

# Re-evaluation of the Interprofessional Collaboration Scale validation between nurses towards other health care professionals occupied in Italian emergency medical services

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**Abstract.** *Background and aim:* Interprofessional collaboration (IPC) between health professionals is fundamental for the provision of an efficient and effective medical care service. This is especially so in states of emergency, as highlighted by the ongoing coronavirus disease 2019 pandemic. This study aimed to obtain further evidence regarding the validity and reliability of the Italian language IPC scale – an instrument for measuring interprofessional collaboration – in a setting that has yet to be investigated at an in-depth level: the emergency departments in Italian hospitals. *Methods:* The survey tool was a structured questionnaire in the Italian language. It comprised the validated Italian version of the IPC scale plus a question concerning the frequency of collaborations between the nurses interviewed and other health professionals. Confirmatory factor analysis was applied to rate the three factors (“communication”, “accommodation” and “isolation”) that compose the scale. *Results:* Four hundred thirty-six nurses working in an emergency department for at least one year completed the questionnaire, which assessed collaboration with other health professionals working in the same department. The model fit statistics are satisfactory for all the nurse-target group combinations analysed. Regarding the Cronbach’s alpha statistic used to compute the reliability of the scale, acceptable values were obtained for all items, except for those related to the isolation factor for each case of interprofessional collaboration considered. *Conclusions:* The results confirm the validity of the IPC scale as an instrument for the assessment of interprofessional collaboration involving nurses and other workers occupied in the provision of healthcare in Italian emergency departments. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** interprofessional collaboration, validation, emergency medical services, nurses, multiple-group measurement, survey

## Background

The extensive and intense nature of the COVID-19 pandemic resulted in emergency departments and medical services worldwide being placed under unprecedented levels of internal and external pressure. Although the effects of the pandemic have

been widespread, certain well-developed countries such as Italy have suffered more than others (1). In many cases, hospital services have been required to undergo significant reorganisation, with the emergency department being one of those facing the greatest challenges (2, 3). Throughout this gruelling time, collaboration between the different medical operators has

been a key, indeed necessary, element to obtain and maintain in order to provide an efficient care service (4). Successful collaborations render work more efficient, which helps generate greater levels of job satisfaction (5).

To assess whether staff with different job roles are collaborating in an effective way, tools designed to evaluate interprofessional collaboration should be used (6, 7). However, these tools (in the format of specifically designed questionnaires) are principally available in the English language, and few of them have been validated in other languages, such as Italian (8).

A number of different definitions of the concept of interprofessional collaboration can be found in the literature (9). The World Health Organization (WHO) defines it as: “collaborative practice [that] happens when multiple health workers from different professional backgrounds work together with patients, families, carers and communities to deliver the highest quality of care across settings” (10). Other scholars, focusing on specific professional healthcare workers, such as nurses and physicians, have defined the concept as “working cooperatively, sharing responsibility for problem solving, addressing conflict management, performing joint decision-making and using open communication” (11). Others consider interprofessional collaboration (IPC) as “a type of interprofessional work which involves different health and social care professions who regularly come together to solve problems or provide services” (12). Some use the concept interchangeably with that of teamworking (13), despite others deeming it more correct to keep the two terms separate (12,14).

Irrespective of the different definitions used by scholars in the literature, what has become clear is that collaboration within the health sector improves patient outcomes and the quality of patient care (7,15,16), and reduces mortality rates in the inpatient setting (17).

Although interprofessional collaboration is an established principle in healthcare, it is not actually put into practice on many occasions, as stated by Bujak and Bartholomew (18) – who, analyzing communication in healthcare, underlined that “the two most important people responsible for patient care – the nurse and the physician – often never talk to each other, and when they do, the interchange is often dysfunctional.

This poor communication is having dire results including putting patients in harm’s way, undermining staff morale and increasing turnover among nursing staff” (18).

In order to assess whether the strategies put into place aimed at improving IPC in different settings and between different professions are working, it is necessary to monitor it. Fortunately, the literature offers a number of different instruments for doing just so. Some examples of these tools include: the collaborative practice scale (CPS) (19), the interprofessional collaborative competency attainment survey (ICCAS) (20), the measure of current collaboration – MCC (21), the interprofessional collaboration scale – IPC (22), and the assessment of interprofessional team collaboration scale (AITCS) (23). Some of these have only been used to assess the collaboration between specific professions, such as nurses and physicians, while others have only been used in specific settings, such as acute care settings (24).

Considering the Italian context, few ICP studies have been conducted to date, and their focus has been limited to specific professions, such as nurse-physician collaborations (25, 26), or nurses and different types of physicians (27), or to a specific geographic area of the country (28), or to a specific hospital (8). More recently, researchers have also started to address IPC between multiple health professions (29-31), although studies of this type are still scarce, probably because only a handful of the methodological instruments developed for measuring interprofessional collaboration are actually available in the Italian language, and the process of validating translated tools requires both time and resources.

Of the many tools developed to measure IPC or interprofessional teamwork (a less integrated and interdependent manner of working), the few which have thus far been validated in the Italian language are: i) the Team Climate Inventory – TCI (32); ii) the Nurse-Physician Collaboration Scale – NPCCS (33); iii) the Ottawa Crisis Resource Management Global Rating Scale – GRS (34); iv) the Interprofessional Collaboration Scale – IPC (30); v) the Interprofessional Team Collaboration Scale II (I – AITCS II) (35); and vi) the Chiba Interprofessional Competency Scale – CICS29 (29).

