A multiple-group measurement scale for interprofessional collaboration: Adaptation and validation into Italian and German languages

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Abstract

This paper presents a study that aimed to validate a translation of a multiple-group measurement scale for interprofessional collaboration (IPC). We used survey data gathered over a three month period as part of a mixed methods study that explored the nature of IPC in Northern Italy. Following a translation from English into Italian and German the survey was distributed online to over 5,000 health professionals (dieticians, nurses, occupational therapists, physicians, physiotherapists, speech therapists and psychologists) based in one regional health trust. In total, 2,238 different health professions completed the survey. Based on the original scale, three principal components were extracted and confirmed as relevant factors for IPC (communication, accommodation and isolation). A confirmatory analysis (3-factor model) was applied to the data of physicians and nurses by language group. In conclusion, the validation of the German and Italian IPC scale has provided an instrument of acceptable reliability and validity for the assessment of IPC involving physicians and nurses.

Key terms: Interprofessional collaboration; interprofessional practice; survey; validation; multiple-group measurement

Introduction

This article describes the adaptation and validation of a multiple-group measurement scale for interprofessional collaboration (IPC) which was used in a study involving seven groups of health professions working in one regional health trust located in a tri-lingual region of Northern Italy (where German, Italian and Ladin are the official languages). The study originated from a growing acknowledgement from policymakers of the need for IPC to help address a number of societal challenges such as an aging population and a rise in multiple chronic diseases/conditions which demand effective coordination between different health providers (e.g. Epidemiologische Beobachtungsstelle des Landes Südtirol, 2010, 2014; Interprofessional Care Steering Committee, 2007; World Health Organization, 2010) IPC is increasingly being viewed as an important activity for achieving safe, high quality as well as more affordable care across clinical settings (e.g. Reeves, Lewin, Espin, & Zwarenstein, 2010; Reeves, Pelone, Harrison, Goldman, & Zwarenstein, 2017)

IPC has been defined as "a type of interprofessional work which involves different health and social care professions who regularly come together to solve problems or provide services" (Reeves et al., 2010, p. xi). As such, this type of activity requires regular negotiation between professionals to agree how they will work together when delivering patient care. As Strauss and colleagues (Strauss, 1964) have shown in their seminal sociological study on psychiatric institutions, these negotiated agreements are fluid and require continued (daily) re-negotiation. These insights were explored in later studies using different case studies (Strauss, 1978, 1993) which emphasized the complexity of 'doing things together' from which negotiation is one important social process among many others.

However, problematic issues such as limited understanding of others' clinical roles/responsibilities, professional boundary friction and imbalances of authority can undermine collaborative work (Baker, Egan-Lee, Martimianakis, & Reeves, 2011; Reeves et al., 2010). Research has also documented the impact of interprofessional communication problems on impeding clinical processes and outcomes, as well as seriously comprising patient safety (Lillebo & Faxvaag, 2015; Reeves, Clark, Lawton, Ream, & Ross, 2017). For example, failures of collaboration were found to be at the center of a number of reported health care problems (Francis, 2013; The Joint Commission, 2014). It is clear therefore that professionals need to ensure that they collaborate in an effective manner to deliver safe, high quality patient care.

Background

The paper is based on a study that aimed to generate an empirical account of the nature of IPC within the South Tyrolean Health Trust. Key objectives of this study were to: (1) understand the strengths and shortcomings of IPC in this European region; (2) develop an insight into the kind of specific interprofessional interventions or support measures (e.g. education, organizational structures) needed to improve IPC.

A key activity within this study was the adaptation and validation of an IPC scale (Kenaszchuk, Reeves, Nicholas, & Zwarenstein, 2010). The rationale for choosing this scale was that it enabled us to evaluate perceptions of collaboration of more than two professional groups. In doing so, it allowed us to go beyond scales which only measure nurse-physician collaboration (Lindeke & Sieckert, 2005; Pomari, 2009; Refatti & Bevilacqua, 2007; Ushiro, 2009) or other dyadic relationships. As our literature searches did

not reveal a similar scale in the languages of our region, the Kenaszchuk et al (2010) scale was selected, despite the fact it was only available in English.

When one examines the literature, the vast bulk of instruments in the interprofessional field are only available in English, having for the most part been developed in either the US, Canada or the UK. The wide range of quantitative tools reported by the Canadian Interprofessional Health Collaborative (CIHC, 2012) are, with a few exceptions, all in English. This is also the case when one accesses the National US Center for Interprofessional Practice and Education (2017) which contains an extensive collection of different interprofessional evaluative scales. As a result, there is a need for such instruments in other languages.

