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RESEARCH ARTICLE

Development of a Care System for Patients with Communicable Respiratory Diseases in the Inpatient Department, Namon Hospital, Kalasin Province

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Abstract

This research and development study, using a two-group pretest–posttest design in the evaluation phase, aimed to examine the situation, develop a care system for patients with communicable respiratory diseases in the inpatient department, and evaluate its effects on the knowledge and practice of healthcare personnel. The study was conducted at Namon Hospital, Kalasin Province, from January 2024 to December 2025. The sample consisted of healthcare personnel caring for patients, 29 in the experimental group and 29 in the control group (58 in total) from Namon Hospital and one neighboring community hospital, respectively, selected by purposive sampling and matched by position and work experience. The research instruments were the care system for patients with communicable respiratory diseases with an 8-week competency development program, a knowledge test, a practice assessment, and a personal protective equipment (PPE) donning and doffing demonstration checklist (KR-20 = 0.81, Cronbach's alpha = 0.86). Data were analyzed using descriptive statistics, paired t-test, independent t-test, chi-square test, and ANCOVA.

After implementation, the experimental group had a mean knowledge score of 17.62±1.55, significantly higher than at baseline (11.45±2.18; $t = 16.38$, $p < 0.001$) and higher than the control group (12.14±2.27; $t = 10.74$, $p < 0.001$). The mean practice score of the experimental group was 45.07±3.02, higher than that of the control group (34.83±4.51; $t = 10.16$, $p < 0.001$). Good practice was found in 96.55% of the experimental group compared with 20.69% of the control group ($\chi^2 = 34.40$, $p < 0.001$), and the PPE demonstration pass rates were 93.10% and 55.17%, respectively ($\chi^2 = 10.88$, $p = 0.001$). Thus, knowledge and practice scores of the experimental group were higher than those of the control group after implementation. The system may be used continuously and tested further in community hospitals with similar contexts, including patient outcomes.

Keywords: Communicable respiratory diseases, Inpatient department, Infection prevention and control

Introduction

Communicable respiratory diseases, including coronavirus disease 2019 (COVID-19), influenza, and pneumonia, are major global public health problems. Patients present with fever, cough, and dyspnea and may develop severe complications or die. As of April 2022, the COVID-19 pandemic had caused 511,536,014 cumulative cases worldwide, with 464,778,834 recoveries and 6,253,427 deaths, while Thailand had 4,262,909 cumulative cases, 4,092,878 recoveries, and 28,617 deaths.[1] Although the severity of COVID-19 has declined, non-COVID-19 lower respiratory infections remain a major disease burden; the global mortality rate decreased from 56.5 to 32.9 per 100,000 population between 1990 and 2019, and *Streptococcus pneumoniae* was the leading cause of morbidity and mortality.[2] In 2021, approximately 2.18 million deaths worldwide were attributed to these infections (27.7 per 100,000 population).[2] In Thailand, from 1 January to 24 February 2025, there were 131,826 cumulative influenza cases and 12 deaths, and the Department of Disease Control projected approximately 903,446 cases for the whole of 2025.[3]

As of early May 2022, Kalasin Province had 75,453 cumulative COVID-19 cases, 69,011 recoveries, and 194 deaths.[4] Namon District had 219 confirmed cases distributed across Nong Bua, Namon, Song Plueai, Lak Liam, and Yot Kaeng subdistricts. Namon Hospital is a 30-bed hospital that admits patients with all conditions 24 hours a day. Between July 2021 and May 2022, 515 COVID-19 patients were admitted and 4 died; the inpatient department therefore established a cohort ward in 2021–2022. In 2023, 312 patients with communicable respiratory diseases (influenza, pneumonia, COVID-19, and pulmonary tuberculosis) were admitted to the inpatient department, accounting for 21.40% of all inpatients (1,458). The problems identified were limited staff, a service area close to the general ward building that made isolation difficult, potentially insufficient personal protective equipment, and the inability to determine patients' risk levels before examination, all of which placed personnel at risk of infection. In 2023, four inpatient personnel acquired occupational respiratory infections, and the ward's compliance with infection prevention and control practices was 66.50%, below the target of 80%.

