policies and mutual support among staff members (3 action points), and welfare in the work area (2 action points).*

clinical nursing practice   PAOT   participatory action-oriented training   tool kit

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## 1. INTRODUCTION

Musculoskeletal disorders, rubber allergy and needle injuries are the most frequently encountered health and safety risks in modern clinical nursing practice [1]. They may lead to occupational accidents and involve considerable costs. Appropriate health and safety practices have to be implemented to protect nurses. Because the average workforce age and the proportion of part-time nurses increase, the role of self-monitoring may become important in the risk management [2, 3].

Participatory action-oriented training (PAOT) programs can be used to help clinical nurses practice self-monitoring and promote risk-modifying behaviors [4, 5]. PAOT programs, originally developed by experts in ergonomics, have been used across many industries to improve working environment and to accredit services. Following the ILO-OSH 2001 guidelines [6], KOSHA 18001 certification [7] was introduced in Korean workplaces. Since the introduction of an accreditation system for medical institutions in

Korea in 2004, many hospitals have participated in Standard No. ISO 9001:2009 [8] and Standards No. 14000 to gain international accreditation; similar efforts have been made in clinical nursing.

PAOT programs use action checklists which comprise suggested action points and corresponding examples of good practice. Each question may be matched with several examples suggesting improvements in an area relevant to the suggested action. Photos taken in the workplace are the examples of good practice and they play an important role in motivating clinical nurses to modify their behaviors. This feature distinguishes action checklists from other available tools.

Many studies in Korea and worldwide used questionnaires to assess clinical nursing practices and patients' health and safety [9, 10, 11, 12]. However, few studies in Korea focused on developing a tool kit improving the safety and health of clinical nurses, with the exception of preventing musculoskeletal diseases [13]. The aim of the present study was to develop such a tool kit.

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## 2. METHODS

The Institutional Review Board of Hanyang University Seoul Hospital in Korea approved the study. Qualitative and quantitative methods analyzed gathered data.

### 2.1. Subjects

Four clinical nurses employed in different hospitals in Seoul (at the time of the interviews) took part in in-depth interviews. The nurses differed in age and experience. Moreover, 97 nurses participated in a questionnaire survey. All nurses were registered female nurses selected via convenience sampling. They were either undergraduate or graduate students of nursing at the Seoul University. The undergraduate students, who were enrolled in a 4-year bachelor of nursing course, had previously completed a 3-year training and held a nursing license. General nurses with current ward experience only took part in the study. Head nurses, supervisors and nurses working in outpatient or specialized departments were excluded from the study. All nurses signed a consent form before the study.

The nurses' mean (*SD*) age was 32.34 (5.28) years (range: 24–45, interquartile range: 29–37). The nurses' mean (*SD*) clinical experience was 8.90 (5.12) years (range: 2–27, interquartile range: 5.6–12). The mean (*SD*) size of hospitals where the nurses worked was 1207.42 (715.26) beds (range: 60–2300, interquartile range: 750–1100). The mean (*SD*) nurses' monthly overtime was 9.64 (5.36) hours (range: 2–33, interquartile range: 4.50–26.5). The reported overtime of 1–2 h every day was similar to overtime of clinical nurses in the USA [14]. The average hospital size of 1207 beds represents most large university hospitals in Seoul.

### 2.2. Developing Tool Kit

Firstly, a list of semistructured in-depth questions was developed on the basis of available literature [4, 5, 15, 16]. The examples of the questions are “What cause unnatural posture?”, “What kind of nursing station do you think is good for nursing treatments?”, “How do you manage hazardous

substances in your hospital?”, “Would you please state any accidents of nurses that you experienced directly or indirectly?”. To extract 43 statements, data obtained from the interviews were analyzed with the method developed by Colaizzi [17]. The statements were structured as questions, which could be scored on a 1–5 Likert scale in a questionnaire survey. The survey was conducted between November 25 and December 10, 2011, and the collected data were analyzed with exploratory factor analysis. A total of 16 potential action points associated with five distinct factors (domains), which were identified in the analysis, were used to create an action checklist. Confirmatory factor analysis was used to test the compatibility of action checklist with PAOT principles.

Each action point was then matched with at least one photograph showing an example of behavior improving safety and health of clinical nurses. The photos were taken in collaboration with the nursing departments of several hospitals in Seoul. A panel of five experts selected 19 representative images by unanimous decision from a total of 58 photos. They were converted into illustrations by a graphic expert and matched with the 16 action points on the checklist. Each point was matched with at least one example; two points were matched with two or three examples.

The final tool kit comprised 16 action points in five domains (Appendix A, p. 157). The domains were named after the action point with the highest standardized factor loading within the domain or according to PAOT principles [4, 5]. The acronym WICN (Work Improvements in Clinical Nursing) was proposed as the name of the tool kit.