Translating evaluative scales

A number of different procedures are described for translating "assessment instruments of various kinds" from one language (source language) into another one (target language). For example, the guidelines proposed by (Beaton, Bombardier, Guillemin, & Ferraz, 2000), take into account not only the "process of language" (translation) but also the process of "cultural adaptation". Both processes are important in order to "produce equivalency between source and target based on content" (Beaton et al., 2000, p. 3187). In short these describe the following stages: (1) initial translation; (2) synthesis; (3) back translation; (4) expert committee; (5) test of the pre-final version; and (6) all previous stages are submitted to scale developers or a coordinating committee for final appraisal. A similar translation process has been reported in a study conducted by (Nordin, Elf, McKee, & Wijk,

2015). The translation and cultural adaptation process can however vary from one study to another. (Chen & Boore, 2010; Wild et al., 2005; Zeneli et al., 2016)

(Epstein, Osborne, Elsworth, Beaton, & Guillemin, 2015) address the problem of cross-cultural adaptations of existing instruments. They stress that the overall goal of these procedures is that the translated survey produces data that are equivalent to the original version. In their study they tested the relative contribution of the back-translation and an interprofessional committee to the content and psychometric validity of the translation of a multidimensional tool. The results gave rise to the following recommendations: "First, to secure content accuracy, a multidisciplinary committee should be involved and supported by clear guidelines with members who are experienced in questionnaire development and validation, including some bilingual experts. Second, back-translation can be avoided in circumstances in which the original questionnaire is robust and the committee is reasonable proficient with the source language. The back-translation remains critical for communication with the author when he/she has inadequate proficiency in the target language. Third, the main threats to translation accuracy appear to be variations in style, intensity, frequency/time frame, breadth, and meaning. Each of these threats should be considered throughout the adaptation process." (Epstein et al., 2015, p. 368). We employed the guidelines outlined by Epstein and colleagues to help orientate our translation work.

Below we describe the process of enhancement and adaptation of the original IPC scale. We then present the results of the validity and reliability analysis on this instrument by

replicating the statistical tests used by Kenaszchuk et al. (2010). Finally, we discuss our findings in relation to the wider interprofessional literature.

Methods

IPC Scale

The multi-group measurement scale for IPC developed by Kenaszchuk et al. (2010) was the result of a review of IPC measurement scales in which the authors did not find any scale with "multiple rater/target groups". They therefore validated a newly constructed instrument in which 13 statements are rated by the participants on a 4-point likert scale, and can be allocated to three key factors of IPC – communication, accommodation, and isolation. The authors concluded from the results of their validation and reliability tests that the scale was suitable for use with nurses assessing physicians.

Despite the reported limitations of this scale we saw a number of benefits in using it with another interprofessional study population in a different country. Mindful of the argument that the IPC scale, "may not be suitable for judgments of allied health care professionals considered as a homogeneous group" (Kenaszchuk et al., 2010, p. 13), we decided to attempt to adapt this scale in such a way that it was suitable for multiple target groups. Therefore we enhanced and adapted this instrument into German and Italian, and tested the new version in these two European languages.

Adapting the IPC Scale

Unlike the original scale in which professions other than physicians and nurses have been collapsed together in the umbrella term "allied health care professions" we decided to

differentiate between these various professions. Indeed, we felt that the scale did not provide concrete information of, for example, how a physiotherapist or occupational therapist may collaborate with a physician or a nurse or vice versa. We therefore reasoned that the IPC scale needed adaptation in order to measure IPC among a wider group of health care professions. It was anticipated that the adaptation would enable us to produce a more nuanced picture of how different professional groups assessed the nature of their collaborative relations with the other professions. Such a modification was seen as necessary to produce data to address our stated research objectives, and to generate a detailed account of the nature of IPC in the South Tyrol region.

We used the following inclusion criteria for deciding which professions we would invite to participate in our study: "a health care profession who frequently works with chronically ill patients and has an academic degree (or equivalent)." According to these criteria, the following professional groups were included: physicians, nurses, dieticians, occupational therapists, physiotherapists, speech therapists and psychologists. As a result of including seven professional groups, we needed to revise the original IPC scale and adapt the wording of the statements so the content suited all the professions being assessed by each other. This part of the paper goes on to describe this process.

Scale enhancement and transfer into German and Italian versions

Below are the 13 statements of the original IPC scale in which physicians assessed nurses:

1. "Doctors have a good understanding with the nurses about our respective responsibilities.

2. Nurses are usually willing to take into account the convenience of doctors when planning their work.

3. I feel that patient treatment and care are not adequately discussed between doctors and nurses.

4. Medical staff and nurses share similar ideas about how to treat patients.

5. Nurses are willing to discuss medicine issues.

6. Nurses cooperate with the way we organize medical care.

7. Nursing staff would be willing to cooperate with new medical care practices.

8. The nurses do not usually ask for medical staff's opinions.

9. Nursing staff anticipate when doctors will need their help.

10. Important information is always passed on from doctors to nurses.

11. Disagreements with nurses often remain unresolved.

12. Nurses think their work is more important than the work of medical staff.

13. Nurses would not be willing to discuss their new practices with doctors" .

In the original scale, the same statements were used for assessing "allied health care professions" by substituting the word "nurses" with "allied health care professionals" as exemplified in the following two statement marked in italics:

- Doctors have a good understanding with the *allied health care professionals* about our respective responsibilities.

