Original Article

Reliability and validity of the Taiwanese version of the collaborative practice assessment tool: A pilot study

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ABSTRACT

Objectives: To promote teamwork communication and collaboration between health-care professionals, educators emphasized proper training programs to develop interprofessional collaborative practice (IPCP) among postgraduate (PG) trainees. A literature review indicated that the faculty necessarily measured the competency in IPCP with structured and applicable assessment tools in collocation to training programs domestically. A cross-sectional psychometric study was conducted to construct a reliable assessment tool for measuring PG learning outcome in Taiwan through a bidirectional translation. The study aimed to assess the interprofessional team behavior of trainees using the Taiwanese version of the collaborative practice assessment tool (T-CPAT). **Materials and Methods:** The study recruited 43 participants to undergo a PG training program in a single institute and to complete T-CPAT. Data were analyzed using SPSS 22.0 software. We employed descriptive analysis of demographic variables. The validity of T-CPAT was analyzed by experts in different specialties and its availability was assessed by item-level analysis. Furthermore, the T-CPAT reliability was tested using Cronbach's α. **Results:** The average score was 305.2 (standard deviation = 38.08), and the expert validity of the T-CPAT was 0.96. In the item-level analysis, there were no failure items in T-CAPT. Cronbach's α reached 0.94 (95% confidence interval = 0.90–0.96). **Conclusion:** The study demonstrated good reliability and validity for the T-CPAT. Thus, the T-CPAT can be used to accurately measure and assess the competence of IPCP in PG trainees in general medicine in Taiwan. The results were deemed sufficient to provide faculties with related arrangements for future teaching plans.

KEYWORDS: *Collaborative practice, Interprofessional, Postgraduate year training, Taiwanese version–collaborative practice assessment tool*

INTRODUCTION

*I*n the past, the health-care system emphasized the specialization of medical professional practice and the division of responsibilities. Nowadays, educators promoted competency-based education and patient-centered interprofessional collaborative practice (IPCP) [1-3]. To promote teamwork and communication, mutual understanding and respect, trustable collaboration between medical professionals, and patient-centered care, educators proposed that several effective training programs can develop IPCP among postgraduate (PG) trainees [4-7]. The benefits of upcoming concepts of medical education not only provided holistic medical care but also ensured patient safety, including the prevention of medical errors [8].

In 2010, The Canadian Interprofessional Health Collaborative proposed that a collaborative practice model can operate patient-centered health care based on interprofessional teamwork to enable comprehensive and safe medical care [9]. IPCP was defined as a group of medical professionals working toward the goals of patient-centered health care through the contribution of knowledge and skills, support, and collaboration [10-12]. However, IPCP required team members to learn from, about, and with one another. To enhance

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interpersonal relationships, communication, and trust, an educational program that promotes interprofessional teamwork was considered necessary for holistic medical care [9,10].

Previous studies reported that faculties can adopt multiple teaching activities to model the IPCP training program across diseases and scenarios [11-14]. Moreover, educational goals stressed communication, human interaction, trust, support, and collaboration among PG trainees [8,14,15]. PG trainees underwent training in cross-disciplinary teamwork, which strengthened competency in teamwork and efficiently enhanced patient care. Finally, it improved medical quality and patient safety [8].

Educational outcomes were significantly related to the instruction for PG trainees on developing collaborative practice as interprofessional team members. An appropriate IPCP teaching model harmonizes knowledge, skills, attitude, medical ethics, personal values, communication, and behavioral types. Therefore, faculties implemented various learning theories to design distinct learning activities, such as group discussions, team-based learning, peer-reflective learning, and team simulation [6-8,15]. Moreover, competency in IPCP can be developed by applying various learning activities within a comprehensive program [8,15]. Thus, IPCP training programs are an important bridge from the undergraduate year to independent health-care practice postgraduation. Utilizing appropriate assessment tools for measuring the team performance of trainees in various domains is important as the results can help realize the actual status of team communication and collaboration to enable contribution to patient-centered medical care [8].