Of these scales, the IPC scale is one of the most flexible, since it is not limited to specific professions, but can instead be used to address to different health professions, where “respondents are proxy reporters on the collaboration behaviours of group targets” (22).

The 13 original statements of the IPC scale in which nurses assess physicians are the followings:

1. Nurses have a good understanding with the physicians about our respective responsibilities.
2. Physicians are usually willing to take into account the convenience of nurses when planning their work.
3. I feel that patient treatment and care are not adequately discussed between nurses and physicians.
4. Nurses and physicians staff share similar ideas about how to treat patients.
5. Physicians are willing to discuss nurses issues.
6. Physicians cooperate with the way we organize nurses care.
7. Physicians staff would be willing to cooperate with new nurse practices.
8. The physicians do not usually ask for nurses staff's opinions.
9. Physicians staff anticipate when nurses will need their help.
10. Important information is always passed on between nurses and physicians.
11. Disagreements with physicians often remain unresolved.
12. Physicians think their work is more important than the work of nurses.
13. Physicians would not be willing to discuss their new practices with nurses.

The response options for each item are: strongly disagree (1), disagree (2), agree (3), and strongly agree (4). The same items, in the original scale, were used for assessing “allied health care professional”, by substituting the word “physicians” with “allied health care professional”. In this research, the “allied health care professionals” investigated correspond to dieticians, midwives, physicians, physiotherapists, psychologists, nursing aides/orderlies, speech therapists and radiographers, thus rendering the scale more inclusive of different professional groups.

As was identified by Kenaszchuk et al. (22), and confirmed by Vittadello et al. (30), the above-listed items principally load on three factors defined as: “communication” (item: items: 1, 3, 9, 10 and 11), “accommodation” (items: 2, 4, 5, 6 and 7) and “isolation” (items 8, 12 and 13).

In the validation of the IPC scale in the Italian language, which the authors also simultaneously validated in the German language by collecting data in a Health Trust located in a trilingual region of Northern Italy (31) – Vittadello et al. (30) confirmed the three factors identified by Kenaszchuk et al. (22), but in the Italian version the internal consistency reliability for the factor isolation was lower than that for the other two factors (communication and accommodation). Furthermore, when examining the corrected item-total correlation, the authors found that items 10 and 12 correlated less with their respective factors, and the authors attributed this to the hierarchy between workers, in particular between physicians and nurses.

The purpose of this study was to obtain further evidence regarding the validity and reliability of the Italian language version of the IPC scale, which measures IPC (22, 30), in a setting that has yet to be investigated in any great depth: the emergency medical services of Italian hospitals. More specifically, the interprofessional collaboration experienced from the perspective of nurses was assessed in relation to working with nursing aides/orderlies, physicians, physiotherapists, and radiographers – all of whom are key practitioners occupied in the emergency medical setting.

## Methods

### *Study design*

The aim of the study was to provide further evidence on the validity and reliability of the Italian version of the IPC scale (22, 30), specifically in the context of emergency medical services in Italy, a setting different to the one studied in the IPC scale's validation and not yet explored by any other Italian studies. To this end, a quantitative research plan was designed.

### *Study setting*

The data were collected between September and December 2019. The research was carried out within the context of emergency healthcare services in Italian hospitals, specifically: 1) the accident and emergency department/short-stay observation (unit/ward), 2) emergency medicine and surgery, 3) multifunctional intensive care, 4) paediatric emergency medicine department/the neonatal intensive care unit (NICU), and 5) the intensive care unit (ICU)/sub-intensive care unit (SICU) therapy, 6) pre-hospital emergency care.

Thus, the data collected referred to the nurses who had worked in one of these units for one or more years.

### *Data collection*

The survey tool was a structured questionnaire created ad-hoc in the Italian language. It comprised the validated Italian version of the IPC scale (22, 30) plus a question concerning the frequency of collaborations between the nurses interviewed and other health professionals and some questions concerning the socio-demographic characteristics of the interviewed participants.

The use of the Italian version of the IPC scale was authorized by the Claudiana (College of Healthcare Professions Bolzano/Bozen, Italy) Research Centre, following an official request. The survey participants were nurses, who were asked about their inter-professional collaborations with: dieticians, midwives, nursing aides/orderlies, physicians, physiotherapists, psychologists, speech therapists, and radiographers.

The LimeSurvey platform, owned by the University of Parma, was used to administer the questionnaire, which took approximately 15 minutes to complete. A filter question was inserted at the beginning of the questionnaire which selected participants based on the number of years they had worked in the emergency area (at least one year of work was required to continue onto the questionnaire). Respondents who had not worked in the emergency area for at least one full year were sent automatically to the end of the questionnaire. The questionnaire was completely anonymous.

The process of data collection involved the “Associazione Nazionale Infermieri di Area Critica

- ANIARTI” (Italian Association of Critical Care Nurses), an Italian nurses association founded in 1981 for nurses working in the field of emergency medicine. At the end of 2019, its members numbered 777 nurses employed in health facilities scattered across all of the twenty regions that make up Italy. ANIARTI signed an agreement drawn up by our group regarding the nature of this research and how it was to be conducted, namely: to promote and provide information about the research to their associates, to send the link containing the questionnaire to their associates only, and not to send the questionnaire to any other subjects.