- *Allied health care professionals* would not be willing to discuss their new practices with doctors.

To amend the scale to become more inclusive of different professional groups we needed to substitute the terms 'doctors', 'nurses' or 'allied health care professions' with a general term which applies to every profession. While the terms like doctor and nurse are specific, finding a general term for 'profession' which transports the same meaning across three languages is problematic. The English word profession is easier to translate into the Italian than into German. In the German language, profession has a specific meaning which did not cover all the groups we wanted to include in the revised IPC scale. Therefore the word "Berufsgruppe" was chosen, a much broader term which can be applied to all kinds of work while in the Italian language, the preferred general term was "figura professionale".

We had to use the term profession in such a way that it referred in each case to the assessing profession as well as to the profession being assessed. This was a linguistic challenge and led to some reversals in the wording of the statement. Our overall linguistic goal was to reformulate the statements in such a way that the original content was preserved analogously but that the wording of the statements were appropriate to all professions. (Fawcett, 2014) describes several strategies for translations and the linguistic theories behind these procedures. From his description it becomes clear that the "reality of language in use" is not as clear-cut as one might hope and for this reason translating a text from one language into another is always an approximation where each approach or translation strategy has its limitations.

Since our translational work was combined with the transformation of the original scale into one which could be used by different professions we undertook our work in all three languages at the same time. All members of the research team have been involved in this

process except CN. All members speak and read English. English is the first language of one member, German of four members and Italian of three members. In addition, four German and two Italian speaking members of the team speak both German and Italian. Furthermore, the research team represent most of the professions who were involved in the study. The team carefully discussed each step of this work process in order to assure that statements "fit" the respective target language. The translation process was based on the procedure described by World Health Organization (WHO, 2015) which includes four steps: forward translation; expert panel back-translation; pre-testing and cognitive interviewing before the final version is ready for use. For the adaption work this meant that statements were translated forward and backwards from the Italian (FV, LC) and German (MMK, HW, LL, VF) native speaking team members until we reached a point of general consensus. An outcome of this process was that we agreed to change item numbers 3, 8, 11 and 13 (which are written in a negative form in the original scale) into the positive statements.

Once we had reached consensus within the research team regarding the translation of the scale, we undertook a pre-testing phase. For testing the comprehensibility of the translated and adapted questions we asked ten individuals (who presented the professions in our study) to provide feedback. These individuals represented our targeted language groups and all were familiar with the clinical work of our study population. We used their feedback for enhancing our translation and adaptation as well as the survey. Exemplars of statements of the final version of the IPC scale are presented in Box 1.

INSERT BOX 1 ABOUT HERE

Data collection

We decided to access our target groups via an online-survey, using the Survey Monkey software. Before utilizing this software we undertook a pilot phase using printed versions of the survey with the same ten individuals mentioned above. Following the development of an online version of the survey in Italian and German we completed a technical testing phase to ensure that our intended study participants could easily access and complete the survey. After final modifications, the dual language survey was ready for online distribution.

A total of 5,070 individual professionals were approached (from a total of 5,226 working at the health trust) and invited to participate in the study. Individuals were recruited from seven general hospitals and from all the community services of the four health districts of the South Tyrolean Health Trust. Each received an invitation email to participate at the survey and a web link to get access to the survey. The survey was accompanied by information explaining the purpose of the study, providing the researchers' affiliations and contact information, and informing that the answers would be treated confidentially and anonymously. At the end of the data collection period, 2,238 of those invited completed the survey – 1,554 respondents (69.4%) answered the survey in German and 684 (30.6%) answered it in Italian.

Statistical analysis

All survey data were downloaded and a database of completed surveys was constructed and prepared in IBM SPSS (v18.0) format for analysis. Categorical variables were analyzed by descriptive statistics, counts and percentages. Confirmatory factor analysis was applied to determine factorial/construct validity. Tucker – Lewis index (TLI, acceptable fit > 0.90), Comparative fit index – (CFI, acceptable fit > 0.90), Root Mean Square Error of

Approximation (RMSEA, acceptable fit < 0.08) Weighted Root Mean Square Residual (WRMR, acceptable fit < 1) were calculated for evaluating model fit. Cronbach's alpha was calculated in order to assess internal consistency. All tests were two-tailed with the significance level set at $p < 0.05$. All data were analyzed with the Statistical Package for Social Sciences (IBM Ver. 18.0) and Mplus software Ver. 6, (Muthen and Muthen, 2010). In the next section we present the results of the construct validity and the reliability of the scale.

For the validation procedure we only included data where respondents declared that they had worked at least once a month together with one or more of our target professions. Even though we gathered an empirical insight into the perceptions of IPC by seven different professions, the statistical procedures for validating the scale could only be undertaken with two professions (medicine and nursing) due to the small numbers of the other five professional groups (dieticians, occupational therapists, physiotherapists, speech therapists and psychologists).

