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Generalist Versus Specialist Nurses' Knowledge, Attitudes, and Behavioral Intentions Toward Promoting Pulmonary Rehabilitation for Patients with Chronic Obstructive Pulmonary Disease: A Cross-Sectional Correlational Study

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Generalist versus specialist nurses' knowledge, attitudes, and behavioral intentions toward promoting pulmonary rehabilitation for patients with chronic obstructive pulmonary disease

A cross-sectional correlational study

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Abstract

Pulmonary rehabilitation (PR) is an effective strategy to manage chronic obstructive pulmonary disease (COPD), though its utilization rate is low. One reason for this low utilization rate is that nurses do not provide COPD patients with enough health education to increase the patient's motivation for PR participation. This study examined knowledge, attitudes, and behavioral intention toward PR promotion. The study also investigated the correlates of behavioral intentions to promote PR among pulmonary nurses.

A cross-sectional correlational design was used. Overall, 284 nurses (all women) from chest medicine and general internal medicine wards in 3 hospitals within Midwest Taiwan were recruited. Data were collected by anonymous, self-administered questionnaires. We aimed to understand if there would be differences in the Chest Medicine and Generalist nurses on these outcomes, given the specialty versus generalist nature of their practice. Results were analyzed using multiple linear regressions.

Although the 2 groups of nurses (ie, Chest Medicine, General Medicine) showed no differences in PR knowledge, attitudes, or behavioral intentions, they lacked sufficient PR knowledge and skills. The accuracy rate of PR knowledge was approximately 12% and self-evaluated PR skills were less than 50%. Self-efficacy in promoting PR was above average (ie, 57%–60%), and the strength of attitudes and behavioral intentions was over 70%. A multiple linear regression revealed that behavioral intentions of nurses working in the chest medicine ward were influenced by behavioral attitudes, and also PR skills and self-efficacy (explanatory power 33.3%).

Attitudes, skills, and self-efficacy heavily affected pulmonary nurses' ability to promote PR; however, PR knowledge and skills remain low. Therefore, future implementation of practical PR training courses is needed to strengthen nurses' behavioral intentions toward PR promotion.

Improved pulmonary rehabilitation-related skill, attitudes, clinical experience of PR programs, and/or practical PR training are needed among both generalist and specialist nurses. Education courses and clinical practice training should be increased in the future to promote pulmonary rehabilitation of COPD patients.

Abbreviations: AECOPD = acute exacerbation of chronic obstructive pulmonary disease, BCKQ = Bristol COPD Knowledge Questionnaire, CMW = chest medicine wards, COPD = chronic obstructive pulmonary disease, CVI = content validity index, GIMW = general internal medicine wards, GOLD = Global Initiative for Chronic Obstructive Lung Disease, PCPs = primary care physicians, PR = pulmonary rehabilitation, S-CVI = scale-level content validity, SD = standard deviation.

Keywords: attitudes, behavioral intention, chronic lung disease, knowledge, nurses, pulmonary rehabilitation

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1. Introduction

In 2012, chronic obstructive pulmonary disease (COPD) was the fourth leading cause of death and the fifth leading cause of disability worldwide.[1] In Taiwan, COPD was the seventh leading cause of death in 2015.[2] COPD is a global health issue that creates substantial medical burden.[3] This disease is characterized by dyspnea and inactivity, resulting in an irreversible decline in lung functioning.[4] The treatment goal is to provide patients with support and tools for self-management.[5] Without proper treatment, individuals with COPD may develop other adverse physical and psychological outcomes including skeletal muscle dysfunction, secondary polycythemia, pulmonary hypertension, systemic inflammation, anxiety disorders, and depression.[6–8]

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) recommends pulmonary rehabilitation (PR) as the standard treatment for patients with moderate-to-severe COPD.[4] PR is a comprehensive intervention based on a thorough patient assessment followed by tailored therapies. These tailored therapies include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and emotional condition of people with chronic respiratory disease and to promote long-term adherence to health-enhancing behaviors.[9] PR may be a good strategy to manage COPD effectively, which relieves dyspnea, improves exercise tolerance, and improves quality of life.[4,5,9–12] In addition, PR can decrease medical burden.[13]