The specific role of ANIARTI was to promote the compilation of the questionnaire, which they carried out by publicizing the research initiative and the survey through the Association’s social media (e.g., Facebook) and by sending the questionnaire link (that allowed members to access and complete the survey) to their e-mail list of members, specifically inviting them to participate in the survey. It was also made clear that they should not take part in the survey more than once.

### *Data analysis*

All data were downloaded from the LimeSurvey platform software, organized into a database, and the database was analysed in an aggregate way. Descriptive statistics, counts and percentages were used to analyse the categorical and continuous variables. Confirmatory factor analysis (CFA) was applied (using R Package ‘lavaan’ version: 0.6-7) to determine the construct validity of the IPC scale. The diagonally weighted least squares was the estimator used, which was justified by the properties of the input data.

We used a variety of indices to evaluate model fit. Goodness-of-fit indices included the: Chi square model (a low chi-square value is better than a high one), but since this is sensitive to sample size other indices were also considered; Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), both of which indicate an acceptable model fit (36) for values ranging from 0.90 to 0.95, and a good model fit for values greater than 0.95 (37); Root Mean Square Error of Application (RMSEA), for which an adequate model fit is considered for values < 0.08, and good model fit for values < 0.05 (38); Standardized Root Mean Square

Residual (SRMR), for which a good model fit is considered for values  $< 0.05$  (37), and acceptable for values less than 0.08 (39); and the Weighted Root Mean Square Residual (WRMR), for which an acceptable fit is considered for values  $\leq 1$  (40). Nonetheless, it is important to note that these model fit statistics are simply guidelines and should not be interpreted as golden rules (41).

The internal consistency was checked by computing Cronbach's alpha (R Package 'jmv', Version 1.2.23).

All tests were two-tailed with the significance level set at  $p < 0.05$ .

### *Ethical considerations*

The study proposal was submitted to the Reggio Emilia Ethics Committee, and a response – from the local secretary of the AUSL-IRCCS Reggio Emilia – was received stating that the research could be conducted since subjects were not to be subjected to any physical or invasive intervention, and the instrument for data collection guaranteed participant anonymity. The principles of the Declaration of Helsinki and Good Clinical practice guidelines were followed.

Before filling in the questionnaire, all participants received an informative message outlining the purpose of the research and guaranteeing the anonymity of all data collected. Participants were required to provide their informed consent before proceeding with the questionnaire. The survey database is held at the University of Parma.

## **Results**

### *Participants*

The sampling procedure was non-probabilistic and non-proportionally stratified. In total, 436 nurses working in the area of emergency medicine for one or more years completed the questionnaire. Of these, 265 (60.78%) were female. Regarding participant age: 30 nurses were  $< 25$  years old (6.88%); 81 were 20–26 years old (18.58%); 56 were 31–35 years old (12.84%); 72 were 36–40 years old (16.50%); 68 were 41–45 years old (15.60%); 64 were 46–50 years old (14.68%);

38 were 51–55 years old (8.72%); 18 were 56–60 years old (4.13%); 7 were 61–65 years old (1.61%), and 2 were  $> 65$  years old. The majority of the participants had a high degree of education, and almost the entire population interviewed had a full-time work contract (415 nurses, 95.18%) whereas the reminders were working part-time contracts (Table 1).

### *Collaboration*

Nurses were asked to indicate the health professionals with which they had collaborated over the last 12 months (dichotomic question for each health profession listed). They were then asked about the frequency of these collaboration (Table 2).

Nurses mostly reported to have collaborated with physicians (92%), followed by nursing aides/orderlies (approximately 87%), radiographers (66%) and physiotherapists (52%). The percentage of nurses reporting to have collaborated with each of the other listed professions remained below 21%.

The majority of nurses reported to have daily contact with nursing aides/orderlies (93%), physicians (approximately 90%) and radiographers (60%). Nearly half reported to have daily contact with physiotherapists (46%). The professionals with which nurses claimed to collaborate least during the year (i.e., only occasionally during the year) were dieticians (46%), speech therapists (40%) and midwives (38%).

Considering the high number of professionals with whom nurses declared to collaborate with, the procedure for validating the scale was simplified by only analysing the data provided by nurses who had reported to collaborate with physicians, nursing aides/orderlies, radiographers and physiotherapists

**Table 1.** Participants according to their workplace.

<b>Emergency department of work</b>	<b>N = 436</b>	<b>%</b>
Paediatric emergency medicine /NICU	15	3.44
Accident and emergency/short-stay observation (unit/ward)	81	18.58
Emergency medicine and surgery	21	4.82
ICU/SICU therapy	207	47.48
Pre-hospital emergency care	43	9.86
Other emergency departments	69	15.83

**Table 2.** Frequencies of collaborations between nurses and other healthcare professionals.

Nurse towards:	Have collaborated with in the last 12 months (Yes answer; N=436)	Frequency of collaboration					%	N
		Every day	More than once a month	Once a month	Sometimes during the last 12 months?			
Dieticians	12.84	3.57	37.5	12.5	46.43	100	56	
Midwives	13.07	7.02	40.35	14.04	38.5	100	57	
Physicians	92.43	89.83	9.18	0.25	0.74	100	403	
Physiotherapists	52.06	46.7	41.40	7.05	4.85	100	227	
Psychologists	20.64	17.78	42.22	12.22	27.78	100	90	
Nursing aides/Orderlies	86.93	93.67	4.49	0.79	1.05	100	379	
Speech therapists	14.68	7.81	17.19	34.38	40.62	100	64	
Radiographers	66.28	60.21	37.02	2.08	0.69	100	289	
None of these	3.21							

on at least a monthly basis over the course of the last 12 months.