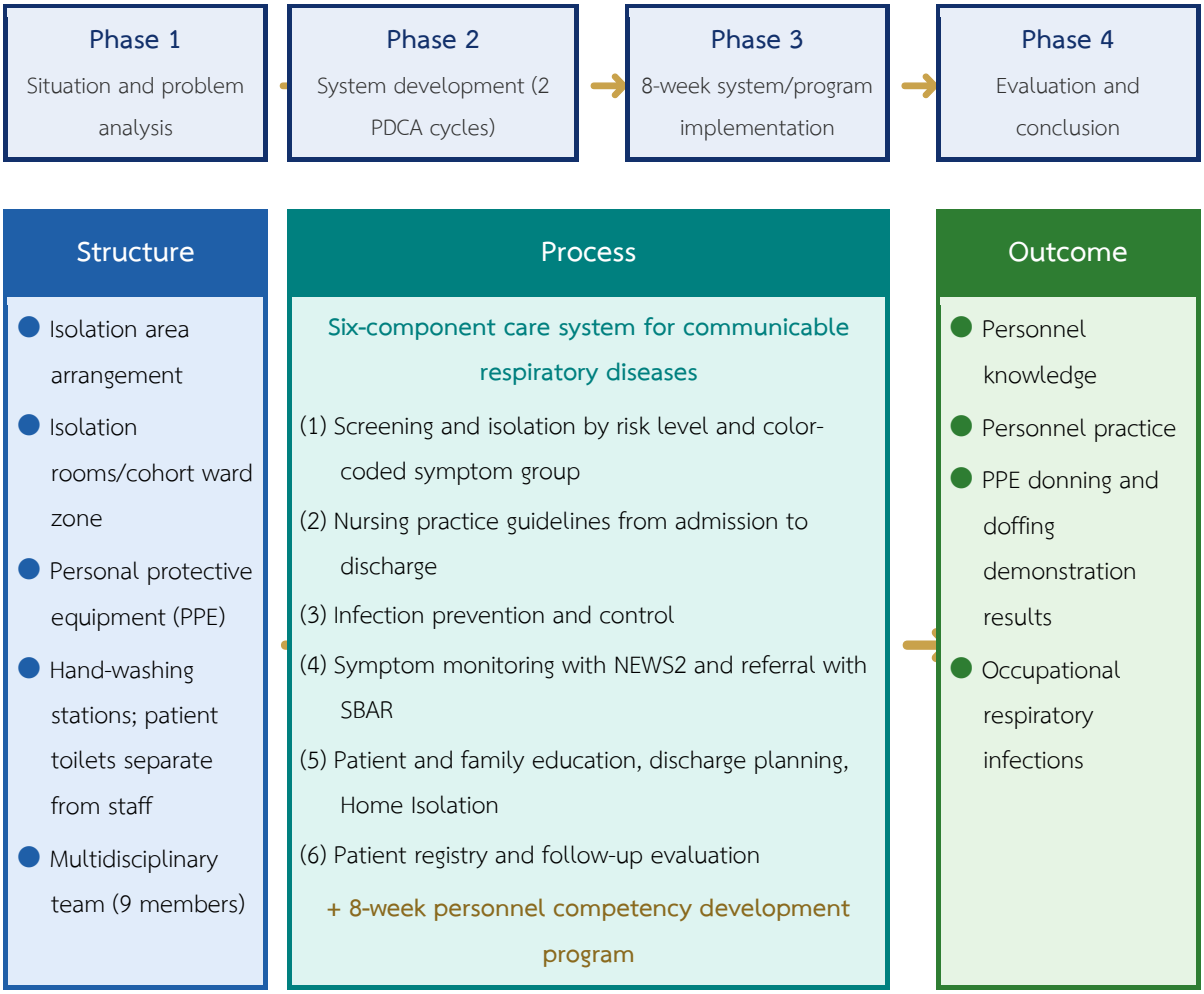
Care of patients with communicable respiratory diseases in the inpatient department requires infection prevention and control, including standard precautions; contact, droplet, and airborne precautions; and isolation rooms,[5,6] together with assessment of clinical deterioration using the National Early Warning Score 2 (NEWS2)[7] and handover communication using SBAR (Situation, Background, Assessment, Recommendation).[8] The researcher applied Donabedian's quality-of-care framework of structure, process, and outcome[9] to develop the system, together with the Department of Medical Services Home Isolation guideline[10] (revised 4 January 2022), adapted to the reclassification of COVID-19 as a communicable disease under surveillance from 1 October 2022. However, most studies have focused on respiratory clinics or COVID-19 care, and few have developed a system covering multiple communicable respiratory diseases in the inpatient departments of small community hospitals, which represents a knowledge gap. For example, the respiratory