The main source of patient engagement in PR programs is referral by physicians or other health professionals, including nurses. Despite the profound impact that PR programs can make in patient outcomes, these programs are seldom promoted in hospitals. For instance, a study in Australia reported that 10 of 12 physicians never referred patients to PR; the major reasons for physicians not making referrals were insufficient knowledge of PR, being unfamiliar with referring procedures, anticipated access difficulties for patients, and being unclear about PR's benefits.[14] Another study in Taiwan found that nurses did not give COPD patients enough health education to increase patient motivation and action toward PR participation.[15] In addition, a survey of 999 primary care physicians (PCPs) in 10 cities of Mexico found that, although 72.5% of PCPs knew about the GOLD guidelines, only 34.1% of PCPs applied these guidelines into clinical practice.[16] In an Australian medical chart review study, although medical professionals endorsed complying with GOLD guidelines, the PR referral rate of in-patients with acute exacerbation of COPD (AECOPD) was only 16%.[17] Further, a prospective study in England with 286 patients with AECOPD who qualified for a PR program revealed a referral rate of 31%, with only 9.6% completing the program.[18] Another study in Taiwan found that among 58 patients with AECOPD who qualified for a PR program, 57% was willing to participate; however, only 37.9% completed the PR program.[15]

Underutilization of PR by COPD patients, whether due to low referral, attendance, or adherence, is a global issue. PR promotion should be improved through professional training, including enhancing health professionals' PR-related knowledge and familiarity with referral procedures.[17] As 1 of the main providers of patient education, nurses are well-situated to make referrals to PR for qualified patients. Therefore, this study explored nurses' PR-related knowledge, attitudes, and behavioral intentions toward PR promotion, and investigated the obstacles to providing PR promotion. We aimed to understand if there would be differences in the Chest Medicine and Generalist nurses on the outcomes, given the specialty versus generalist nature of their practice. Our findings may provide a reference for promoting PR in clinical practice and a framework for future research and school curricula.

2. Methods

2.1. Design and sampling

A cross-sectional, correlational design was used to understand nurses' knowledge, attitudes, and behavioral intentions towards PR promotion. Nurses who work in Chest Medicine units have more exposure and experience working with patients with COPD. Those in General Internal Medicine see a wide variety of patients, and therefore would be less likely to be aware of the needs of COPD patients. In addition, To understand the effects of in-service training—specifically, hospital-level pulmonary rehabilitation—we not only collected data from specialist nurses working in the chest medicine wards (CMWs), but also nurses working in general internal medicine wards (GIMWs). This study used structured, self-administered questionnaires with a convenience sample of 284 participants at 3 hospitals in Midwest Taiwan. Inclusion criteria were: certified, practicing nurses; working in Internal Medical wards including CMWs; and having worked as an Internal Medical ward nurse for more than 3 months. The minimum sample size was obtained to have 80% power to yield significant results, with a medium effect size of $f^2 = 0.15$, and an alpha level of 0.05.[19]

In this study, 416 nurses from Internal Medicine wards were contacted, and 356 met the inclusion criteria. After the exclusion of participants with missing data (n = 16), 284 participants were included in final data analyses. However, there were no significant differences in demographic characteristics between the participants who have missing data (n = 16) and those who have not missing data (n = 284) from the study.

2.2. Ethical and research approvals

This study was approved by the Institutional Review Board of Chang Gung Medical Foundation (number 101–3088C). Potential participants were informed of its purposes, benefits, risks, and their voluntary participation would remain anonymous and confidential. They were also reassured that they could terminate at any time. Those who agreed to participate provided written consent. All instruments were self-administered, placed into an opaque envelope after completion, and sealed.

2.3. Measures

Instruments included: a structured demographic questionnaire; the Bristol COPD Knowledge Questionnaire (BCKQ); PR-related questionnaires including PR knowledge, skills, attitudes, and behavioral intention toward PR promotion; and self-efficacy in promoting PR. The demographic information sheet was used to assess age, education level, working years, working years in chest-related areas, nursing classification, PR training, and PR experience. The validity of all instruments, except for BCKQ, was examined using content validity index (CVI). CVI is based on expert ratings of relevance and is also the most widely used index in quantitative studies.[20] Compared with item-CVI, we used the overall scale-level content validity (S-CVI). The S-CVI is the proportion of items on an instrument that achieved a rating of

3 or 4 by all the content experts.[20] Good validity is based on a S-CVI value of 0.80 or greater. A Cronbach alpha—the internal consistency reliability of the instruments—between 0.70 and 0.80 implies acceptability, and a good reliability is Cronbach alpha 0.80 to 0.90.[21,22]