### 2.3. Statistical Analysis

PASW version 19 and AMOS version 19 were used for data analyses. The final model was developed with exploratory factor analysis and was tested with confirmatory factor analysis. Cronbach's  $\alpha$  assessed the internal reliability of the checklist. Standardized factor loadings, *t* values and average variance extracted (AVE) estimates assessed the convergent validity. Correlation coefficients assessed the discriminant validity of the factors. Goodness-of-fit was tested with

six indices:  $\chi^2$ , goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), Tucker-Lewis index (TLI), comparative fit index (CFI) and root mean square error of approximation (RMSEA).

### 3. RESULTS

#### 3.1. Model Validity and Goodness-of-Fit

A typical PAOT action checklist comprises 5–6 domains and 20–30 action points [4, 5]. The WICN comprises 5 domains with 16 action points. Table 1 shows that the reliability estimated for the checklist exceeded .60 [18]. It was higher than the value achieved with the performance measurement scale for hospital nurses or with the nursing professional value scale [9, 10]. This suggests that the internal consistency of the tool kit was satisfactory. Standardized factor loadings exceeded  $\pm .30$  in all cases, which confirmed that the action points were correctly categorized into their respective domains [19]. The degree to which all action points converge on the same concept was measured with  $t$  values. Table 1 shows that values obtained in  $t$  values for all 16

action points were over 1.96, which justify their use in a single tool kit [20].

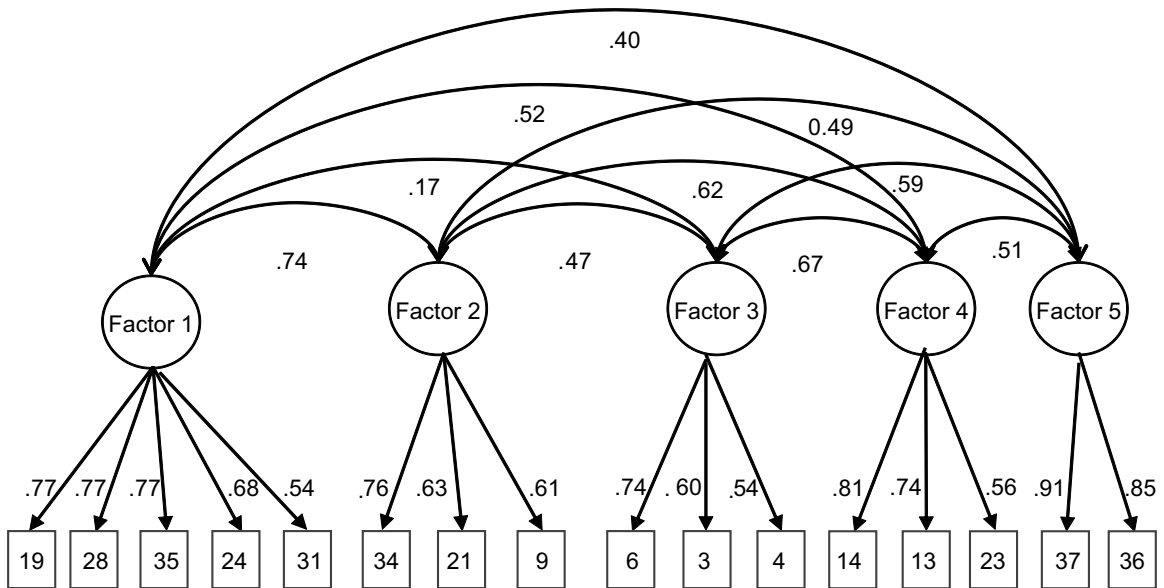
AVE values above .50 are acceptable. Factors 3–5 reached this threshold; the value of factor 1 was .42, while factor 2 did not reach it. This may be caused by a possible bias associated with action point 6 (factor 2) referring work schedules arrangements. It is common for nurses to be mobilized for various reasons and this may influence measured values. AVE estimates may have an influence on the discriminant validity of different factors but they have no effect on construct validity. Discriminant validity over .85 indicates a high correlation (or little discrimination) between two factors [21]. Discriminant validity in this study was under .85 in all cases showing that all five factors were discrete.

To achieve acceptable goodness-of-fit, GFI, TLI, CFI and AGFI  $> .90$ , RMSEA  $< .05$  and  $p$  in  $\chi^2$  test  $< .05$  [20]. Figure 1 shows that three indices (CFI, TLI, RMSEA) met this criterion and two (GFI and AGFI) approximated it. The  $\chi^2$  test did not reach significance, but this may be due to the small sample size. Overall, the model's goodness-of-fit is deemed acceptable.