Ethical approval

The study was approved by the Ethical committee of the Health district of Bolzano – "Comitato Etico del Comprensorio Sanitaria di Bolzano" (Reference number: 81/2013).

Results

Response rates

We reached different response rates for our target groups. Response rates ranged from 24.4 % (337 from 1,380) for physicians to 72.6% (45 from 62) for dieticians. Nurses

reached a response rate of 47.5% (1,532 from 3,225) while occupational therapists had a rate of 68.8% (44 from 64), speech therapists a rate of 64% (71 from 111), physiotherapists 62% (132 from 213), and finally psychologists reached a response rate of 45% (77 from 171).

Construct validity: factor analysis

A confirmatory factor analysis was conducted on raw data by Mplus to confirm that the scale items principally load on the same three factors (communication, accommodation and isolation) identified by Kenaszchuk et al. (2010) and correlate weakly with other factors. A model, based on a priori information from exploratory factor analysis, was constructed in order to specify latent factors, their component variables, and the inter-correlations of the response variables.

Because of the low number of completed questionnaires by five of the target professions (dieticians, occupational therapists, physiotherapists, psychologists, speech therapists) which were due to the numbers of employment (response rate of the professions ranges from 45% to 73%), the validation analysis was conducted only considering the data by physicians and nurses. The analysis was performed separately on data by physicians evaluating nurses and on data by nurses evaluating physicians. The number of cases available in the first analysis (physicians evaluating nurses) was 123 (Italian language) and 195 (German language) respectively. In order to confirm the 3-factor–model (communication, accommodation and isolation) identified by (Kenaszchuk et al., 2010), a confirmatory analysis was applied on our data. The results were satisfactory for the questionnaires in the two languages. For the Italian version, the following values were

obtained: RMSEA= 0.124, WRMR=0.925, CFI= 0.963 , TLI=0.980. For the German version, values were: RMSEA=0.090, WRMR= 0.781, CFI= 0.955 and TLI=0.985.

The number of nurses evaluating physicians available for the analysis was 435 (Italian language) and 1,063 (German language) respectively. Also for this profession the results were acceptable: For the Italian version, Root mean square error of approximation (RMSEA) and Weighted Root Mean Square (WRMR) values were 0.108 (RMSEA) and 1.091 (WRMR), while CFI and TLI values were equal to 0.960 and 0.990 respectively. Concerning the responses in German language, the values of the indices were 0.069 (RMSEA), 1.202 (WRMR), CFI= 0.966, TLI=0.991.

INSERT TABLE 1 ABOUT HERE

In Table 2 and Table 3 factor pattern coefficients for the items are presented: for items number 1, 2, and 8 the factor loadings were fixed at 1 and each factor's variance was estimated.

INSERT TABLES 2 AND 3 ABOUT HERE

R-squared values for the items are presented in Table 4. Both for the Italian and German version of the questionnaire, item nr. 12 appears to be weakest in comparison with the other statements.

INSERT TABLE 4 ABOUT HERE

Reliability of scales

Internal consistency reliability of the IPC factors was estimated with Cronbach's reliability statistic. George and Mallery (2003) provide the following rules of thumb: ">0.9 = Excellent, >0.8 = Good, >0.7 = Acceptable, > 0.6 = Questionable, >0.5 = Poor, and <0.5 – Unacceptable".

For physicians' IPC scale assessments of nurses (Italian language), reliability was 0.81, 0.89, and 0.57 (communication, accommodation, isolation). For physicians' IPC scale assessments of nurses in German language, reliability was 0.80, 0.85, and 0.64 (communication, accommodation, isolation). Evaluating all items together, the Cronbach's alpha was 0.91 both for the Italian and German version. For nurses' IPC scale assessments of physicians (Italian language), reliability was 0.80, 0.92, and 0.53 (communication, accommodation, isolation), while for the German language reliability was respectively 0.77, 0.86, and 0.72. Evaluating all items together, the Cronbach's alpha was 0.92 for German version and 0.92 for Italian version

INSERT TABLE 5 ABOUT HERE

In Tables 6 and 7 are also reported the values of correlation of the item with the summated score for all other items. Among physicians rating nurses at all sites, r values ranged from 0.227 to 0.809 (Italian language) and from 0.402 to 0.750 (German language). Concerning nurses rating physicians, r values ranged from 0.167 to 0.810 (Italian language) and from 0.354 to 0.731 (German language). Two of the items (8 and 13) contribute well to overall reliability, both for physicians and nurses, as Cronbach's alpha would sensibly decrease if deleted. This is more evident in the Italian than German language.

INSERT TABLES 6 AND 7 ABOUT HERE

Discussion

We adapted the English version of the IPC scale by Kenaszchuk et al. (2010) as we wanted to use a validated scale in order to evaluate the current state of IPC between seven professions working in the South Tyrolean Health Trust. As noted above, as there were no

validated scale in either German and Italian languages we adapted and translated the Kenaszchuk and colleagues (2010) scale.