#### *Construct validity*

CFA was applied to investigate the validity of the three factor-model (“communication”, “accommodation” and “isolation”), developed by Kenaszchuk et al. (22) in the English language and validated in the Italian language by Vittadello et al. (30), for the present dataset. In accordance with the validation procedure set out by Vittadello et al. (30), we only considered nurses who declared to have collaborated with physicians, nursing aides/orderlies, radiographers and physiotherapists on at least a monthly basis over the course of the last 12 months.

The fit statistics for the model are presented in Table 3, where the number of completed questionnaires used in the validation process is also specified in column N. The model is based on priory information from exploratory factor analysis (22, 30).

The model fit statistics are satisfactory for all the nurse-target group combinations analysed. For the assessments of nurses towards physicians, the following values were obtained: CFI=0.977; TLI=0.970; RMSEA=0.062; SRMR=0.051; WRMR=0.936. For nurses towards physiotherapists, the values were: CFI=0.984; TLI=0.980; RMSEA=0.056; SRMR=0.056; WRMR=0.737. For nurses towards nursing aides/orderlies, the values

were: CFI=0.993; TLI=0.992; RMSEA=0.035; SRMR=0.038; WRMR=0.654. For nurses towards radiographers, the values were: CFI=0.979; TLI=0.973; RMSEA=0.065; SRMR=0.054; WRMR=0.834.

The intercorrelation values obtained for the three factors were as follows: nurses towards physicians: communication-accommodation=0.508, communication-isolation=0.477, and accommodation-isolation=0.459; nurses towards physiotherapists: communication-accommodation=0.494, communication-isolation=0.517, and accommodation-isolation=0.489; nurses towards nursing aides/orderlies: communication-accommodation=0.591; communication-isolation=0.535, and accommodation-isolation=0.606; nurses towards radiographers: communication-accommodation=0.578; communication-isolation=0.542 and accommodation-isolation=0.605. All values are significantly different from zero.

Table 4 reports the complete standardized parameter estimates for each item. All coefficient factor loadings were statistically significant ( $p < 0.05$ ). The factor loading of items 1, 2 and 8 were fixed at 1 as factor markers (42).

The proportion of the variance of each indicator that is accounted for (or not) by the latent factors is reported in table 5. The estimate values indicate the percentage of variance of each item that is explained by the factor. The higher the percentage of variance of an item that is explained by the factor, the better the item is at measuring the factor. In each case examined,

**Table 3.** Model fit statistics for CFA models for each rater-target group (i.e., nurse-health professional) combination.

Nurses toward	N	Model $\chi^2$	df	P	CFI	TLI	RMSEA	SRMR	WRMR
Physicians	400	156.186	62	0.000	0.977	0.970	0.062	0.051	0.936
Physiotherapists	216	103.594	62	0.001	0.984	0.980	0.056	0.056	0.737
Nursing aides /Orderlies	375	90.332	62	0.011	0.993	0.992	0.035	0.038	0.654
Radiographers	287	136.456	62	0.000	0.979	0.973	0.065	0.054	0.834

**Table 4.** Full CFA models. Complete standardized coefficients.

	Nurses towards											
	Physicians			Physiotherapists			Nursing aides/Orderlies			Radiographers		
	Estimate	S.E.	P	Estimate	S.E.	P	Estimate	S.E.	P	Estimate	S.E.	P
Communication												
1	0.704 <sup>a</sup>			0.719 <sup>a</sup>			0.757 <sup>a</sup>			0.688 <sup>a</sup>		
3	0.752	0.055	0.000	0.841	0.084	0.000	0.806	0.056	0.000	0.793	0.083	0.000
9	0.479	0.062	0.000	0.666	0.090	0.000	0.627	0.058	0.000	0.653	0.077	0.000
10	0.551	0.069	0.000	0.554	0.103	0.000	0.571	0.072	0.000	0.619	0.081	0.000
11	0.716	0.059	0.000	0.755	0.089	0.000	0.733	0.055	0.000	0.756	0.078	0.000
Accommodation												
2	0.718 <sup>b</sup>			0.732 <sup>b</sup>			0.814 <sup>b</sup>			0.823 <sup>b</sup>		
4	0.715	0.055	0.000	0.789	0.070	0.000	0.783	0.041	0.000	0.803	0.039	0.000
5	0.742	0.052	0.000	0.802	0.075	0.000	0.680	0.047	0.000	0.777	0.043	0.000
6	0.748	0.053	0.000	0.827	0.075	0.000	0.834	0.041	0.000	0.836	0.039	0.000
7	0.706	0.050	0.000	0.823	0.078	0.000	0.718	0.046	0.000	0.773	0.046	0.000
Isolation												
8	0.741 <sup>c</sup>			0.7361 <sup>c</sup>			0.7701 <sup>c</sup>			0.7851 <sup>c</sup>		
12	0.295*	0.085	0.000	0.162	0.095	0.020	0.167	0.077	0.005	0.272	0.074	0.000
13	0.716	0.054	0.000	0.686	0.080	0.000	0.805	0.057	0.000	0.743	0.053	0.000

\*Reverse-code; <sup>a,b,c</sup> Factor loadings were fixed at 1 before estimating the variance.

item 12 appeared to be the weakest in comparison with the other statements. Considering each type of relationship examined, we can see that items 9 and 10 also have a low variance value compared with the other items.