Clinical faculties conducted formative or summative assessments of various skills among PG trainees in interprofessional teams [7,8]. However, examining medical professionals with a limited and tight schedule is difficult, which may be due to the time allotment for many clinical faculties and the equal workload, especially in Taiwan. Thus, a useful assessment tool for collecting data and summarizing the status of trainees' abilities is necessary. The results could provide faculties with clinical contexts and modifications for reinforcing the learning needs of PG trainees accordingly. Thus, selecting the appropriate tool is a linchpin to assess PG trainees [8].

After a literature review, we translated the collaborative practice assessment tool (CPAT) of Queen's University in Canada to measure the IPCP competency of PG trainees [9,10]. The method was deemed to cause minimal or no harm to trainees and may benefit respondents in terms of reflection of team cooperative care ability. According to the CIHC's (Canadian Interprofessional Health Collaborative) interprofessional educational framework, the team members worked efforts toward patient-centered clinical care, and those behaviors were reduced to a domain of patient involvement with the team, besides, attributes to the other domain of the team mission, meaningful purpose and goals [9]. During the team process, the relationship was characterized as the domain of team leadership, opposite to nonleader members. The humanistic interaction infrastructured team dynamic was defined as the domain of relationships with team members. Talked about the team function, the literature emphasized communication, roles and responsibilities, and conflict-solving strategies and decision-making mechanisms interprofessionally. The common and individual contributions were integrated among clear and concise team collaboration by different health-care professions. Even though inhospital clinical care was supported by institutional resources, the CIHC framework also pointed out the importance of connectivity from inhospital to outside of hospital longitudinally [9]. Thus, the domain of community linkage and coordination of care was established [9,16]. As above eight domains, clinical faculties and educators can utilize the quantitative data of the structured survey to assess and understand educational outcomes and issues [7,8].

Therefore, the study aims to evaluate IPCP among PG trainees in Taiwan as future medical personnel. The original IPCP scale was converted into the Taiwanese version through bidirectional translation to evaluate the practical performance of cooperation in the medical team, and the Taiwanese version scale with good reliability and validity.

MATERIALS AND METHODS

Study samples

The study recruited 43 medical personnel with 2-year PG training. Their medical categories include physicians, pharmacists, nurses, medical examiners, medical radiologists, and nutritionists. In April 2018, interviewees who met the inclusion criteria were briefed on the significance and purpose of this research. The participants provided written informed consent. The questionnaire was filled out anonymously. The Buddhist Tzu Chi Medical Foundation Hualien Tzu Chi Hospital Research Ethics Committee reviewed and approved the study protocol (IRB106-52-B), as it complies with research ethics regulations.

Study design and instruments

The research is cross-sectional and stratified the sample by professional job category. The research tools are a structured questionnaire and the Taiwan version of the Taiwanese version-CPAT (T-CPAT) translated from the CPAT of Queen's University in Canada and surveyed the respondents. We wrote to the Centre for Advancing Collaborative Healthcare and Education (CACHE) requesting the use of the CPAT [17]. The webpage of the CACHE has written that as long as researchers fill in their name and E-mail to request the use of the CPAT, they can receive a free toolkit in their mailboxes. Therefore, the authors have written to the CACHE to request the use of the scale. Therefore, the CPAT has been licensed for use in the study. The study was conducted using the following steps.

Stage 1: Constructing the Taiwanese-collaborative practice assessment tool

First, we invited nine experts, including clinical medicine, community medicine, medical education, and biostatistics to conduct expert meetings. The experts checked and reviewed the tool in line with the objectives and structure of the study. The literature on communication behavior and cooperation performance as PG learning objectives after 2-year PG

training was discussed. Afterward, we selected the 56-item and 3 open-ended questions of CPAT published on the webpage of the National Center for Inter-professional Practice and Education of Queen University, Canada [9,10,18]. The Chinese version of the scale was compared with the English version and adjusted for differences in medical culture. Brislin's translation model [19,20] for scales in different languages was used for the bidirectional translation of the scale during group discussions. Nine experts compared the texts, terminologies, and terms of both versions. Next, the experts determined whether the scale differed from the intent of the English version. After further discussions among the experts, the Chinese scale was revised and re-compared to complete the first version of the T-CPAT. Afterward, further adjustments were made according to the differences in the medical culture in Taiwan. Experts modified the title of community linkages and coordination of care in Taiwanese, which was fulfilled with the domestic context of IPCP in the hospital setting. Furthermore, experts deleted item 45 belonging to the domain (F) because the patient was allowed to visit one attending physician at a single clinic in Taiwan, whereas in other countries, multiple physicians in different specialties conjoined with other health-care professionals visited the single patient in a similar situation. Therefore, the final version of the T-CPAT contained 55 items and 3 open-ended questions [Figure 1].