Even though we gathered data from seven professional groups, our validation process was conducted on surveys from the physicians and nurses due to the small numbers of these other professions. A confirmatory factor analysis (3-factor–model) was applied on the medical and nursing data, divided by language group. The three IPC factors - communication, accommodation and isolation - identified by Kenaszchuk et al. (2010) were evaluated in our study and compared well with the original results. The values of RMSEA and WRMR for the German version were 0.09 and 0.78 (on physicians responses), 0.07 and 1.20 (on nurse responses), respectively. These values are in acceptable ranges and similar to those obtained for the English version (RMSEA: 0.07, WRMR: 0.84, obtained on nurse responses). The German version of the survey highlighted a better performance and seemed to fit better the original version, as the values of RMSEA and WRMR for the Italian version were 0.12 and 0.93 (on physicians responses), 0.11 and 1.09 (on nurse responses). While in the analysis by Kenaszchuk et al. (2010) all coefficients were statistically significant our analysis did not produce the same results as three items (1, 2 and 8) were not significant.

Concerning the reliability statistics for scales, analyzed by Cronbach's alpha, results were acceptable (>0.70), with a satisfactory correlation – mostly over 0.50 with a slight difference between the Italian and German version - between the items and the factors to whom they belong. Examining the corrected item total correlation we identified that they are always high except of item number 12 (Italian version of the survey) and both for

physicians and nurses. Another item that seemed to correlate lower with the factor was item 10, but only for nurses in both languages. For both items, the different performances could be explained by considering the current existing hierarchy between these two professions.

The interprofessional literature has employed a range of different scales to assess various aspects of IPC (Hepp et al., 2015; Kim & Ko, 2014; Korner, Wirtz, Bengel, & Goritz, 2015; Odegard & Bjorkly, 2012; Orchard, King, Khalili, & Bezzina, 2012) . To our knowledge no other study has used an IPC scale for an adaptation and translation into two different languages. The study therefore provides a unique contribution to the interprofessional measurement literature. We anticipate that the adapted and translated scale will be of use to IPC researchers in both Germany and Italy.

In regards study limitations, a key limitation with this work was that we could did not test the adapted scale with English speaking target groups. Therefore for us it was not possible to find out if the same analysis would produce comparable results with this specific language group.

In summary, our analysis shows that our translation of the IPC scale into German and Italian provides an instrument of acceptable reliability and validity for IPC assessment for physicians and nurses. in addition, the results reported in this paper go beyond those reported by Kenaszchuk et al. (2010) as we found that our adapted scale is not only suitable for nurses to assess physicians but also for physicians to assess nurses involving a German and/or an Italian speaking study population.

References

Baker, L., Egan-Lee, E., Martimianakis, M. A., & Reeves, S. (2011). Relationships of power: implications for interprofessional education. *Journal of Interprofessional Care, 25*(2), 98-104. doi: (10.3109/13561820.2010.505350)

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine, 25*(24), 3186-3191.

Canadian Interprofessional Health Collaborative (CIHC). (2012). An Inventory of Quantitative Tools Measuring Interprofessional Education and Collaborative Practice Outcomes. CIHC: Vancouver.

Chen, H. Y., & Boore, J. R. (2010). Translation and back-translation in qualitative nursing research: methodological review. *Journal of Clinical Nursing, 19*(1-2), 234-239. doi: 10.1111/j.1365-2702.2009.02896.x

Epidemiologische Beobachtungsstelle des Landes Südtirol. (2010). *Gesundheitsbericht, Bozen*. Retreived from: www.provinz.bz.it/eb

Epidemiologische Beobachtungsstelle des Landes Südtirol. (2014). *Landesgesundheitsbericht*. Retreived from: www.provinz.bz.it/eb

Epstein, J., Osborne, R. H., Elsworth, G. R., Beaton, D. E., & Guillemin, F. (2015). Cross-cultural adaptation of the Health Education Impact Questionnaire: experimental study showed expert committee, not back-translation, added value. *Journal of Clinical Epidemiology, 68*(4), 360-369. doi: 10.1016/j.jclinepi.2013.07.013

Fawcett, P. (2014). *Translation and Language. Linguistic Theories Explained*. Oxon, New York: Routledge.

Francis, R. (2013) *Report of the Mid Staffordshire NHS Foundation Trust inquiry*. London: The Stationary Office.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference*. 11.0 update. Boston: Allyn & Bacon

Hepp, S. L., Suter, E., Jackson, K., Deutschlander, S., Makwarimba, E., Jennings, J., & Birmingham, L. (2015). Using an interprofessional competency framework to examine collaborative practice. *Journal of Interprofessional Care, 29*(2), 131-137. doi: 10.3109/13561820.2014.955910

Interprofessional Care Steering Committee. (2007). Interprofessional Care: A blueprint for Action. Ontario Ministry for Health and Long Term Care: Toronto.