#### Reliability of the scales

The internal consistency (i.e., the reliability) of each single ICP dimension was estimated by means of the Cronbach's alpha coefficient. As stated by Taber (43), different opinions exist in the literature regarding how alpha values should be interpreted. One of these,

for example, is to consider the following rule of thumb: " $\alpha \geq 0.9$  = excellent;  $0.9 > \alpha \geq 0.8$  = good;  $0.8 > \alpha \geq 0.7$  = acceptable;  $0.7 > \alpha \geq 0.6$  = questionable;  $0.6 > \alpha \geq 0.5$  = poor;  $\alpha < 0.5$  = unacceptable" (44).

For nurses' IPC scale assessments of physicians, the values of Cronbach's alpha (Table 6) were: 0.69, 0.79 and 0.42 (communication, accommodation and isolation, resp.). Evaluating all items together, the overall Cronbach's alpha was 0.86. For nurses' IPC scale assessments of physiotherapists, the values of Cronbach's alpha were: 0.76, 0.84 and 0.49 (communication, accommodation and isolation, resp.); while evaluating all items together, the overall Cronbach's

**Table 5.** Variance values.

	Nurses towards							
	Physicians		Physiotherapists		Nursing aides/Orderlies		Radiographers	
	Estimate	Residual variance	Estimate	Residual variance	Estimate	Residual variance	Estimate	Residual variance
1	0.496	0.504	0.517	0.483	0.574	0.426	0.473	0.527
2	0.516	0.484	0.536	0.464	0.662	0.338	0.678	0.322
3	0.565	0.435	0.708	0.292	0.650	0.350	0.629	0.371
4	0.511	0.489	0.622	0.378	0.613	0.387	0.645	0.355
5	0.551	0.449	0.643	0.357	0.463	0.537	0.603	0.397
6	0.560	0.440	0.684	0.316	0.696	0.304	0.699	0.301
7	0.498	0.502	0.677	0.323	0.516	0.484	0.598	0.402
8	0.549	0.451	0.541	0.459	0.593	0.407	0.617	0.383
9	0.229	0.771	0.444	0.556	0.393	0.607	0.427	0.573
10	0.304	0.696	0.307	0.693	0.326	0.674	0.384	0.616
11	0.512	0.488	0.569	0.431	0.537	0.463	0.571	0.429
12	0.087	0.913	0.026	0.974	0.028	0.972	0.074	0.926
13	0.513	0.487	0.471	0.529	0.649	0.351	0.552	0.448

**Table 6.** Values of Cronbach's alpha.

Nurses' responses referring to:	Physicians	Physiotherapists	Nursing aides/Orderlies	Radiographers
Communication	0.696	0.762	0.753	0.752
Accommodation	0.797	0.842	0.822	0.851
Isolation	0.424	0.492	0.518	0.583
Overall	0.866	0.889	0.886	0.900

alpha was 0.88. For nurses' IPC scale assessments of nursing aides/orderlies, the values of Cronbach's alpha were: 0.75, 0.82 and 0.51 (communication, accommodation and isolation resp.), and the overall Cronbach's alpha was 0.88 for all items together. For nurses' IPC scale assessments of radiographers, the values of Cronbach's alpha were 0.75, 0.85 and 0.58 (communication, accommodation and isolation, resp.). Evaluating all items together, the overall Cronbach's alpha was 0.90. Isolation was the factor presenting the lowest values of Cronbach's alpha, and was therefore considered to have the poorest reliability.

Table 7 reports the corrected item-total correlation when each item is omitted. These were used to identify the correlation between each individual item and the total scale when that item is omitted. The

values that exceed the cut-off of 0.30 indicate that each item shows a good level of correlation with the scale (45). For the nurses' ratings of physicians, the item-total correlation values ranged from 0.074 to 0.625, whereas they ranged from 0.187 to 0.725 for nurses' ratings of physiotherapists. Considering the nurses' ratings of nursing aides/orderlies in the ICP scale, the item-total correlation values ranged from 0.163 to 0.644, and considering the radiographers, these values ranged from 0.287 to 0.733. In all cases, item 12 presented an item-rest correlation value below the cut-off point.