2.3.1. Bristol COPD Knowledge Questionnaire. The BCKQ, which was developed by White et al,[23] was used to assess participants' COPD knowledge and examine the effectiveness of patient health education. The BCKQ consists of 65 items related to the cause and nature of the condition, symptoms, prevention and management (ie, epidemiology, etiology, symptoms, breathlessness, phlegm, infections, exercise, smoking, vaccination, inhaled bronchodilators, antibiotics, oral steroids, inhaled steroids, etc).[23] The responses were coded as follows: "correct" responses were coded as "1," and both "incorrect" and "I do not know" responses were coded as "0." The possible scores ranged from 0 to 65, with higher scores indicating better COPD knowledge. The questionnaire was judged by COPD patients and professional healthcare providers (respiratory consultants, general practitioners, respiratory nurses, respiratory physiotherapists) to have good content and face validity. In White et al's[23] study, the Cronbach alpha and test–retest reliability were 0.73 and 0.71, respectively.[23] In this study, the Cronbach alpha was 0.89.

2.3.2. Knowledge of PR and PR skill. Pulmonary rehabilitation-related knowledge and PR skill were examined using 8 and 6-item questionnaires, respectively, which were developed by the research team, based on previous PR studies.[24] Possible scores of PR-related knowledge ranged from 0 to 8; higher scores indicated a greater knowledge of PR. The Cronbach alpha was 0.73 and the S-CVI was 0.90. Possible scores of PR skill ranged from 0 to 30; higher scores indicated greater skill. The Cronbach alpha was 0.92 and the total S-CVI was 0.91.

2.3.3. Attitude toward PR. As in previous PR studies,[25,26] a 9-item questionnaire was used to assess nurses' agreement concerning the importance of PR. The questionnaire was measured using a 5-point Likert scale: 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). Possible scores ranged from 0 to 45. A higher score indicated that the nurses more positively perceived the importance of a PR program. The Cronbach alpha for reliability was 0.81 and for total S-CVI was 0.87.

2.3.4. Behavioral intention. Two items were used to assess behavioral intentions toward PR promotion, with scores ranging from 0 to 10. A 5-point Likert scale was used to determine participants' willingness to promote COPD patients' involvement in a PR program: 1 (strongly disagree) to 5 (strongly agree). A higher score represented more positive behavioral intentions toward PR promotion. The Cronbach alpha was 0.88 and total S-CVI was 0.83

2.3.5. Self-efficacy. A questionnaire was used to assess nurses' confidence levels (self-efficacy) in encouraging COPD patients to participate in the PR program. It consisted of 4 items, and the score ranged from 0 to 400. A higher score indicated greater self-efficacy of nurses in encouraging COPD patients to participate in the PR program. The Cronbach alpha was 0.97 and total S-CVI was 0.88.

2.4. Statistical analyses

The data were analyzed using frequency distributions and descriptive statistics. Before performing regression analyses, a 1-way analysis of variance, *t* tests, and Pearson correlations were used to analyze the relationships among variables. A 2-step model building procedure was used to determine variables to include in assessing correlates of behavioral intentions to promote PR in a multivariate regression model. In the first step, univariate regression analyses were conducted to determine the unadjusted associations between behavioral intentions to promote PR and knowledge, attitude toward PR, self-efficacy, and potential confounders (age, working-years in chest area, education level, nursing classification, PR training, PR experience). In the second step, as recommended by Hosmer et al,[27] only variables that were associated with behavioral intentions to promote PR at $P < .25$ were included in the multivariate model. A $P < .05$ was considered statistically significant. All analyses were performed using SPSS software version 22.0 (IBM Corp., Armonk, NY).

3. Results

Questionnaires were distributed to 356 nurses who met the inclusive criteria, and 300 participants were initially included (response rate 84.27%). Sixteen participants were excluded due to missing information; therefore, 284 valid questionnaires were included for data analysis (Fig. 1).