infection care system developed at Pho Chai Hospital, Roi Et Province, was implemented in the emergency department and focused on severity triage using the SIRS criteria and SOS score, without covering inpatient care.[11]

As the epidemic has become less severe and controllable, there is an opportunity to develop a clear and sustainable care system for patients with communicable respiratory diseases in the inpatient department, so that patients receive correct, high-quality care and timely referral, and transmission to personnel, other patients, relatives, and visitors is prevented. The findings are expected to serve as a model for other community hospitals.

Conceptual framework The study applied Donabedian's quality-of-care framework: structure, comprising isolation areas and protective equipment; process, comprising the six-component system and the 8-week personnel competency development program; and outcome, comprising personnel knowledge and practice, as shown in Figure 1.

Figure 1 Conceptual framework and model of the care system for patients with communicable respiratory diseases in the inpatient department



Feedback from outcomes ⟶ continuous review and system improvement through the PDCA cycle

Donabedian's quality-of-care framework: Structure ⟶ Process ⟶ Outcome

Research Objectives

1. To examine the situation and problems in caring for patients with communicable respiratory diseases in the inpatient department of Namon Hospital
2. To develop a care system for patients with communicable respiratory diseases in the inpatient department of Namon Hospital
3. To evaluate the effects of the developed system on personnel knowledge and practice, comparing before and after implementation and between the experimental and control groups

Methods

This research and development study used a quasi-experimental two-group pretest–posttest design in the evaluation phase. It was conducted in the inpatient department of Namon Hospital, Kalasin Province, from January 2024 to December 2025 in four phases. Phase 1, situation and problem analysis (January–March 2024), comprised a review of medical records of patients with communicable respiratory diseases and incident reports from 2023, a focus group with 12 inpatient personnel, and interviews with 2 nursing administrators; quantitative data were analyzed using descriptive statistics and qualitative data using content analysis. Phase 2, system development and quality verification (April–September 2024), was carried out by a 9-member multidisciplinary team (1 physician, 5 registered nurses, 1 infection control nurse, 1 pharmacist, and 1 medical technologist) through two PDCA cycles. Phase 3 was system implementation: the experimental group attended an 8-week competency development program (October–November 2024), outcomes were measured after the program in week 9 (December 2024), and the system was used continuously until September 2025. Phase 4 was evaluation and conclusion (October–December 2025). Details are as follows.

Population

The population comprised 36 personnel providing patient care in the inpatient department of Namon Hospital, Kalasin Province, and 38 personnel providing patient care in the inpatient department of one 30-bed community hospital with a similar context in Kalasin Province in 2024. The control hospital was selected on the following criteria: a 30-bed community hospital in the same province with similar staffing and patient characteristics, no specific care system for patients with communicable respiratory diseases, and a location approximately 45 kilometers from Namon Hospital with no shared staff rotation, to prevent contamination of the intervention.

Sample

The sample size was calculated using G*Power for a two-tailed independent t-test with an effect size of 0.80, considered large according to Cohen's criteria,[12] a significance level of 0.05, and a power of 0.80, yielding 26 participants per group. With an additional 10% to allow for attrition, 29 participants per group were required, for a total of 58.[13] Purposive sampling was used: the experimental group consisted of inpatient personnel at Namon Hospital and the control group of personnel at the neighboring community hospital, with frequency matching by position and work experience. Of the 36 personnel in the experimental hospital, 4 did not meet the inclusion criteria (less than 6 months of work) and 3 declined to participate, resulting in a sample of 29.