Stage 2: Expert validity analysis of the Taiwanese version of the collaborative practice assessment tool

Nine experts jointly evaluate the validity of T-CPAT, including physicians, pharmacists, nurses, medical education experts, biostatistics experts, and questionnaire design experts. The experts evaluated the validity of the T-CPAT by assessing the appropriateness of the items, including words and phrases used, and whether lengthy questions can be replaced with concise ones, whether questions will lead to cognitive biases, and whether the meaning of the question fits the concepts being evaluated. The experts rated the content of each item with the dichotomized scale as 0 = not relevant and 1 = relevant [21]. Afterward, the content validity index (CVI) of the scale is calculated as (the score of each item) divided by (the total number of items times 1 score) times 100%. The validity of the judgment result of CVI >0.80 is acceptable [22]. Furthermore, the Delphi technique was used to conduct expert meetings on the validation, revision, and finalization of the scale [23]. The nine experts expressed their opinions with questionnaires. The results of each round were passed on to the experts' panel. The experts' panel was blind to reviewing computing data independently in rounds. This process allowed everyone to read other experts' opinions without registration. Then adjustment was done according to the experts' opinions. The steps are as follows:

a. formed an expert panel;
b. sent the questionnaire for the first round;
c. computed and passed the results of the previous round to the experts' panel;
d. revised the expert's original ideas with reference to other experts' opinions;
e. repeat the processing rounds and share the results until the convergence of consensus.

The experts modified the concept of the domain of community linkage for the PG trainees. The revised definition of community linkage in Taiwanese highlighted out-of-hospital resources to support cross-disciplinary care longitudinally. They also corrected the subject of the scale questions and defined the subject as our team. In addition, the experts decided to use a seven-point scale instead of a five-point scale, because the seven-point scale can better measure the changes in the PG trainees' ability.

Stage 3: Conducting the survey

The respondents were requested to fill out the scale. Afterward, the results were used to verify the internal consistency reliability and validity of the scale.

Instruments

A structured questionnaire was used as the research instrument to collect information on the demographics and cooperative practices of the participants.

The demographic variables included gender, first job after graduation (yes or no), medical category (physician, pharmacist, nurse, medical examiner, medical radiologist, or nutritionist), and PG training (the first or second years of postgraduate).

The variables for cooperative practice were mainly investigated using the T-CPAT [Appendix Table]. The domains are divided into (A) mission, meaningful purpose, goals (eight items), (B) general relationships (eight items), (C) team leadership (nine items), (D) general role responsibilities, autonomy (ten items), (E) communication and information exchange (six items), (F) community linkage and coordination of care (three items), (G) decision-making and conflict management (six items), and (H) patient involvement (five items). Items were rated using a seven-point Likert-type scale
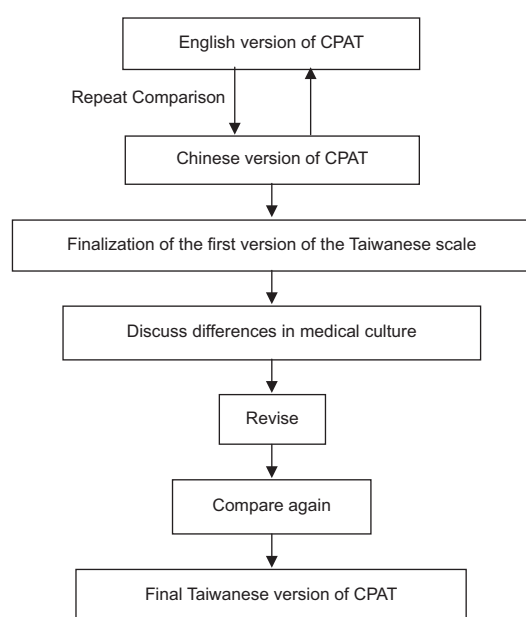

Figure 1: Bidirectional translation process of the T-CPAT. Taiwanese version of the collaborative practice assessment tool

ranging from 7 = strongly agree and 1 = strongly disagree. Items 20, 23, 35, and 48 were reverse-coded. The low and high scores range from 55 to 385. The higher score of T-CPAT represented the better performance of PG trainees during collaborative practice. Furthermore, three open-ended questions of T-CPAT were additional items to inquire about trainees' comments about the participating strengths and weaknesses generally.