TABLE 1. Average Values and Validity of Action Points in Confirmatory Factor Analysis ( $N = 97$ )

Factor	Action Point	$M$ ( $SD$ )	Convergent Validity			
			Standardized Factor Loading	$t$	Reliability	AVE
1	1	2.20 (1.13)	.77	4.56	.79	.42
	2	2.97 (1.20)	.77	4.55		
	3	2.60 (1.22)	.77	4.57		
	4	2.72 (1.10)	.68	4.26		
	5	2.46 (1.24)	.54	fix		
2	6	3.10 (1.33)	.76	4.21	.59	.32
	7	3.41 (1.49)	.63	4.68		
	8	3.07 (1.12)	.61	fix		
3	9	4.53 (0.69)	.74	3.92	.79	.55
	10	4.18 (0.64)	.60	3.60		
	11	4.15 (0.83)	.54	fix		
4	12	3.56 (0.91)	.81	4.52	.82	.60
	13	3.93 (0.70)	.74	4.39		
	14	4.44 (0.85)	.56	fix		
5	15	3.97 (0.76)	.91	9.07	.72	.50
	16	3.73 (1.16)	.85	fix		

Notes. AVE = average variance extracted.



**Figure 1. Confirmatory factor analysis.** Notes.  $\chi^2 = 102.80$ ,  $p = .25$ , goodness-of-fit index (GFI) = .86, adjusted goodness-of-fit index (AGFI) = .80, Tucker–Lewis index (TLI) = .97, comparative fit index (CFI) = .97, root mean square error of approximation (RMSEA) = .03.

### 3.2. Completed WICN Action Checklist

Appendix A (p. 157) shows the complete WICN action checklist composed of 16 action points across five domains.

Domain I (health promotion) includes action points 1–5. Table 1 shows that standardized factor loadings for action points 1–5 ranged from .54 to .77, which elicited the concept of health promotion. Action point 1 (engaging in therapeutic activities that use art or music for relaxation) helps to reduce stress; these leisure activities require moderate support from the organization or role intervention of supervisors [22]. The study focusing on maintaining natural posture preventing musculoskeletal disorders suggested using a chair when administering injection or treatment (action point 2) [13]. In the present study, it serves to maintain calmness and stability to prevent injury. Action point 3 (ensuring adequate length of mealtime breaks) corresponds with the findings that clinical nurses often do not take adequate breaks after meals, which increase the risk of injuries and accidents [23, 24]. The legal right to adequate rest is an controversial issue, even in the USA [25]. Taking exercise (action point 4) is associated with general health promotion. In the USA, 14.6% of all workplaces have fitness room, 13.5% are furnished with fitness equipment and

6.2% use posters to encourage workers to use stairs [26]. These efforts promote occupational health by creating supportive environments [22]. Action point 5 encourages systematization of rest. Short-term booster breaks significantly improved workers' health and safety [21]. Activities from Domain I are essential in the management of health and safety risks in clinical environment; many large hospitals in Korea are interested in their implementation.

Domain II (work management) includes action points 6–8. Table 1 shows that their standardized factor loadings ranged from .61 to .76, which elicited the concept of work management. Because erratic schedules contribute to unhealthy working conditions [3], schedule fixing (action point 6), taking short naps and reducing overtime are important strategies to improve the safety and health of clinical nurses [28, 29]. Hospitals in Japan encourage nurses to use a cart when carrying medical documents (action point 7), which is similar to using a bedside cart when carrying mobile computers [30]. Action point 8 encourages good communication with external cleaning staff, which has a considerable impact on risk management in hospitals [31].

Domain III (ergonomic work methods) includes action points 9–11. Table 1 shows that their

standardized factor loadings ranged from .54 to .74, which elicited the concept of ergonomic work methods. Appropriate storage of hazardous substances (action point 9) may have an impact on hospitals accreditation status. Moreover, inappropriate storage of hazardous substances has been linked to acute and chronic health problems [32]. Action points 10–11 encourage to place nursing materials within reach and ask for help when moving patients to prevent musculoskeletal pain and injuries associated with lifting, bending or twisting. In the United States, the cost associated with these types of injuries amounted to \$50 000–100 000 per nurse [33]. Various alternatives such as using mechanical lifting devices, adopting a no-lift policy or forming a lift team have been proposed, [34, 35, 36]. The practice level of clinical nurses in this domain was higher than that in the other domains.

Domain III can be justified since managing hazardous substances, arranging materials, posture, etc., are also treated in ergonomic methodology [4, 5].