3.1. Nurses' demographic characteristics

Participants (n = 284) comprised nurses from CMWs (n = 93) and GIMWs (n = 191) from 3 hospitals in Midwest Taiwan. All participants were women with a mean age of 28.47 ± 5.66 (mean ± standard deviation [SD]) and 27.72 ± 4.95 years (mean ± SD), respectively, and mean working-years of 5.34 ± 4.41 (mean ± SD) and 5.05 ± 4.38 (mean ± SD), respectively. Most of these participants had completed a college degree, level 2 of their clinical nursing classification, and had never received PR training or PR clinical training in practice (Table 1). As compared with GIMW nurses, CMW nurses had a greater seniority of working experience (4.77 ± 3.55 vs 1.22 ± 2.58 years; $P < .001$) and were more likely to have received PR training (32.3% vs 16.2%; $P = .002$). Detailed information is shown in Table 1.

3.2. The importance of PR programs and the current PR promotion situation

The majority (87.1% of CMWs; 90.9% of GIMWs) of participants agreed that PR is important, helpful, can be used in daily life, improved performance of self-care management, and was strongly recommended for attendance and implementation for patients with COPD. However, only 18.6% (GIMW) to 29.1% (CMW) of study participants actively promoted PR, with 17.0% (GIMW) to 25.8% (CMW) of them reporting having the extra energy needed to deal with PR problems. The possible reasons may be due to insufficient time and PR-related knowledge among nurses; however, further research is needed. In this study, low ratios among the 2 groups (13.2% of CMWs and 7.4% of GIMWs) reported having extra time to provide PR-related health education for patients with COPD. For attitudes toward PR, nurses considered that some things are more important than providing PR-related health education for patients with COPD, such as providing medication (38.7% [CMW] to 48.9% [GIMW]). Only 13.3% (GIMW) to 18.3% (CMW) of nurses acknowledged that PR-related health education is the most important for patients with COPD.

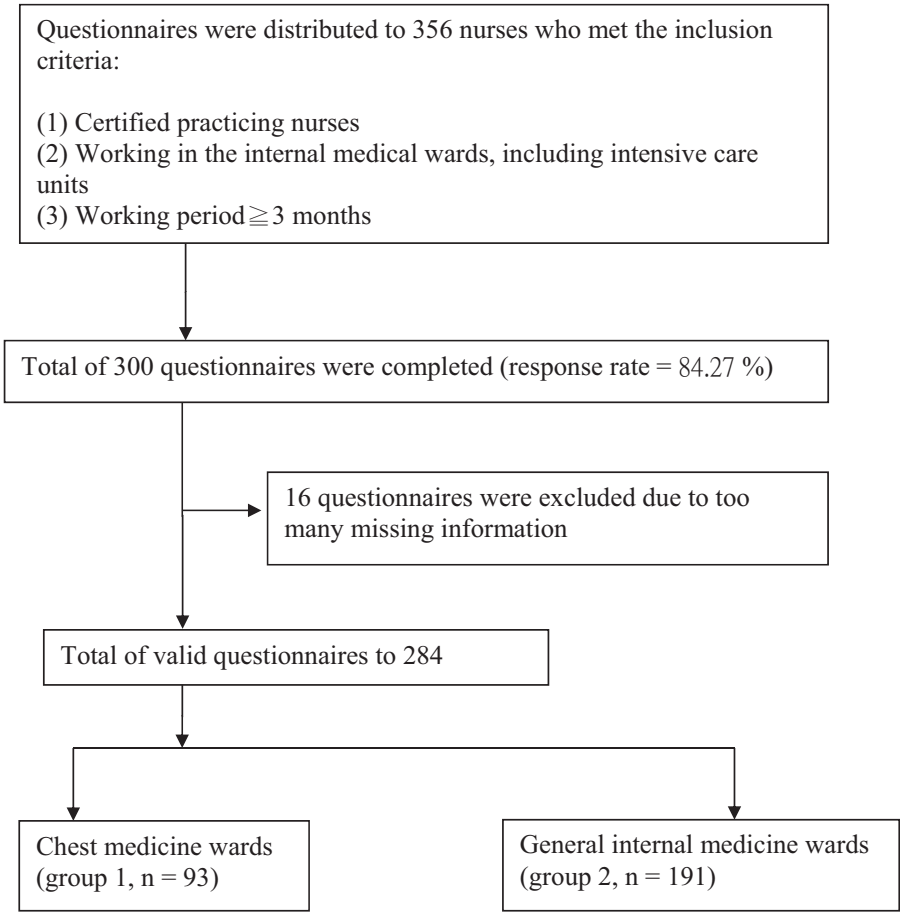

Figure 1. Flow chart diagram of this study.