Statistical analysis

SPSS 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) was used for data analysis. Descriptive statistics were used to analyze the data distribution of the demographic and cooperative practice variables. The item-level analysis is based on seven indicators to assess the availability of the scale [24]. The seven indicators of item-level analysis are the percentage of missing values of items (>10%), the mean score of an item (>6.5 or <1.5), the variation of items (<1), the skewness coefficient of items (>1 or <−1), the independent t-test of the high and low groups of items (no significant), the corrected items and the total score correlation (<0.3), and the α coefficient after deleting the item (α increase) [24,25]. When the item has three fail indicators, it is regarded as a failed item [24,25]. The internal consistency reliability of the scale was verified using Cronbach's α, and the reliability of the judgment result of it >0.8 is good [24]. The expert validity was calculated appropriateness of the content and content validity.

RESULTS

The majority of PG trainees in medical personnel are women (74.4%). This job is the first job after graduation for PG trainees, accounting for 74.4%, and 72.1% are PG1 trainees. In addition, nurse practitioners accounted for the majority of the sample [67.4%; Table 1].

The average score of the T-CPAT is 305.2 (standard deviation = 38.08), and the average scores of the domains range from 15.8 to 55.7 [Table 2].

The expert validity of the T-CPAT is CVI = 0.96, which ranges from 0.85 to 1.00. The validity of the judgment result of CVI >0.96 is acceptable [Table 3].

According to the item-level analysis, the failure indicators of all items are <3, thus there are no failure items in T-CAPT [Table 4].

The overall reliability of the scale reached Cronbach's α = 0.94 at a 95% confidence interval = 0.90–0.96. The total correlation of the correction items is between 0.52 and 0.89, whereas the scales are oriented at Cronbach's α = 0.92–0.94 [Table 5].

DISCUSSION

The CPAT was translated into Taiwanese via bidirectional translation. After reliability and validity testing, the study proposes that the scale can be used by clinical teachers to evaluate the general medical training after graduation and the practical performance of medical personnel in medical teams to

Table 1: Demographic variables of medical personnel at 2 years postgraduation (*n*=43)

Variables	*n* (%)
Sex	
Male	11 (25.6)
Female	32 (74.4)
First job after graduation	
Yes	32 (74.4)
No	11 (25.6)
Practitioners	
Physician	3 (7)
Pharmacist	6 (14)
Nurse	29 (67.4)
Medical laboratory scientist	1 (2.3)
Medical radiation technologist	3 (7)
Nutritionist	1 (2.3)
PG	
PGY 1[a]	31 (72.1)
PGY 2[b]	12 (27.9)

[a]The first year of postgraduate, [b]The second years of postgraduate. PG: postgraduate

Table 2: Analysis of the variables and overall scale of the Taiwanese version of collaborative practice assessment tool

Variables/domains	Items	Mean	SD
A	8	46.4	6.48
B	8	46.6	6.42
C	9	47.0	6.53
D	10	55.7	7.80
E	6	33.7	5.12
F	3	15.8	3.28
G	6	31.3	4.10
H	5	28.5	4.30
Total scores	55	305.2	38.08

A: Mission, meaningful purpose, goals (eight items), B: General relationships (eight items), C: Team leadership (nine items), D: General role responsibilities, autonomy (ten items), E: Communication and information exchange (six items), F: Community linkage and coordination of care (three items), G: Decision-making and conflict management (six items), H: Patient involvement (five items). SD: standard deviation

improve the quality of interdisciplinary team teaching of clinical teachers. Moreover, T-CPAT can also enhance the ability of teams to cooperate and care for medical personnel [9,10,18]. Based on Kang *et al.* research, CPAT provided a compatible tool to measure teamwork in a general medical care setting [26]. The domains were derived from current literature about the interprofessional collaborative framework and it was one of few scales that emphasized "patient involvement" as one of the collaborative tasks. Although there were more than 50 questions, it provided the most comprehensive evaluation of a health-care team member's performance with the reflection of the clinical learning environment. The research results of the Taiwanese version of CPAT supported our PG trainees' competence in general practice which was compatible with the domains of CPAT.