Kenaszchuk, C., Reeves, S., Nicholas, D., & Zwarenstein, M. (2010). Validity and reliability of a multiple-group measurement scale for interprofessional collaboration. *BMC Health Service Research, 10*, 83. doi: 10.1186/1472-6963-10-83

Kim, K., & Ko, J. (2014). Attitudes toward interprofessional health care teams scale: a confirmatory factor analysis. *Journal of Interprofessional Care, 28*(2), 149-154. doi: 10.3109/13561820.2013.857645

Korner, M., Wirtz, M. A., Bengel, J., & Goritz, A. S. (2015). Relationship of organizational culture, teamwork and job satisfaction in interprofessional teams. *BMC Health Services Research, 15*, 243. doi: 10.1186/s12913-015-0888-y

Lillebo, B., & Faxvaag, A. (2015). Continuous interprofessional coordination in perioperative work: an exploratory study. *Journal of Interprofessional Care, 29*(2), 125-130. doi: 10.3109/13561820.2014.950724

Lindeke, L. L., & Sieckert, A. M. (2005). Nurse-physician workplace collaboration. *Online Journal Issues in Nursing, 10*(1), 5. Retrieved from: http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume102005/No1Jan05/tpc26_416011.html

Muthen and Muthen. (2010). Mplus software.

National US Center for Interprofessional Practice and Education.(2017). *Resource exchange*. Retrevied from: https://nexusipe.org/informing/resource-center/

Nordin, S., Elf, M., McKee, K., & Wijk, H. (2015). Assessing the physical environment of older people's residential care facilities: development of the Swedish version of the Sheffield Care Environment Assessment Matrix (S-SCEAM). *BMC Geriatr, 15*, 3. doi: 10.1186/1471-2318-15-3

Odegard, A., & Bjorkly, S. (2012). A mixed method approach to clarify the construct validity of interprofessional collaboration: an empirical research illustration. *Journal of Interprofessional Care, 26*(4), 283-288. doi: 10.3109/13561820.2011.652784

Orchard, C. A., King, G. A., Khalili, H., & Bezzina, M. B. (2012). Assessment of Interprofessional Team Collaboration Scale (AITCS): development and testing of the instrument. *Journal of Continuing Educatio in the Health Professions, 32*(1), 58-67. doi: 10.1002/chp.21123

Pomari, C. (2009). Studio descrittivo sugli atteggiamenti riguardanti la collaborazione medico-infermiere in un Azienda Sanitaria Locale Veneta. *Professioni Infermieristiche, 62*(2), 109-119.

Reeves, S., Clark, E., Lawton, S., Ream, M., & Ross, F. (2017). Examining the nature of interprofessional interventions designed to promote patient safety: a narrative review. *International Journal for Quality in Health Care, 29*(2), 144-150. doi: 10.1093/intqhc/mzx008

Reeves, S., Lewin, S., Espin, S., & Zwarenstein, M. (2010). *Interprofessional Teamwork in Health and Social Care*. Oxford: Wiley-Blackwell.

Reeves, S., Pelone, F., Harrison, R., Goldman, J., & Zwarenstein, M. (2017). Interprofessional collaboration to improve professional practice and healthcare outcomes. *Cochrane Database Syst Rev, 6*, CD000072. doi: 10.1002/14651858.CD000072.pub3

Refatti, C., & Bevilacqua, A. (2007). L'integrazione tra infermiere e medico nelle medicine. Risultati di un'indagine. *Assistenza Infermieristica e Ricerca 26*(1), 32-37.

Strauss, A. (1964). *Psychiatric ideologies and institutions*. New York: Free Press of Glencoe.

Strauss, A. (1978). *Negotiations: Varieties, Contexts, Processes, and Social Order*: Jossey-Bass Publishing: San Francisco.

Strauss, A. (1993). *Continual Permutations of Action*: Aldine de Gruyter.

The Joint Commission. (2014). *Sentinel Event Data - Root Causes by Event Type*. Retrieved from : http://www.tsigconsulting.com/tolcam/wp-content/uploads/2015/04/TJC-Sentinel-Event-Root_Causes_by_Event_Type_2004-2014.pdf

Ushiro, R. (2009). Nurse-Physician Collaboration Scale: development and psychometric testing. *Journal of Advanced Nursing, 65*(7), 1497-1508. doi: 10.1111/j.1365-2648.2009.05011.x

Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A., . . . ISPOR Task Force for Translation & Cultural Adaptation. (2005). Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. *Values in Health, 8*(2), 94-104. doi: 10.1111/j.1524-4733.2005.04054.x

World Health Organization. [WHO]. (2015). *Process of translation and adaptation of instrument without year translation*. Retrieved from: http://www.who.int/substance_abuse/research_tools/translation/en/

World Health Organization. [WHO] (2010). *Framework for action on interprofessional education and collaborative practice*. Retrieved from: http://www.who.int/hrh/resources/framework_action/en