Domain IV (managerial policies and mutual support among staff members) includes action points 12–14. Table 1 shows that their standardized factor loadings ranged from .56 to .81, which elicited the concept of managerial policies and mutual support among staff members. Forming positive working relationships with doctors and patients (action point 12) is associated with higher quality of nursing services, while negative relationships may increase the turnover of nursing staff [34, 37]. Action point 13 recommends making available in the workplace the protocol related to the management of health and safety risks. Implementing policies is a factor contributing to patient safety [38]. Previous recommendations included posting the protocol or health and safety notices in a resting area or a changing room for nursing staff [27, 39]. Action point 14 focuses on preventing injuries associated with the use of needles, blades or scissors. Reported compensation costs for needle-stick injuries were very high [39, 40], but the introduction of needleless systems in American hospitals in 1993 halved the number of reported injuries [24]. A study in Korea reported that the annual injury rate

of 4.7 needle-stick injuries per 100 hospital staff affected mainly doctors, medical laboratory technicians and nurses [41]. Careful disposal of needles is crucial to prevent injuries and requires the cooperation of staff members at all levels.

Domain V (welfare in the work area) includes action points 15–16. Table 1 shows that their standardized factor loadings were .91 and .85, respectively, which elicited the concept of welfare in the work area. Keeping the nurses' station tidy and well-organized (action point 15) provides room for movement and can improve work efficiency [4, 5]. Similarly, providing an area for nurses to rest or change (action point 16) encourage them to take breaks, which has been shown to enhance work efficiency.

#### 4. DISCUSSION

The WICN is a tool kit developed according to PAOT principles to improve the training of clinical nurses in the management of health- and safety-related risks. The tool kit may help clinical nurses practice self-monitoring and promote risk-modifying behaviors by providing examples of good practice.

Experienced clinical nurses can frequently identify potential health and safety hazards on their wards and manage them appropriately. However, risk management in clinical nursing practice should not be limited to preventing accidents of medical personnel. Instead, a culture of cooperation should be promoted at all levels [42].

This study has several limitations. Domain V, which had only two action points, would be beneficial if extended. It should be noted that the tool kit developed in this study was based on data from nurses working in different hospital departments and the hospitals varied in size. It may be beneficial to develop tool kits that would take these differences into consideration. Likewise, further research should include male nurses and nursing managers, who were not surveyed in this study. More and better examples of good practice could improve the quality of the tool kit. Finally, future models should include work-related stress, which is a recognized factor affecting the health and safety of clinical nurses.

## 5. CONCLUSIONS

The convergent validity (including the reliability) of the WICN developed in this study was acceptable. The concepts of 16 action points contained in the tool kit are based upon risk assessment. Therefore, the WICN could be used for practical purposes such as group education, web-based Internet education and mobile applications to reduce work-related risks of clinical nurses.

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**APPENDIX A. The WICN tool kit action checklist**

This action checklist contains practical suggestions that can improve the workplace environment and the management of health and safety risks by clinical nurses.

Using the checklist

1. Read each suggestion carefully and look for ways to implement it. If measures are already in place or are not needed, mark **No** under “Do you propose action?”. If you think the suggestion is worthwhile, mark **Yes**. Use the space next to “Remarks” to describe how you would implement it.
2. Once you have gone through the entire checklist, look again at the suggestions you have marked **Yes**. Decide which are the most important or beneficial, and mark them as **Priority**.

Before finishing, make sure that you have selected **Yes** or **No** for all items on the checklist, and **Priority** for some of the items marked **Yes**.

Domain I. Health promotion

1. Engage in therapeutic activities that use art or music for relaxation.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_



2. Use a chair when administering injection or treatment.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_



3. Ensure that mealtime breaks are adequate.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_



4. Take exercise.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_



5. Take breaks.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_



Domain II. Work management

6. Fix your monthly schedule and try to keep it.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_



7. Use a cart when carrying medical documents.

Do you propose action?

No             Yes             Priority

Remarks \_\_\_\_\_

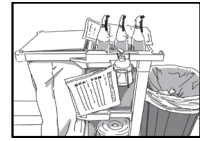


8. Communicate with outsourced cleaning staff about the chemical hazards of sanitary materials.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



Domain III. Ergonomic work methods

9. Make sure that all hazardous substances are appropriately stored.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



10. Place nursing materials within easy reach and where they are easy to find.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



11. Ask for help when moving heavy, unconscious, intoxicated, or surgical patients.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



Domain IV. Managerial policies and mutual support among staff members

12. Form good working relationships with doctors and patients.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



13. Implement and keep a health and safety protocol at the workplace.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_

14. Carefully dispose of used needles, dressing sets, blades, scissors, etc.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



Domain V. Welfare in the work area

15. Keep the nurses' station tidy.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



16. Provide a changing or resting room exclusively for nurses.

Do you propose action?

No  Yes  Priority

Remarks \_\_\_\_\_



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