Inclusion Criteria

1) Registered nurses, technical nurses, practical nurses, nursing assistants, or other personnel providing patient care in the inpatient department; 2) at least 6 months of work in the inpatient department; and 3) voluntary consent to participate in the study.

Exclusion Criteria

Personnel planning study leave or transfer during the study period were excluded. Discontinuation criteria were 1) study leave, sick leave, or transfer during the study; 2) participation in less than 80% of all activities (experimental group); and 3) withdrawal from the study. The number of discontinued participants was reported in the results.

Research Instruments

The instruments comprised 1) the experimental instrument, i.e., the care system for patients with communicable respiratory diseases in the inpatient department, consisting of patient screening and isolation, nursing practice guidelines, infection prevention and control, symptom monitoring and referral, patient and family education, and follow-up evaluation, together with an 8-week personnel competency development program; and 2) data collection instruments: (1) a demographic questionnaire; (2) a 20-item knowledge test (1 point for a correct answer, 0 for an incorrect answer); (3) a 10-item practice assessment rated by observation on a 5-point rating scale, with total scores of 10–50 and a score of ≥80% (40 points) indicating good practice; and (4) a personal protective equipment (PPE) donning and doffing demonstration checklist rated as pass/fail. Content validity was examined by 3 experts, yielding IOC values of 0.67–1.00 and a content validity index (CVI) of 0.92 (S-CVI/Ave). The instruments were tried out with 30 personnel who were not in the sample, yielding a Kuder–Richardson 20 (KR-20) coefficient of 0.81 for the knowledge test and a Cronbach's alpha of 0.86 for the practice assessment.

Data Collection

After obtaining ethics approval and permission from hospital administrators, the researcher explained the study objectives and obtained consent. Pretest data (week 0) were collected using the demographic questionnaire, knowledge test, and practice assessment. The experimental group participated in the program according to the developed system, whereas the control group continued routine practice and received the manual and program training after the study ended. Posttest data (week 9) were collected using the same instruments and the PPE demonstration checklist by infection control nurse assessors who had been briefed on the criteria and were unaware of participants' group

allocation. The assessors did not serve as coaches in week 7, and the forms used codes instead of names; however, because the two groups were in different hospitals, complete blinding was not possible.

Data Analysis

Demographic data were analyzed using descriptive statistics, including frequency, percentage, mean, and standard deviation. Within-group pretest and posttest mean scores were compared using the paired t-test, and between-group comparisons were made using the independent t-test and analysis of covariance (ANCOVA) adjusted for pretest scores, reporting mean differences, 95% CIs, and effect sizes (Cohen's d) after testing for normality and homogeneity of variance (Levene's test). Categorical variables were compared using Pearson's chi-square test or Fisher's exact test when expected frequencies were less than 5. Statistical significance was set at .05.

Ethical Considerations

This study complied with the principles of human research ethics and was approved by the Kalasin Provincial Public Health Office (No. KLS.REC 105/2566, dated 25 December 2023), with permission from the director of the control hospital. The researcher explained the objectives, procedures, and benefits of the study to the participants, who signed voluntary informed consent forms. Data were kept confidential and reported in aggregate, and participants could withdraw from the study at any time without any effect on their work.

Results

1. Situation and Problems in Caring for Patients with Communicable Respiratory Diseases in the Inpatient Department

1.1 General characteristics of the sample The 58 participants were divided into experimental and control groups of 29 each. Most were female (89.66% and 86.21%, respectively), with mean ages of 38.62±7.45 and 37.90±8.12 years; 41.38% and 44.83% were registered nurses, and mean work experience was 11.24±6.38 and 10.76±6.91 years, respectively. General characteristics did not differ between the groups ($p > 0.05$), including sex (Fisher's exact test, $p = 1.000$), age ($t = 0.35$, $p = 0.726$), proportion of registered nurses ($\chi^2 = 0.07$, $p = 0.791$), and work experience ($t = 0.27$, $p = 0.784$). No participants discontinued the study.