Zeneli, A., Fabbri, E., Donati, E., Tierney, G., Pasa, S., Berardi, M. A., & Maltoni, M. (2016). Translation of Supportive Care Needs Survey Short Form 34 (SCNS-SF34) into Italian and cultural validation study. *Support Care Cancer, 24*(2), 843-848. doi: 10.1007/s00520-015-2852-0

Box 1: Exemplar statements of the final version of the IPC scale

Example 1 (statement 2):

Original: *The other profession is usually willing to take into account the convenience of us when planning their work*

German: *Die andere Berufsgruppe ist in der Regel bereit, unsere Arbeit bei der Planung ihrer Arbeit zu berücksichtigen (German)*

Italian: *L'altra figura professionale è solitamente disposta a facilitare la mia figura nella pianificazione del lavoro*

Example 2 (statement 10):

Original: *Important information is always passed on from us to the other profession*

German: *Wichtige Informationen werden von meiner Berufsgruppe an die andere Berufsgruppe weitergegeben*

Italian: *La mia figura comunica sempre le informazioni importanti all'altra figura professionale*

Example 3 (statement 13):

Original: *The other profession is willing to discuss their new practices with us*

German: *Die andere Berufsgruppe ist bereit, ihre neuen Arbeitsweisen mit meiner Berufsgruppe zu diskutieren*

Italian: *L'altra figura professionale è disposta a discutere con la mia figura le sue nuove modalità lavorative*

Table 1: Confirmatory factor analysis results

	Physicians rating nurses		Nurses rating physicians	
	Italian language	German language	Italian language	German language
RMSEA	0.124	0.090	0.108	0.069
WRMR	0.925	0.781	1.091	1.202
CFI	0.963	0.955	0.960	0.966
TLI	0.980	0.985	0.990	0.991

Table 2: Full confirmatory factor analysis model, full validation dataset – physician respondents about nurses (completely standardized coefficients)

	Italian version			German version		
Communication	Estimate	S.E.	P-Value	Estimate	S.E.	P-Value
1. We have a good understanding with the other profession about our respective responsibilities.	1.000	0.000	0.999	1.000	0.000	0.999
3. I feel that patient care is adequately discussed between us and the other profession.	0.931	0.047	0.000	1.022	0.068	0.000
9. The other profession is anticipate when we will need their help.	0.788	0.066	0.000	0.990	0.069	0.000
10. Important information is always passed on from us to the other profession.	0.708	0.082	0.000	0.928	0.085	0.000
11. Disagreements with the other profession are often resolved.	0.966	0.053	0.000	1.123	0.062	0.000
Accommodation						
2. The other profession is usually willing to take into account the convenience of us when planning their work.	1.000	0.000	0.999	1.000	0.000	0.999
4. The other profession and we share similar ideas about how to care patients.	1.080	0.056	0.000	0.999	0.056	0.000
5. The other profession is willing to discuss with us clinical issues.	1.107	0.060	0.000	1.019	0.061	0.000
6. The other profession cooperate with the way we organize patient care.	1.140	0.062	0.000	1.131	0.056	0.000
7. The other profession is willing to cooperate with us concerning new practices.	1.038	0.055	0.000	1.064	0.054	0.000
Isolation						
8. The other profession does usually ask for our opinions.	1.000	0.000	0.999	1.000	0.000	0.999
12. The other profession think their work is more important than ours.*	0.330	0.096	0.001	0.642	0.084	0.000
13. The other profession is willing to discuss their new practices with us.	0.966	0.066	0.000	0.961	0.061	0.000

* We organized the analysis in such a way that this item was interpreted as "The other profession does not think their work is more important than ours".

Table 3: Full confirmatory factor model, full validation dataset – nurse respondents about physicians (completely standardized coefficients)

	Italian version			German version		
Communication	Estimate	S.E.	P-Value	Estimate	S.E.	P-Value
1. We have a good understanding with the other profession about our respective responsibilities.	1.000	0.000	0.999	1.000	0.000	0.999
3. I feel that patient care is adequately discussed between us and the other profession.	0.972	0.028	0.000	1.175	0.038	0.000
9. The other profession is anticipate when we will need their help.	0.965	0.027	0.000	1.107	0.037	0.000
10. Important information is always passed on from us to the other profession.	0.412	0.064	0.000	0.647	0.049	0.000
11. Disagreements with the other profession are often resolved.	0.969	0.024	0.000	1.131	0.037	0.000
Accommodation						
2. The other profession is usually willing to take into account the convenience of us when planning their work.	1.000	0.000	0.999	1.000	0.000	0.999
4. The other profession and we share similar ideas about how to care patients.	0.987	0.024	0.000	1.004	0.027	0.000
5. The other profession is willing to discuss with us clinical issues.	0.983	0.020	0.000	1.042	0.023	0.000
6. The other profession cooperate with the way we organize patient care.	0.987	0.021	0.000	1.074	0.023	0.000
7. The other profession is willing to cooperate with us concerning new practices.	0.985	0.020	0.000	1.055	0.023	0.000
Isolation						
8. The other profession does usually ask for our opinions.	1.000	0.000	0.999	1.000	0.000	0.999
12. The other profession think their work is more important than ours.*	0.250	0.061	0.000	0.785	0.030	0.000
13. The other profession is willing to discuss their new practices with us.	0.900	0.029	0.000	0.999	0.022	0.000

* We organized the analysis in such a way that this item was interpreted as "The other profession does not think their work is more important than ours."