Table 1

Characteristics of 2 groups (n=284).

Characteristics	Chest medicine ward (CMW group), group 1 (n=93) Mean±SD	General internal medicine ward (GIMW group), group 2 (n=191) Mean±SD	*t*	*P*
Age, y	28.47±5.66	27.72±4.95	1.142	.254
Working years	5.34±4.41	5.05±4.38	0.521	.603
Working years in chest area	4.77±3.55	1.12±2.58	7.603	<.001
	n (%)	**n (%)**	χ^2	***P***
Education level			1.028	.311
<College/university	25 (26.9)	41 (21.5)		
≧College/university	68 (73.1)	150 (78.5)		
Nursing classification			0.151	.985
N0	23 (24.7)	44 (23.2)		
N1	26 (28.0)	55 (28.9)		
N2	34 (36.6)	72 (37.9)		
N3+N4	10 (10.8)	19 (10.0)		
PR training			9.527	.002
No	63 (67.7)	160 (83.8)		
Yes	30 (32.3)	31 (16.2)		
PR experience			1.717	.335
No	90 (96.8)	189 (99.0)		
Yes	3 (3.2)	2 (1.0)		

Data represented as mean±SD or n (%).

N0 to N4 is the ladder of the nursing classification system in Taiwan. Generally speaking, levels N0, N1, and N2 are the beginning nurse, and N3 and N4 are senior nurses.

PR=pulmonary rehabilitation, SD=standard deviation.

Table 2

Summary of score distribution on knowledge about COPD, PR-related knowledge, PR skills, attitude toward and behavioral intention of PR promotion, and self-efficacy in two groups (n = 284).

	CMW group (n = 93)			GIMW group (n = 191)		
Variable	Mean	Total score	Mean/total score (%)	Mean	Total score	Mean/total score (%)
Knowledge about COPD	39.79	65	61.20	38.17	65	58.72
PR-related knowledge	0.96	8	12.00	0.97	8	12.10
PR skill	14.76	30	49.20	12.95	30	43.16
Attitude toward PR	33.52	45	74.48	33.95	45	75.44
Self-efficacy	251.80	400	62.95	230.24	400	57.56
Behavioral intention	7.49	10	74.90	7.58	10	75.80

Data represented as mean or (%).

CMW = chest medicine ward, COPD = chronic obstructive pulmonary disease, GIMW = general internal medicine ward, PR = pulmonary rehabilitation.

3.3. COPD and PR-related knowledge, PR skills, attitude toward PR, self-efficacy, and behavioral intentions to promote PR

Table 2 displays the means; the percentage of total score; possible range in COPD and PR-related knowledge, PR skills, self-efficacy, and attitude toward and behavioral intentions toward PR promotion among the 2 groups. There were significant differences in COPD-related knowledge ($P = .015$), PR skills ($P < .001$), and self-efficacy ($P = .021$) between CMW and GIMW nurses. However, there were no significant differences in PR-related knowledge, attitudes toward PR promotion, or behavioral intentions toward PR promotion between the 2 groups (see Table 3).

3.4. Factors associated with behavioral intentions to promote PR

The behavioral intention towards PR promotion was associated with attitudes toward PR for pulmonary nurses. At first, there were significant relationships between behavioral intentions of PR promotion and PR-related knowledge, attitudes toward PR, PR skills or self-efficacy (data not shown). After controlling for those potential confounders (working-years in chest area, nursing classification, PR training, or PR experiences for pulmonary nurses; $P < .25$), attitude towards PR was a vital factor of behavioral intentions to promote PR. In addition, PR skills and self-efficacy still were significant correlates of behavioral intention. The total model explained 33.3% ($F = 4.612$, $P < .001$) of the variance in pulmonary nurses' behavioral intentions to promote PR (Table 4).

4. Discussion

There were no significant differences in self-efficacy or PR-related knowledge, attitudes, and behavioral intentions toward PR promotion among the generalist and specialist nurses. Compared with GIMW nurses, CMW nurses displayed greater knowledge about COPD and PR skills. Hoyer et al[28] investigated the associations among exercise barriers, knowledge, attitudes, and practice between 82 nurses and 38 rehabilitation therapists in the United States. Hoyer et al[28] found that knowledge and attitude were associated with clinical experiences, but not working years, which is similar to the findings of our study. In addition, rehabilitation therapists, compared with nurses, had greater knowledge, attitudes, and behavioral intention. This finding suggests the need for additional training or exposure of nurses to PR to enhance their experience.