1.2 Situation and problems in the inpatient department Data on patients with communicable respiratory diseases in the inpatient department are presented in the Introduction. The situation analysis, based on medical record reviews, incident reports, and a focus group with 12 personnel analyzed using content analysis, identified five main problems: 1) inability to determine patients' risk levels in advance during screening; 2) potentially insufficient personal protective equipment; 3) limited staffing on some days; 4) a service area close to the general ward building, making isolation difficult; and 5) lack of awareness among patients and relatives of person-to-person transmission.

2. Development of the Care System for Patients with Communicable Respiratory Diseases in the Inpatient Department

2.1 The developed system The researcher and the 9-member multidisciplinary team worked through two PDCA cycles comprising briefing meetings and risk identification, development of nursing practice guidelines, personnel training, root cause analysis and correction, evaluation, and review for further improvement. Cycle 1 developed the practice guidelines and patient isolation flowchart; cycle 2 revised the screening form, added a PPE donning and doffing checklist, and revised the criteria for reporting to physicians based on NEWS2 scores. The resulting system consisted of six components: (1) screening and isolation of patients by risk level and color-coded symptom group (green, yellow, red) using isolation rooms or a cohort ward zone; (2) nursing practice guidelines from admission to discharge; (3) infection prevention and control, including risk-based PPE use, hand-washing stations, and patient toilets separate from staff; (4) monitoring of deterioration using NEWS2 and referral using SBAR; (5) patient and family education, discharge planning, and home care (Home Isolation); and (6) patient registry and follow-up evaluation (Figure 1), supported by an 8-week personnel competency development program, as shown in Table 1.

Table 1 Activities of the personnel competency development program based on the care system for patients with communicable respiratory diseases in the inpatient department

Week	Activities/Content	Tools	Duration	Rationale
1	Program orientation, pretest, and education on communicable respiratory diseases (COVID-19, influenza, pneumonia): transmission, symptoms, and treatment	Lecture slides, knowledge test, practice assessment	90 min	Baseline measurement for comparison and linking knowledge to participants' prior experience
2	Infection prevention and control: hand hygiene and PPE donning and doffing, with demonstration and simulation practice	Full PPE sets, PPE donning and doffing checklist	120 min	Standard, contact, droplet, and airborne precautions reduce transmission[5,6]

Week	Activities/Content	Tools	Duration	Rationale
3	Screening and isolation by risk level and color-coded symptom group, use of isolation rooms and cohort ward zones, and patient registry	Admission flowchart, zone signage, patient registry form	90 min	Risk-based isolation from admission reduces exposure of personnel and other patients[5,6]
4	Nursing practice guidelines from admission to discharge, monitoring with NEWS2, and oxygen therapy care	Nursing practice guidelines, NEWS2 record form	120 min	NEWS2 enables early detection of deterioration and timely referral decisions[7]
5	Referral of severely ill patients using SBAR, practiced with case studies	SBAR form, case studies	90 min	Structured communication ensures complete and rapid handover[8]
6	Patient and family education, discharge planning, and home care (Home Isolation)	Educational brochures, Home Isolation guideline	90 min	Patients and relatives practice correctly, reducing transmission to families and communities[10]
7	Supervised hands-on practice in the ward with coaching, observation, and feedback	Practice checklist; infection control nurse as coach	240 min	Learning from actual practice and feedback improves care processes[9]
8	After action review, lessons learned, posttest, and PPE demonstration assessment	Knowledge test, practice assessment, PPE demonstration checklist	120 min	Evaluation of system outcomes and review for continuous improvement through the PDCA cycle[9]

2.2 Quality verification of the system Three experts (1 physician, 1 infection control nurse, and 1 nursing instructor) assessed the appropriateness of the system, yielding IOC values of 0.67–1.00, and suggested revising the isolation flowchart and adding a PPE donning checklist. The researcher revised the system accordingly and piloted it with 10 patients for 2 weeks (July–August 2024) before full implementation. In the pilot, personnel completed the screening form and NEWS2

record in 90% of cases, no in-ward transmission occurred, redundant forms were reduced, and zone signage was made clearer.