From the values of Cronbach's Alpha shown in tables 7 when each item is omitted, we can observe that items 8 and 13 (in the isolation factor) contribute the most to overall reliability, since Cronbach's alpha

**Table 7.** Reliability statistics of scales when each item is omitted.

Nurses towards:	Physicians		Physiotherapists		Nursing aides/Orderlies		Radiographers	
	Item-total correlation	Cronbach's Alpha	Item-total correlation	Cronbach's Alpha	Item-total correlation	Cronbach's Alpha	Item-total correlation	Cronbach's Alpha
Communication								
1	0.497	0.627	0.532	0.719	0.522	0.708	0.458	0.729
3	0.546	0.604	0.589	0.699	0.603	0.677	0.577	0.686
9	0.326	0.694	0.513	0.727	0.520	0.709	0.509	0.712
10	0.376	0.679	0.424	0.755	0.404	0.748	0.506	0.713
11	0.517	0.617	0.602	0.694	0.548	0.698	0.542	0.700
Accommodation								
2	0.550	0.768	0.587	0.826	0.644	0.779	0.652	0.822
4	0.569	0.762	0.615	0.819	0.617	0.787	0.685	0.814
5	0.589	0.756	0.656	0.807	0.582	0.797	0.630	0.828
6	0.625	0.744	0.653	0.808	0.647	0.778	0.733	0.801
7	0.562	0.764	0.725	0.788	0.588	0.795	0.609	0.834
Isolation								
8	0.407	0.050	0.356	0.309	0.394	0.314	0.404	0.464
12	0.074	0.663	0.187	0.580	0.163	0.661	0.287	0.623
13	0.330	0.188	0.399	0.232	0.465	0.166	0.495	0.311

significantly decreases when these items are omitted. This is most evident for nurses' assessments of physicians in relation to item 8, and for nurses' assessments of nursing aides/orderlies in relation to item 13.

## Discussion

In this research we applied the Italian version of the IPC scale, first developed in the English language by Kenaszchuk et al. (22) and subsequently validated by Vittadello et al. (30). The validation process was carried out in a specific geographic area by interviewing people working at the South Tyrolean Health Trust. In that study, seven professional groups were considered, but, due to the small number of respondents for some of the professions, the validation process only considered physicians' assessments of nurses and vice versa.

In this study, we applied the Italian version of the IPC scale to survey health workers occupied in the emergency medical services. As in the previous study, confirmatory factor analysis (the three factor-model)

was applied to nurse evaluations of four other professions, namely physicians, physiotherapists, nursing aides/orderlies and radiographers.

The three IPC factors – communication, accommodation and isolation, identified in the studies by Kenaszchuk et al. (22) and Vittadello et al. (30) – were also evaluated in the present study, and the results relating nurses' assessments of collaborations with physicians were compared with the those obtained by Vittadello et al. (30), which also referred to an Italian context.

The index values obtained evaluating how well the model fit the data all fell within acceptable ranges, and the values of CFI, RMSEA and WRMR obtained here for nurses' evaluations of physicians were similar to those obtained by Vittadello et al. (30). Moreover, the fit indices for the nurses' assessments of other professionals were all acceptable.

In our analysis, as in Vittadello et al. (30), since items 1, 2 and 8 were considered marker indicators, we did not test their significance (42). The other items were all statistically significant.

Considering the variance values for nurses' evaluations of collaborating with physicians, we noticed that the value obtained for item 12 was low, which was also the case in the study by Vittadello et al. (30). Moreover, this value was consistently low in the nurses' evaluations of other health professionals.

Regarding the Cronbach's alpha statistic used to compute the reliability of the scale, acceptable values were obtained for all items, except for those related to the isolation factor for each case of interprofessional collaboration considered, since the values of Cronbach's alpha value were below 0.5. Similarly, the value of Cronbach's alpha obtained in the study conducted by Vittadello et al. (30) regarding the isolation factor for nurses' evaluations of physicians was below 0.6.

Examining the corrected item total correlation, we identified that item 12 was not highly correlated – as also found in the previous Italian study by Vittadello et al. (30). Furthermore, we obtained low correlation values for items 9 and 10 for the assessments of nurses towards physicians. Similarly, Vittadello et al. (30) identified a low value for item 10. However, the authors' interpretations should be developed further since it is fundamental that the nursing and doctor professions, whilst operating in autonomy of each other, need to collaborate in order to obtain the highest levels of patient care. Hierarchy in relations as put forward by Vittadello et al. (30) might be identified in drug prescription procedures for example, but the items assessed did not directly address this procedure. Thus, since the tasks of the doctors and nurses are well defined, the notion of hierarchy in relations could be reformulated as a prejudice that some nurses have towards doctors, and this could be based on out-dated visions of the two roles.

Finally, we identified a decrease in the values of Cronbach's Alpha for items 8 and 13 when they were omitted, as also reported by Vittadello and colleagues (30).

This study has the limitation that it did not evaluate the assessment of interprofessional collaboration from the point of view of other professionals involved in the emergency medical services towards nurses. Another limit is that due to privacy reasons it is not possible to know whether those who participated in the Vittadello et al. (30) study are also included in this research.

## Conclusion

In summary, our analyses provide further evidence confirming the validity and reliability of the Italian language version of the IPC scale. In addition, the results reported here go beyond those reported by previous study Kenaszchuk et al. (22) as we found that our adapted scale is not only suitable for nurses' assessments of physicians but also for their assessment of other professions, such as nursing aides/orderlies, physiotherapists and radiographers.

An interprofessional collaborative approach should be implemented and assessed for all other professions and in all medical departments to improve the interprofessional health care process and job satisfaction.