It is important to note that pulmonary nurses had more opportunities to contact COPD patients; however, PR-related knowledge, attitudes toward PR, behavioral intentions, and self-efficacy among pulmonary nurses were no better than they were in other groups. Moreover, although the seniority of working experience in the chest medicine area in CMW nurses was 4.26 times higher than it was in GIMW nurses, and even though the ratio of receiving PR training in CMW (32%) was 2 times higher

Table 3

The differences of knowledge about COPD, PR-related knowledge, PR skills, attitude toward PR, self-efficacy, and behavioral intention in 2 groups (n = 284).

	Chest medicine ward (CMW) group (n = 93)	General internal medicine ward (GIMW) group (n = 191)		
Variable	Mean ± SD	Mean ± SD	*t*	*P*
Knowledge about COPD*	39.79 ± 4.94	38.17 ± 5.15	2.450	.015
PR-related knowledge†	0.96 ± 0.94	0.97 ± 0.97	−0.138	.890
PR skill‡	14.76 ± 3.47	12.95 ± 3.45	4.113	.000
Attitude toward PR§	33.52 ± 3.53	33.95 ± 3.59	−0.937	.350
Self-efficacy‖	251.80 ± 72.16	230.24 ± 73.31	2.319	.021
Behavioral intention¶	7.49 ± 1.08	7.58 ± 1.24	−0.522	.602

Data represented as mean ± SD.

CMW = chest medicine ward, COPD = chronic obstructive pulmonary disease, GIMW = general internal medicine ward, PR = pulmonary rehabilitation, SD = standard deviation.

* Possible scores range from 0 to 65, higher scores indicate greater knowledge of COPD.

† Possible scores range from 0 to 8, higher scores indicate greater knowledge of PR.

‡ Total scores range from 0 to 30, higher scores indicate greater PR skills.

§ Possible scores range from 0 to 45, higher scores indicate greater attitude toward PR.

‖ Possible scores range from 0 to 400, higher scores indicate greater confident to provide pulmonary rehabilitation.

¶ Possible scores range from 0 to 10, higher score represent more positive behavioral intentions toward PR promotion.

Table 4

Summary results of the multiple regression analyses for evaluating behavior intention of PR promotion among nurses in the chest medicine wards (n = 93).

Variable	Standard error (SE)	Standardized coefficients (β)	*P*
Working years	0.052	0.138	.344
Nursing classification system (N0, N1, N2, N3, N4)	0.176	0.190	.213
PR training			
No (reference)	—	—	
Yes	0.276	−0.028	.211
PR experience			
No (reference)	—	—	
Yes	0.686	0.249	.051
Knowledge about COPD	0.027	−0.221	.060
PR-related knowledge	0.131	0.137	.201
PR skill	0.041	−0.290	.019
Attitude toward PR	0.038	0.460	<.001
Self-efficacy	0.002	0.230	.038

COPD = chronic obstructive pulmonary disease, PR = pulmonary rehabilitation.

than in GIMW (16%), PR-related knowledge and skills among pulmonary nurses may still not be adequate. This indicates that clinical training courses concerning PR should focus more on clinical performance. For example, it is possible to introduce more simulation-based learning experiences for nursing students and new nurses to improve their knowledge and confidence with PR.

Pulmonary rehabilitation-related knowledge and skills were lower than 15.0% and 50.0% of total scores, respectively; knowledge about COPD and self-efficacy were both approximately 60%; and attitudes toward PR and behavioral intentions toward PR promotion were higher than 70%. Moreover, only 29.1% of pulmonary nurses would actively promote PR and 8.3% of them acknowledged that PR-related health education is the most important for patients with COPD. These outcomes represent the insufficiency of PR-related knowledge and skills among nurses, particularly pulmonary nurses. A possible reason is that Taiwanese nurses do not treat PR as a primary responsibility because PR programs are led by respiratory therapists in Taiwan. However, insufficient knowledge concerning PR among nurses might affect patient participation in PR programs[17] because nurses are the frontline healthcare providers who spend vast amounts of time with COPD patients in clinical settings. Educational courses and clinical practice training should be increased in the future to improve pulmonary nurses' knowledge and skills to promote PR participation among patients with COPD.