3. Effects of the System on Personnel Knowledge and Practice

3.1 Within-group comparison before and after the intervention In the experimental group, the mean knowledge score increased from 11.45±2.18 to 17.62±1.55 and the mean practice score from 33.24±4.71 to 45.07±3.02, both statistically significant (p <0.001), whereas the control group showed no significant changes (p = 0.077 and 0.243, respectively). The mean differences in the experimental group were 6.17 points for knowledge (95% CI 5.40–6.94) and 11.83 points for practice (95% CI 10.19–13.47), as shown in Table 2.

Table 2 Comparison of mean knowledge and practice scores before and after system implementation by group

Variable	Group	Before		After		Level	$\bar{d}$	95%CI	t	p-value
		$\bar{x}$	S.D.	$\bar{x}$	S.D.					
Knowledge (full score 20)	Exp.	11.45	2.18	17.62	1.55	Good	6.17	5.40–6.94	16.38	<0.001*
Knowledge (full score 20)	Control	11.28	2.34	12.14	2.27	Mod.	0.86	−0.10–1.82	1.83	0.077
Practice (full score 50)	Exp.	33.24	4.71	45.07	3.02	Good	11.83	10.19–13.47	14.81	<0.001*
Practice (full score 50)	Control	33.69	4.88	34.83	4.51	Mod.	1.14	−0.82–3.10	1.19	0.243

*Statistically significant at p-value <.05; Exp. = experimental; Mod. = moderate

3.2 Comparison between the experimental and control groups Before the intervention, knowledge and practice scores did not differ between the groups (p = 0.776 and 0.722, respectively). After the intervention, the experimental group had significantly higher knowledge and practice scores than the control group (p <0.001), with posttest differences of 5.48 points for knowledge (95% CI 4.46–6.50; Cohen's d = 2.82) and 10.24 points for practice (95% CI 8.22–12.26; d = 2.67). In the analysis of covariance adjusted for pretest scores, the experimental group still had higher knowledge (adjusted mean difference 5.41, 95% CI 4.50–6.33; F(1,55) = 140.88, p <0.001, partial η^2 = 0.72) and practice scores (adjusted mean difference 10.40, 95% CI 8.60–12.21; F(1,55) = 133.25, p <0.001, partial η^2 = 0.71) than the control group, as shown in Table 3.

Table 3 Comparison of mean knowledge and practice scores between the experimental and control groups

Variable	Experimental group		Control group		Level	$\bar{d}$	95%CI	t	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.					
Knowledge, before (full score 20)	11.45	2.18	11.28	2.34	Low / Low	0.17	−1.02–1.36	0.29	0.776

Variable	Experimental group		Control group		Level	$\bar{d}$	95%CI	t	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.					
Knowledge, after (full score 20)	17.62	1.55	12.14	2.27	Good / Mod.	5.48	4.46–6.50	10.74	<0.001*
Practice, before (full score 50)	33.24	4.71	33.69	4.88	Mod. / Mod.	−0.45	−2.97–2.07	−0.36	0.722
Practice, after (full score 50)	45.07	3.02	34.83	4.51	Good / Mod.	10.24	8.22–12.26	10.16	<0.001*

*Statistically significant at p-value <.05; Mod. = moderate

3.3 Good practice and PPE demonstration results After the intervention, 96.55% of the experimental group demonstrated good practice compared with 20.69% of the control group (χ^2 = 34.40, p <0.001), and 93.10% passed the PPE demonstration compared with 55.17% (χ^2 = 10.88, p = 0.001), as shown in Table 4. During the 10-month follow-up (December 2024–September 2025), no occupational respiratory infections occurred among personnel in the experimental group, whereas 3 cases (10.34%) occurred in the control group; the difference was not statistically significant (Fisher's exact test, p = 0.237). Occupational infection was defined as a laboratory-confirmed respiratory infection in a staff member within 14 days of exposure to an infected patient at work, with no history of exposure to infected persons outside work, monitored through reports from the infection prevention and control and occupational health units of both hospitals.