The expert validity of the T-CPAT is CVI = 0.96, whereas the validity of each expert ranges from 0.85 to 1.00. Both scores were more than 0.80, which indicated the good content

Table 3: Expert validity analysis of the Taiwanese version of collaborative practice assessment tool

Variables/domains	Experts								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
A	8	8	8	8	7	8	8	8	7
B	8	8	8	8	7	8	8	8	8
C	9	6	9	9	8	7	8	9	8
D	10	8	10	10	10	10	9	10	9
E	6	5	6	6	6	6	6	6	6
F	3	3	3	3	3	3	3	3	3
G	6	4	6	5	6	5	6	6	6
H	5	5	5	5	3	5	5	5	5
CVI	1.00	0.85	1.00	0.98	0.91	0.95	0.96	1.00	0.95

CVI=The score of each item/the total number of items×1 score×100%. A: Mission, meaningful purpose, goals (eight items), B: General relationships (eight items), C: Team leadership (nine items), D: General role responsibilities, autonomy (ten items), E: Communication and information exchange (six items), F: Community linkage and coordination of care (three items), G: Decision-making and conflict management (six items), H: Patient involvement (five items). CVI: content validity index

Table 4: The item-level analysis of the Taiwanese version of collaborative practice assessment tool

Indicators/ item	Percentage missing values	Mean score of an item	Variance of items	The skewness coefficient of the items	Independent *t*-test for high and low grouping of items	Correlation between the revised item and the total score	α coefficient after deletion	Number of failed indicators
				Mission, meaningful purpose, goals				
1	0.0	6.02	0.74	−0.52	6.25*	0.77	0.94	1
2	0.0	6.02	1.00	−1.72	7.50*	0.75	0.94	1
3	0.0	5.86	1.00	−0.37	10.58*	0.82	0.94	0
4	0.0	5.44	1.11	−0.22	2.66*	0.72	0.95	0
5	0.0	5.74	0.77	−0.13	3.75*	0.78	0.94	1
6	0.0	5.61	1.15	−0.59	6.39*	0.90	0.93	0
7	0.0	5.74	0.81	−0.27	6.03*	0.89	0.93	1
8	0.0	5.98	0.79	−0.60	3.27*	0.83	0.94	1
				General relationships				
9	0.0	5.95	0.81	−0.73	6.14*	0.74	0.95	1
10	0.0	5.72	1.11	−0.99	3.39*	0.72	0.96	0
11	0.0	5.88	0.82	−0.57	4.08*	0.85	0.95	1
12	0.0	5.79	0.79	−0.42	5.64*	0.88	0.95	1
13	0.0	5.84	0.76	−0.58	5.26*	0.90	0.94	1
14	0.0	5.65	1.00	−0.86	3.53*	0.78	0.95	0
15	0.0	5.84	0.81	−0.29	7.30*	0.88	0.95	1
16	0.0	5.88	0.77	−0.65	6.20*	0.92	0.94	1
				Team leadership				
17	0.0	5.72	1.21	−1.45	−0.06	0.46	0.69	2
18	0.0	5.81	0.77	−0.50	2.50*	0.74	0.66	1
19	0.0	5.61	0.72	−0.59	2.34*	0.60	0.68	1
20	0.0	3.54	3.40	0.33	0.97	−0.16	0.84	2
21	0.0	5.88	0.72	−0.26	3.40*	0.76	0.66	1
22	0.0	5.91	1.00	−0.62	3.92*	0.73	0.66	0
23	0.0	4.93	3.26	−0.48	3.96*	0.30	0.74	0
24	0.0	5.70	1.00	−0.43	2.74*	0.70	0.66	0
25	0.0	4.86	2.41	−0.28	4.32*	0.48	0.69	0
				General role responsibilities, autonomy				
26	0.0	5.77	075	−0.43	4.46*	0.85	0.78	1
27	0.0	5.00	2.48	−0.54	0.56	0.21	0.85	2
28	0.0	5.61	1.10	−0.29	4.82*	0.79	0.77	1
29	0.0	5.93	0.64	−0.46	3.54*	0.70	0.79	1
30	0.0	5.84	0.71	−0.43	3.86*	0.83	0.78	1
31	0.0	5.74	1.00	−0.49	6.60*	0.75	0.78	0
32	0.0	5.49	1.78	−0.98	4.95*	0.51	0.80	0
33	0.0	5.77	1.00	−0.65	4.52*	0.85	0.77	0
34	0.0	5.77	1.09	−0.56	4.63*	0.86	0.77	0

Contd...