**Conflict of Interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

## References

1. Jachetti A, Colombo G, Brignolo-Ottolini B, Franchi J, Solbiati M, Pecorino Meli M, Bosco P, Costantino G, Emergency department reorganisation to cope With COVID-19 outbreak in Milan university hospital: A Time-sensitive challenge. *BMC Emerg Med* 2021;21(1):1-8.
2. De Filippis G, Cavazzana L, Gimigliano A, Piacenza M, Vimercati S, Covid-19 pandemic: A frontline hospital reorganization to cope with therapeutic and diagnostic emergency. *Pharmacol Res* 2020;161:105160.
3. Meschi T, Rossi S, Volpi A, Ferrari C, Sverzellati N, Brianti E, Fabi M, Nouvenne A, Ticinesi A, Reorganization of a large academic hospital to Face COVID-19 Outbreak: The model of Parma, Emilia-Romagna REGION, ITALY. *Eur J Clin Invest* 2020;50(6): e13250.
4. Natale JAE, Boehmer J, Blumberg DA, Dimitriades C, Hirose S, Kair LR, Kirk JD, Mateev SN, McKnight H, Plant J, Tzimenatos LS, Wiedeman JT, Witkowski J, Underwood MA, Lakshminrusimha S, Interprofessional/interdisciplinary teamwork during the early Covid-19 pandemic: Experience from a CHILDREN'S hospital within an academic health center. *J Interprof Care* 2020;34(5):682-686.
5. Chang WY, Ma JC, Chiu HT, Lin KC, Lee PH, Job satisfaction and perceptions of quality of patient care, collaboration and teamwork in acute care hospitals. *J Adv Nurs* 2009;65(9):1946-1955.

6. Rawlinson C, Carron T, Cohidon C, Arditi C, Hong QN, Pluye P, Peytremann-Bridevaux I, Gilles I, An Overview of Reviews on Interprofessional Collaboration in Primary Care: Barriers and Facilitators. *Int J Integr Care* 2021;21(2):32.
7. Sollami A, Caricati L, Sarli L, Nurse-physician collaboration: a meta-analytical investigation of survey scores. *J Interprof Care* 2015;29(3):223-229.
8. Carradore M, Michelini E, Caretta I, Carpi S, Corradini L, Ganapini S, Lumetta F, Paterlini G, Pedroni E, Russo A, Sarli L, Artioli G, Interprofessional collaboration between different health care professions in Emilia Romagna. *Acta Biomed* 2021;92(S2):e2021033.
9. D'Amour D, Ferrada-Videla M, San Martin Rodriguez L, Beaulieu MD, The conceptual basis for interprofessional collaboration: Core concepts and theoretical frameworks. *J Interprof Care* 2005;19(sup1):116-131.
10. World Health Organization. 2010. Framework for action on interprofessional education and collaborative practice. Geneva, Switzerland: WHO.
11. Nair DM, Fitzpatrick JJ, McNulty R, Click ER, Glembocki MM, Frequency of nurse-physician collaborative behaviors in an acute care hospital. *J Interprof Care* 2012;26(2):115-120.
12. Reeves S, Lewin S, Espin S, Zwarenstein M. 2010. *Interprofessional Teamwork for Health and Social Care*. London: Blackwell-Wiley.
13. Perreault K, Careau E, Interprofessional collaboration: One or multiple realities? *J Interprof Care* 2012;26(4):256-258.
14. Barr H, Koppel I, Reeves S, Hammick M, Freeth D. 2005. *Effective interprofessional education: Argument, assumption and evidence*. Oxford: Blackwell.
15. Baggs JG, Schmitt MH, Mushlin AI, Mitchell PH, Eldredge DH, Oakes D, Hutson AD, Association between nurse-physician collaboration and patient outcomes in three intensive care units. *Crit Care Med* 1999;27(9):1991-1998.
16. Vegesna A, Coschignano C, Hegarty SE, Karagiannis T, Polenzani L, Messina E, Zoli R, Maio V, Attitudes towards physician-nurse collaboration in a primary care team-based setting: Survey-based research conducted in the chronic care units of the Tuscany region of Italy. *J Interprof Care* 2016;30(1):65-70.
17. Schraeder C, Shelton P, Sager M, The Effects of a Collaborative Model of Primary Care on the Mortality and Hospital Use of Community-Dwelling Older Adults. *J Gerontol A Biol Sci Med Sci* 2001;56(2):M106-M112.
18. Bujak JS, Bartholomew K, Transforming physician-nurse communication. Deteriorating relationships must be reversed for the benefit of patients, staff and the organization. *Healthc Exec* 2011;26(4):56-59.
19. Weiss SJ, Davis HP, Validity and reliability of the Collaborative Practice Scales. *Nurs Res* 1985;34(5):299-305.
20. Archibald D, Trumpower D, MacDonald CJ, Validation of the interprofessional collaborative competency attainment survey (ICCAS). *J Interprof Care* 2014;28(6):553-558.
21. Way D, Jones L, Baskerville NB. (2001). Improving the effectiveness of primary health care through nurse practitioner / family physician structured collaborative practice (Appendix Z). Ottawa: University of Ottawa. Retrieved Feb. 2, 2007. from [http://www.familymedicine.uottawa.ca/eng/nurse\\_physician.aspx](http://www.familymedicine.uottawa.ca/eng/nurse_physician.aspx)
22. Kenaszchuk C, Reeves S, Nicholas D, Zwarenstein M, Validity and reliability of a multiple-group measurement scale for interprofessional collaboration. *BMC Health Serv Res* 2010;10(1):1-15.
23. Prentice D, Jung B, Taplay K, Stobbe K, Hildebrand L, Staff perceptions of collaboration on a new interprofessional unit using the Assessment of Interprofessional Team Collaboration Scale (AITCS). *J Interprof Care* 2016;30(6):823-825.
24. Rettke H, Lehmann AI, Brauchli R, Bauer GF, Petry H, Spirig R, Capturing interprofessional collaboration between physicians and nurses in an acute care setting. A validation study of the revised German version of the Collaborative Practice Scales. *J Interprof Care* 2020;34(2):211-217.
25. Caricati L, Mancini T, Sollami A, Guidi C, Prandi C, Bianconcini M, Silvano R, Taffurelli C, Artioli G, Nurse-physician collaborative scale: A contribution to the Italian validation. *TPM - Testing, Psychometrics, Methodology in Applied Psychology* 2013;20:263-276.
26. di Giulio P, Arnfield A, English M, Fitzgerald E, Kelly D, Jankovic M, Gibson F, Collaboration between doctors and nurses in children's cancer care: Insights from a European project. *Eur J Oncol Nurs* 2013;17(6):745-749.
27. Alcusky M, Ferrari L, Rossi G, Liu M, Hojat M, Maio V, Attitudes Toward Collaboration Among Practitioners in Newly Established Medical Homes. *Am J Med Qual* 2016;31(6):526-535.
28. Tousijn W, Integrating health and social care: Interprofessional relations of multidisciplinary teams in Italy. *Curr Sociol* 2012;60(4):522-537.
29. Tonarelli A, Takeshi Yamamoto T, Foà C, Miraglia Raineri A, Artioli G, Baccarini E, Giampellegrini P, Masciangelo I, Moggi E, Toni D, Valcavi L, Sarli L, Italian Validation of the Chiba Interprofessional Competency Scale (CICS29). *Acta Biomed* 2020; 91(2-S):58-66.
30. Vittadello F, Mischo-Kelling M, Wieser H, Cavada L, Lochner L, Naletto C, Fink V, Reeves S, A multiple-group measurement scale for interprofessional collaboration: Adaptation and validation into Italian and German languages. *J Interprof Care* 2018;32(3):266-273.
31. Wieser H, Mischo-Kelling M, Vittadello F, Cavada L, Lochner L, Fink V, Naletto C, Reeves S, Perceptions of collaborative relationships between seven different health care professions in Northern Italy. *J Interprof Care* 2018;33(2):133-142.
32. Ragazzoni P, Baiardi P, Zotti AM, Anderson N, West M, Research note: Italian validation of the team climate inventory: A measure of team climate for innovation. *J Manag Psychol* 2002;17(4): 325-336.
33. Caricati L, Guberti M, Borgognoni P, Prandi C, Spaggiari I, Vezzani E, Iemmi M, The role of professional and team commitment in nurse-physician collaboration: A dual identity model perspective. *J Interprof Care* 2015;29(5):464-468.