Regarding attitudes toward PR promotion, most participants acknowledged the importance of PR in patients with COPD (>86%). Behavioral intentions towards PR promotion results indicated that most of the participants encouraged patients with COPD to attend a PR program (>72%). Our findings are consistent with those of an Australian qualitative study of 31 medical personnel, which explored the barriers to provide care plans for patients with COPD based on PR-related experience, PR training, and self-efficacy before receiving respiratory and walking training.[26] In this study, Johnston et al[29] found that 68% of medical personnel had never received PR training, and that the percentage of total score in COPD-related knowledge was greater than it was for PR-related knowledge; however, 77% of participants acknowledged the importance of PR.[29] This finding presents an opportunity to further explore ways to equip nurses to encourage patients to attend PR. For example, motivational interviewing techniques may be important to enhance motivation, engagement, and adherence in pulmonary rehabilitation.[30]

Using a multiple regression analysis, our study found that PR skill, attitudes, and self-efficacy were correlates of behavioral intentions toward PR promotion among pulmonary nurses. PR skill was significantly associated with PR clinical performance, but not with PR training. This finding is similar to that of Roha et al,[31] who found that simulation with clinical performance can improve knowledge, skill, and self-efficacy. A survey of 180 nurses who received social psychology care training for patients with tumors reported that the training courses and clinical experience could improve their knowledge, attitude, and abilities.[32] Combined, these results suggest that PR training with clinical practice may improve knowledge of PR, which may affect the performance of PR implementation.

Nevertheless, considering the results of this study, whether an individual received PR training or PR practice, or whether an individual possessed PR-related knowledge did not necessarily predict behavioral intention toward PR promotion. Counter to expectations, enhancement of PR skill level displayed an inverse association with levels of behavioral intention and attitude. This is possibly due to nurses with greater PR skills being senior nurses with no time to promote PR. As mentioned previously, less than 15% of participants (13.2% of CMWs and 7.4% of GIMWs, respectively) reported extra time to provide PR-related health education to patients with COPD and less than 26% (25.8% of CMWs and 17.0% of GIMWs, respectively) reported having extra energy required to deal with PR problems. Additionally, the 2 groups of nurses did not show significant differences in whether they participated in previous PR training or not. A possible reason for this is that the contents of previous PR training programs did not meet the need of pulmonary nurses. Based on the analyses above, one can estimate that there might be a mediating factor among PR skill, attitudes, and behavioral intention, and that this mediating variable likely relates to the content of PR training in practice. Another possible reason is that PR training programs are not typically combined with clinical experience within clinical PR practice courses. Hence, more studies are needed to determine the best ways to provide PR training in practice for nurses.

Our study has some limitations. First, the sample was limited to Midwest Taiwan; therefore, the results may not be generalizable

to pulmonary nurses in other hospitals. Second, this study utilized a cross-sectional design; therefore, we can only analyze the current PR condition in Taiwan with no ability to infer causality. Moreover, the results obtained are limited by the closed-ended nature of the questionnaire. Future studies should include open-ended questions or use a qualitative method to obtain more in-depth information about their experiences of and barriers to promoting PR.

5. Conclusions

To the best of our knowledge, this is the first study to investigate nurses' knowledge, attitudes, and behavioral intentions toward promoting PR. Although Taiwanese nurses who work in GIMWs generally lack COPD knowledge and PR-related knowledge and skills, their attitudes and behavioral intention toward encouraging patients to implement PR was well-represented. Interestingly, although nurses in the CMWs had previous PR training and enhanced PR skills, this enhancement was not associated with increased attitudes and behavioral intentions toward PR promotion. Consequently, we suggest that the future design of PR practical training requires enhancement. A PR practical-training program should include education and a workshop component. In this workshop, nurses with extensive experience can guide inexperienced nurses by sharing their knowledge and skills, and this may increase the advocacy for PR skills.[27,31]

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Author contributions

SEG and HTH substantially contributed to conception and design. SEG, YCL, KDT, and MSL contributed to data collection. SEG and HCS contributed toward data analysis. All authors contributed toward drafting and critically revising the paper and agreed to be accountable for all aspects of the work.

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Writing – review & editing: Su-Er Guo, Hsueh-Chen Shen, Chizimuzo Okoli, Yen-Chi Liao, Kuen-Daw Tsai, Hsin-Tien Hsu.

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