Table 4: R square values – nurse respondents about physicians

Item	Italian version		German version	
	Estimate	*Residual Variance*	*Estimate*	*Residual Variance*
1. We have a good understanding with the other profession about our respective responsibilities.	0.770	0.230	0.540	0.460
2. The other profession is usually willing to take into account the convenience of us when planning their work.	0.685	0.315	0.619	0.381
3. I feel that patient care is adequately discussed between us and the other profession.	0.668	0.332	0.564	0.436
4. The other profession and we share similar ideas about how to care patients.	0.799	0.201	0.617	0.383
5. The other profession is willing to discuss with us clinical issues.	0.839	0.161	0.642	0.358
6. The other profession cooperate with the way we organize patient care.	0.890	0.110	0.792	0.208
7. The other profession is willing to cooperate with us concerning new practices.	0.738	0.262	0.700	0.300
8. The other profession does usually ask for our opinions.	0.814	0.186	0.643	0.357
9. The other profession is anticipate when we will need their help.	0.478	0.522	0.529	0.471
10. Important information is always passed on from us to the other profession.	0.386	0.614	0.465	0.535
11. Disagreements with the other profession are often resolved.	0.718	0.282	0.682	0.318
12. The other profession think their work is more important than ours.	0.088	0.912	0.265	0.735
13. The other profession is willing to discuss their new practices with us.	0.760	0.240	0.594	0.406

Table 5: Cronbach's alpha values

	Physicians rating nurses		Nurses rating physicians	
	Italian language	German language	Italian language	German language
Overall	0.91	0.91	0.92	0.92
Communication	0.81	0.80	0.80	0.77
Accommodation	0.89	0.85	0.92	0.86
Isolation	0.57	0.64	0.53	0.72

Table 6: Reliability statistics of scales and by type: physician responses

Physician respondents about nurses	Corrected Item-Total Correlation		Cronbach's Alpha if Item Deleted	
Communication	Italian	German	Italian	German
1. We have a good understanding with the other profession about our respective responsibilities	.653	.545	.762	.771
3. I feel that patient care is adequately discussed between us and the other profession.	.704	.578	.748	.760
9. The other profession is anticipate when we will need their help.	.530	.580	.810	.760
10. Important information is always passed on from us to the other profession.	.506	.527	.804	.776
11. Disagreements with the other profession are often resolved.	.663	.678	.761	.727
Accommodation	Italian	German	Italian	German
2. The other profession is usually willing to take into account the convenience of us when planning their work	.660	.612	.877	.832
4. The other profession and we share similar ideas about how to care patients.	.732	.608	.861	.834
5. The other profession is willing to discuss with us clinical issues.	.735	.643	.860	.825
6. The other profession cooperate with the way we organize patient care	.809	.750	.842	.796
7. The other profession is willing to cooperate with us concerning new practices.	.702	.707	.869	.809
Isolation	Italian	German	Italian	German
8. The other profession does usually ask for our opinions.	.488	.506	.345	.492
12. The other profession think their work is more important than ours.	.227	.402	.789	.656
13. The other profession is willing to discuss their new practices with us	.500	.482	.298	.498

Table 7: Reliability statistics of scales and by type: nurse resposes

Nurse respondents about physicians	Corrected Item-Total Correlation		Cronbach's Alpha if Item Deleted	
Communication	Italian	German	Italian	German
1. We have a good understanding with the other profession about our respective responsibilities	.635	.520	.750	.734
3. I feel that patient care is adequately discussed between us and the other profession.	.649	.636	.740	.692
9. The other profession is anticipate when we will need their help.	.661	.578	.736	.714
10. Important information is always passed on from us to the other profession.	.282	.354	.838	.782
11. Disagreements with the other profession are often resolved.	.712	.616	.716	.699
Accommodation	Italian	Germ	Italian	Germ
2. The other profession is usually willing to take into account the convenience of us when planning their work	.743	.654	.904	.842
4. The other profession and we share similar ideas about how to care patients.	.784	.666	.896	.838
5. The other profession is willing to discuss with us clinical issues.	.775	.685	.898	.834
6. The other profession cooperate with the way we organize patient care	.803	.731	.892	.823
7. The other profession is willing to cooperate with us concerning new practices.	.810	.685	.890	.833
Isolation	Italian	Germ	Italian	Germ
8. The other profession does usually ask for our opinions.	.462	.570	.246	.593
12. The other profession think their work is more important than ours.	.167	.486	.725	.704
13. The other profession is willing to discuss their new practices with us	.451	.570	.266	.597