Table 4: Contd...

Indicators/ item	Percentage missing values	Mean score of an item	Variance of items	The skewness coefficient of the items	Independent *t*-test for high and low grouping of items	Correlation between the revised item and the total score	α coefficient after deletion	Number of failed indicators
General role responsibilities, autonomy								
35	0.0	3.16	2.09	0.54	0.82	0.32	0.90	1
Communication and information exchange								
36	0.0	5.63	1.38	−1.43	3.72*	0.50	0.87	1
37	0.0	5.54	1.02	−0.10	3.28*	0.79	0.82	0
38	0.0	5.70	0.84	−0.33	4.28*	0.88	0.81	1
39	0.0	5.74	0.86	−0.02	5.56*	0.59	0.85	1
40	0.0	5.70	1.17	−0.66	3.59*	0.70	0.83	0
41	0.0	5.40	1.91	−1.27	4.92*	0.60	0.86	1
Community linkages and coordination of care								
42	0.0	5.35	1.33	−0.54	7.17*	0.91	0.96	0
43	0.0	5.23	1.18	−0.14	9.72*	0.93	0.95	0
44	0.0	5.23	1.33	−0.68	7.41*	0.94	0.94	0
Decision-making and conflict management								
45	0.0	5.33	0.80	0.14	1.53	0.61	0.35	2
46	0.0	5.49	0.88	−0.06	3.39*	0.68	0.31	1
47	0.0	5.63	1.00	−0.30	1.53	0.45	0.41	1
48	0.0	3.23	1.66	−0.04	0.55	−0.28	0.78	2
49	0.0	5.09	1.00	0.11	2.33*	0.12	0.57	2
50	0.0	5.00	1.14	−0.25	3.02*	0.58	0.33	0
Patient involvement								
51	0.0	5.54	1.00	−0.27	4.77*	0.89	0.94	0
52	0.0	5.54	0.87	−0.20	2.74*	0.79	0.96	1
53	0.0	5.74	0.82	−0.27	6.61*	0.93	0.93	1
54	0.0	5.88	0.87	−0.50	8.45*	0.86	0.95	1
55	0.0	5.84	1.00	−0.36	13.57*	0.90	0.94	0

*P<0.05

Table 5: Internal consistency reliability of the Taiwanese version of collaborative practice assessment tool

Variables/ domains	Mean (SD)	Corrected item-total correlation	Cronbach's α
A	46.2 (6.56)	0.79	0.93
B	46.5 (6.49)	0.83	0.92
C	47.1 (6.60)	0.80	0.93
D	55.7 (7.90)	0.89	0.92
E	33.7 (5.12)	0.84	0.92
F	15.9 (3.31)	0.52	0.94
G	31.3 (4.15)	0.79	0.93
H	28.5 (4.35)	0.88	0.92

A: Mission, meaningful purpose, goals (eight items), B: General relationships (eight items), C: Team leadership (nine items), D: General role responsibilities, autonomy (ten items), E: Communication and information exchange (six items), F: Community linkage and coordination of care (three items), G: Decision-making and conflict management (six items), H: Patient involvement (five items). SD: standard deviation

validity of the scale [24,27]. Therefore, the validity of the judgment result of CVI >0.96 is acceptable.