Table 4 Comparison of good practice and PPE demonstration results after the intervention between the experimental and control groups

Variable/Status	Experimental group n (%)	Control group n (%)	χ^2	p-value
Overall practice after intervention: good (≥40 points)	28 (96.55)	6 (20.69)	34.40	<0.001*
Moderate or low (<40 points)	1 (3.45)	23 (79.31)		
PPE donning and doffing demonstration: pass	27 (93.10)	16 (55.17)	**10.88**	**0.001***
Fail	2 (6.90)	13 (44.83)		

*Statistically significant at p-value <.05

Discussion

Regarding the first objective, the problems identified in the inpatient department included screening without prior knowledge of risk levels, insufficient personal protective equipment, limited staffing, and a service area close to the general ward building that made isolation difficult. These reflect the context of a 30-bed community hospital that admits patients with all conditions in the same area. Analyzing problems across structure, process, and outcome according to Donabedian's framework was therefore appropriate for system development[9] and consistent with internationally recommended principles of patient isolation and transmission prevention.[5,6]

Regarding the second objective, the developed system comprised six interconnected components, ranging from patient screening and isolation, nursing practice guidelines, infection prevention and control, symptom monitoring with NEWS2, and referral with SBAR to education and discharge planning.[6,7,8] The system was built through multidisciplinary participation using the PDCA cycle, adapted to the limited resources of a community hospital, and verified by experts (IOC 0.67–1.00) and a pilot test before implementation, which may have facilitated its acceptance and adoption by personnel.

Regarding the third objective, after implementation, the experimental group had significantly higher knowledge and practice scores than before the intervention and than the control group ($p < 0.001$), whereas the control group showed no significant change. This may be explained by the program's combination of lectures, demonstrations, simulations, and supervised hands-on practice with coaching and feedback, which enabled personnel to understand and apply infection prevention principles more accurately.[5,6] The PPE demonstration results are consistent with a Cochrane systematic review showing that face-to-face training, simulation, and video-based training reduce doffing errors more than written materials or lectures alone,[14] and with a study at Phon Thong Hospital, Roi Et Province, in which a nursing model comprising knowledge and competency development, nursing practice guidelines, and supervision significantly increased registered nurses' knowledge and practice scores for preventing transmission.[15] However, the very large effect sizes (Cohen's d >2.5) may have been influenced by a ceiling effect of the knowledge test, the use of the same test within 9 weeks, and differences between hospitals, and should therefore be interpreted with caution.

Limitations of this study include the lack of random sampling; the control group came from a different hospital, so not all confounding variables could be controlled; the sample size was small; and patient outcomes were not analyzed inferentially. In addition, there was only one hospital per group, so the effects of the system may be confounded with between-hospital differences; blinding of assessors was limited; and knowledge and practice were not re-measured during follow-up.

Conclusion

The care system for patients with communicable respiratory diseases in the inpatient department of Namon Hospital comprised six components: patient screening and isolation, nursing practice guidelines, infection prevention and control, symptom monitoring and referral, patient and family education, and follow-up evaluation. After implementation, the experimental group's knowledge and practice

scores increased and were significantly higher than those of the control group ($p < 0.001$), with good practice in 96.55% versus 20.69% and PPE demonstration pass rates of 93.10% versus 55.17%.

Recommendations

1. Recommendations for applying the findings Inpatient departments of community hospitals may adopt the six-component system and 8-week program, emphasizing PPE donning and doffing demonstrations and supervised ward-based practice with coaching. In addition, isolation areas and dedicated patient equipment, such as vital sign monitors, should be provided; personnel should attend regular refresher training; and updates from the Department of Disease Control and the Ministry of Public Health should be followed to keep guidelines current.

2. Recommendations for future research Future studies should examine patient outcomes, such as satisfaction, referral time, length of hospital stay, and mortality; use randomized designs with long-term follow-up across multiple community hospitals; and use designs suited to unit-level interventions, such as cluster randomized trials involving several hospitals.

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