34. Franc JM, Verde M, Gallardo AR, Careno L, Ingrassia PL, An Italian version of the Ottawa Crisis Resource Management Global Rating Scale: a reliable and valid tool for assessment of simulation performance. *Intern Emerg Med* 2017;12(5):651-656.
35. Caruso R, Magon A, Dellafiore F, Griffini S, Milani L, Stievano A, Orchard CA, Italian version of the Assessment of Interprofessional Team Collaboration Scale II (I-AITCS II): a multiphase study of validity and reliability amongst healthcare providers. *Med Lav* 2018;109(4):316-324.
36. Bentler PM, Comparative fit indexes in structural models. *Psychol Bull* 1990;107(2):238-246.
37. Byrne BM, 2012. Structural equation modeling with Mplus: Basic concepts, applications, and programming. Routledge/Taylor & Francis Group.
38. Browne MW, Cudeck R, Alternative Ways of Assessing Model Fit. *Sociol Methods Res* 1992;21(2):230-258.
39. Hu LT, Bentler PM, Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Model* 1999;6(1):1-55.
40. DiStefano C, McDaniel HL, Zhang L, Shi D, Jiang Z, Fitting Large Factor Analysis Models With Ordinal Data. *Educ Psychol Meast* 2019;79(3):417-436.
41. Marsh HW, Hau KT, Wen Z, In Search of Golden Rules: Comment on Hypothesis-Testing Approaches to Setting Cutoff Values for Fit Indexes and Dangers in Overgeneralizing Hu and Bentler's (1999) Findings. *Struct Equ Model* 2004;11(3):320-341.
42. Brown TA, (2015). *Confirmatory Factor Analysis for Applied Research, Second Edition (Methodology in the Social Sciences)* (Second ed.). The Guilford Press.
43. Taber KS, *The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education*. *Res Sci Educ* 2018;48:1273-1296.
44. Cazzola M, Hanania N, MacNee W, Rudell K, Hackford C, Tamimi N, A review of the most common patient-reported outcomes in COPD – revisiting current knowledge and estimating future challenges. *Int J Chron Obstruct Pulmon Dis* 2015;10:725-38
45. Nunnally J, Bernstein I, 1994. *Psychometric Theory*. New York: McGraw-Hill.

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