The results of item-level analysis showed that the failure indicators of all items were <3, thus there were no failure items in T-CAPT [24-26]. According to Tu JT. and Lester *et al.*, the item-level analysis needed to judge whether there was a failure indicator based on 7 indicators, including the percentage of missing values of items (>10%), the mean

score of an item (>6.5 or <1.5), the variation of items (<1), the skewness coefficient of items (>1 or <−1), the independent *t*-test of the high and low groups of items (no significant), the corrected items and the total score correlation (<0.3), and the α coefficient after deleting the item (α increase) [24]. Based on Tu JT. when the scale was a five-point, the mean score of an item was >4.5 points or <1.5 points, it was judged as a failure indicator [24]. However, Lester *et al.* proposed that the scale was a seven-point, the mean score of an item was >6.5 points or <1.5 points, and it was judged as a failure indicator [25]. When a scale item had three failure indicators, it was defined as a failed item. Therefore, according to this definition, there was no failure item in the 55-item of T-CPAT. The results of item analysis showed 6 items with 2 failed indicators [Table 4]. Moreover, It was owing to a few PG physicians 39 subjects (*n* = 3/43; 7%) to participate in this pilot study, the clinical hierarchy of young nurses following and carrying out senior doctor's orders, rather than PG physicians as clinical decision-makers. As the previous description, the variables might lead to impairing the reliability of those items. The majority of PG nurses worked with senior attending physicians domestically, rather than physicians in the PG training program. Therefore, the disnormality of data between the above items was found. Researchers suggested the careful interpretation of those items and following individualized educational objectives of PG training programs.

In terms of overall reliability, the scale reached 0.94, the literature demonstrated an index of reliability higher than 0.80–0.89 or 0.90 (Cronbach's alpha) indicating a highly reliable tool. Certainly, Cronbach's alpha of T-CPAT ranged from 0.92 to 0.94, we suggested it as a reliable assessment instrument [24,28]. In addition, the reliability of each domain of the scale is higher than the original version of the scale (0.73–0.84) [18], which indicated high internal consistency. As one of the Asian ethnicities, we found that Quek *et al.* demonstrated high-to-moderate consistency of CPAT with participants who worked within a single hospital in Singapore [29]. Meanwhile, the participants worked as physicians, nurses, and other kinds of therapists. We considered the similar sole working environment and similarities between Taiwan and Singapore. Besides, the result of the scale's reliability was higher than 0.9 in eight domains of the Taiwanese CPAT. Thus, we had the same conclusions about CPAT application to interprofessional collaboration in the clinical environment.

Besides, three open-ended questions of T-CPAT inquired about trainees' comments about the participating strengths and weaknesses in general. The trainees expressed any kind of assistance during the implementation of IPCP from their owner's view.

The participants were medical personnel in various departments who underwent general medical training within the 2-year program after graduation. The sample was stratified according to health-care professional subjects, where the majorities are nurses. The hospital employed medical personnel based on vacancies and registration formally. PG nurses bared a high clinic working load and lack promotion, which revealed that the appointment rate of nurses is usually higher than other nonnurse medical personnel. The high amount of recruited PG nurses was exhausting; besides, the proper training of IPCP for PG nurses was a burden and eagerness.

The limitation of the study was that the results may not apply to other medical personnel due to the small sample size and the proportion of nurses in the majority. In addition, the study did not enroll a large number of samples for the following reasons. At first, the study stratified the sample by health-care professional subjects. There were very few PG trainees in various health-care occupations, such as nutritionist and pharmacist. Hence, it was not possible to enroll sufficient samples to participate in a single year. Second, PG trainees, especially physicians, could not fully participate in the study due to tight training schedules inhospital, and also, outside the hospital. Finally, this research's purpose conducted the applicable comprehensive scale in IPCP domestically. Thus, we designed and processed it as a pilot study. In addition, this study focused on rebuilding a T-CAPT with good reliability and validity and confirmed the availability of the scale with item-level analysis. Researchers recommend that future studies should be considered sufficient sampling and a diversity of medical personnel close to clinical settings.

Conclusions

In summary, the T-CPAT displayed good reliability and validity. Based on our results, we suggested that T-CPAT was an applicable tool to measure the performance of teamwork quantitatively in a general health-care setting. The domains were derived from literature and it was one of few surveys that include patient involvement as one of the domains of teamwork. Although there were 55 questions plus additional 3 open-ended questions, it provided a comprehensive assessment of a health-care team [30].

Thus, we deem that it can accurately measure IPCP among PG trainees in Taiwan as general medical personnel. During IPCP, the level of performance in terms of collaborative practice of medical personnel within a medical team can be assessed. Thus, the study confirmed that the T-CPAT was a measurement tool with good reliability and validity. Moreover, it was expected for clinical teachers and stakeholders to understand the team behavior effectively of PG trainees during IPCP.

Data availability statement

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Conflicts of interest

There are no conflicts of interest.

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APPENDIX

Appendix Table : The Taiwanese version of collaborative practice assessment tool

Items	Score (1–7)
(A) Mission, meaningful purpose, goals	
1. Our team mission provides an interprofessional collaborative practice to patient care	
2. Our team's purpose is to assist patients in achieving treatment goals	
3. Our team's goals are specific and appropriate to my practice	
4. Our team's mission and goals are supported by our institute sufficiently (e.g., skills, human resource, funding, time, or space)	
5. All team members are committed to collaborative practice	
6. Members of our team realize patients' treatment goals and care plans	
7. Patients' care plans and treatment goals incorporate best practice guidelines from multiple professions	
8. Team members desire to work with each other collaboratively	
(B) General relationships	
9. Team members can work together and respect each other	
10. Team members care about one another's personal well-being	
11. Team members interact to enhance teamwork effectively	
12. It is enjoyable to work with other team members	
13. Team members respect each other's roles and health-care professions	
14. Working collaboratively keeps most team members enthusiastic and interested in their job	
15. Team members trust each other's work and contributions related to patient care	
16. Our team's level of respect for each other enhances our ability to work together	
(C) Team leadership	
17. In coordination of teamwork about patient care, there is a clear role of team leader	
18. All professionals are actively involved in a team	
19. The roles and responsibilities of each professional member working about patient care are clearly defined	
20. Professionals are discouraged from making decisions about patient care within the team	
21. Team leader supports the opportunities of interprofessional collaboration	
22. Our team leader demonstrates and advocates a model of patient-centered care	
23. Our team leader doesn't care about the concerns and ideas of members	
24. Our team leader encourages members to demonstrate their professionalism	
25. Our team has a process of peer review	
(D) General role responsibilities, autonomy	
26. Team members can affirm the skills and expertise of different professional members	
27. Physicians assume the responsibilities for team decisions and clinical patients' outcome	
28. Team members can negotiate their roles they want to develop and execute the patient's care plan	
29. Team members are to be accountable for their work	
30. Team members are aware of individual responsibility in patients' care plan	
31. Physicians usually ask other team members for opinions about patient care	
32. Team members feel comfortable to advocate for the patient	
33. Team members share the responsibility for team decision-making and clinical outcome	
34. Team members have the responsibility to communicate and provide their expertise in an assertive manner	
35. Team members feel restrictedly with autonomy of clinical practice that they can assume	
(E) Communication and information exchange	
36. Patients' concerns can be reflected effectively through team meetings and discussions regularly	
37. Our team develops effective communication strategies to share patients' treatment goals and outcomes of care	
38. The relevant information relating to patients' condition or care plan is reported to the team member in a timely manner appropriately	
39. I believe that the information exchanged among team members is correct	
40. Our team meeting provides an open, comfortable and safe environment to discuss issues of concern	
41. The patients' medical records are used as a tool for communication efficaciously by all team members	
(F) Community linkage and coordination of care	
42. Our team is able to develop partnerships with out-of-hospital institutions to ensure the best patient care outcomes	
43. Our team members share information about out-of-hospital resources with each other	
44. Our team has a mechanism to work with out-of-hospital agencies to effectively coordinate patient care	
(G) Decision-making and conflict management	
45. We have mechanisms to identify problems and to make response quickly	
46. When team members disagree, all points of view are considered before decision-making	

Contd...

Appendix Table : Contd...

Items	Score (1–7)
47. Disagreements among team members are ignored	
48. On our team, the final decision about patient care relies on the physician	
49. In our team, there are problems that regularly need to be solved by supervisors	
50. Our team establishes mechanisms for conflict management	
(H) Patient involvement	
51. Team members encourage patients/clients to be actively participating in care decisions	
52. Team members discuss with patients face-to-face	
53. Patients can get information about health-care plans	
54. The patient is considered a member of health-care team	
55. The patient's family and key caregivers are enrolled in health-care planning, on the patient's request	
Open-ended questions	
56. What does our team do well with regard to collaborative practice?	
57. In our team, what are the most difficult challenges to collaboration?	
58. What does our team need help with to improve collaborative practice?	