Development and Validation of Performance Assessment Tools for Interprofessional Communication and Teamwork (PACT)

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Abstract

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Background: Medical errors caused by breakdowns in teamwork and interprofessional communication contribute to many deaths in the United States each year. Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) is an evidence-based teamwork system developed to improve communication and teamwork skills among health care professionals to combat these breakdowns. Preparing pre-licensure health profession trainees with efficient interprofessional communication and teamwork skills was proposed as a possible solution. However, the effectiveness of such trainings was inconclusive. Evaluating the effectiveness of training requires reliable and valid measures of teamwork and interprofessional communication skills. The research team was not successful in finding existing validated tools.

The" Performance Assessment for Interprofessional Communication and Teamwork" (PACT) tools were developed for this specific purpose.

Objectives: This dissertation consists of two papers. The objective of the first paper is to describe the processes, challenges and lessons learned during the development stage of the PACT tools. The objectives of the second paper are to 1) describe the pilot study using the PACT tools and 2) summarize the validity evidence for the PACT tools.

Methods: A literature search was performed to identify existing tools that evaluate teamwork, team performance, and team communication. Items from these tools were compiled and reviewed by an expert panel. After several iterations, the PACT tools were created for different uses. Pilot data were collected in 2010 from six interprofessional student teams (49 students total) each practicing communication skills in three acute simulated scenarios. The PACT tools were then modified based on the feedback received.

The validity evidence was gathered for the final PACT tools in 2011. Approximately 500 students from a medicine, nursing, pharmacy, and physician assistant (PA) program were recruited to participate in TeamSTEPPS® simulation training between May 31and June 3, 2011. Students participated in interprofessional teams to perform in three acute simulated scenarios each set addressing one of three clinical domains: 1) asthma, congestive heart failure (CHF), and supraventricular tachycardia (SVT), 2) three pediatric scenarios, or 3) three obstetric scenarios. The PACT tools were used to assess teamwork and team communication skills in real-time and retrospectively through analysis of the video recordings of the asthma and SVT scenarios.

The validity evidence for PACT tools was presented based on Messick's (1995) framework that includes six distinguishable aspects: 1) content, 2) substantive, 3) structural, 4) generalizability, 5) external, and 6) consequential.

Results: The total numbers of records for PACT-Novice, PACT-Expert and PACT-Video were 934, 85, and 120, respectively. The ICC of PACT-Novice was .85 (n=904, F=6.46, $p < .001$). The ICC of PACT-Expert was .76 (n=85, F=4.09, $p < .001$). The ICC of PACT-Video was .90 (n=112, F=9.63, $p < .001$). One-Way ANOVA and exploratory factor analyses were also performed to provide preliminary validity evidence for the PACT tools.

Conclusions: The PACT tools are reasonably consistent, reliable and exhibit some evidence they can be validly used for debriefing and evaluating team performances with pre-licensure health professional students. Further studies with larger sample sizes, standardized training experiences, and longitudinal follow-ups are needed to build the validity evidence for the PACT tools.

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DEDICATION

This dissertation is dedicated
to my heavenly Father,
who always walks beside me,
to my parents, Ping-Hung and Li-Chu,
whose sacrifices and encouragement have guided me through my life,
to my husband, Randy Lai Yuu,
who supports me unconditionally,
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who bring laughter and joy to me during the most difficult times.

CHAPTER 1

The Need and Challenges of Developing Performance Assessment Tools for Interprofessional Communication and Teamwork (PACT)

This is a series of two papers describing the development and validation of Performance Assessment for Interprofessional Communication and Teamwork (PACT); tools to assess pre-licensure interprofessional student teams' performance in acute care simulated scenarios. The first paper focuses on the processes, challenges, and lessons learned associated with the development of the PACT tools. The second paper presents reliability and validity evidence for the PACT tools. This is the first of the two papers.

1.1 Background

Interprofessional Education (IPE)

The World Health Organization (WHO) first described interprofessional collaboration (IPC) as an important component of primary health care in 1978 (WHO, 1978), recommending development and training of health care teams to effectively deliver health care. At that time, interprofessional education (IPE) was proposed as a possible approach to address the issue of insufficient IPC in medical care teams; however, it did not gain much attention. A decade later in a 1988 report, the WHO described 10 rationales in support of IPE and called for research in this area. In 2010, the WHO report "Framework for Action on Interprofessional Education and Collaborative Practice" stated:

> *After almost 50 years of enquiry, the World Health Organization and its partners acknowledge that there is sufficient evidence to indicate that effective interprofessional education enables effective collaborative practice. Collaborative practice strengthens health systems and improves health outcomes. (p. 7)*

Many studies have demonstrated the positive impact of IPE on clinicians (improved working culture, more collaborative behaviors, decreased error rates, and improved patient satisfaction) and on students' attitude/perception about interprofessional collaboration (Art, De Roo, Willems, & De Maeseneer, 2008; Berridge, Mackintosh, & Freeth, 2010; Reeves, 2000). While some studies demonstrated positive outcomes, other studies have reported no impact of IPE on patient care and professional practice (Reeves, Perrier, Goldman, Freeth, & Zwarensteiin, 2013). Studies by Coster et al. (2008) and Reeves & Pryce (1998) suggested that IPE delivered early in a health professional's education works better in building positive attitudes and gaining knowledge towards interprofessional practice (IPP). Although the impact of pre-licensure IPE on IPP after graduation has not been studied by researchers pre-licensure students who receive IPE may have a greater understanding of the roles and responsibilities of other health professions and should hold more positive attitudes and knowledge about IPP, and have the foundation to work more collaboratively when entering practice.

Increasingly, academic institutions and professional licensing and regulatory bodies (e.g., Accreditation Council for Pharmaceutical Education, 2012) have recognized the importance of IPE; thereby requiring standards for accreditation. The Interprofessional Education Collaborative (IPEC) was established in 2011 to identify core competencies of interprofessional collaborative practice. As a result, many academic programs have begun to incorporate some form of interprofessional training in their curricula (Art et al., 2008; Bandali, Parker, Mummery, & Preece, 2008; Cox, Scott, Hall, Aud, Headrick, & Madsen, 2009; Vyas, McCulloh Dyer, Gregory & Higbee, 2012). Based on the comparative analysis by Zorek and Raehl (2013), the majority of the health professions accreditation bodies had some applicable or accountable IPE statements. However, not all health professions graduates were required to complete IPE. Consistency in IPE

could be improved by U.S. accreditation bodies working together to develop common IPE accreditation standards to ensure the graduates' readiness for IPC. Currently, the U.S. accreditation bodies that include IPE in accreditation standards are medicine, nursing, dentistry, pharmacy, and physician assistants' (PA) programs.

Definition of IPE.

Since 1988, several definitions of IPE have been proposed (See Table 1.1). The most commonly accepted definition of IPE was developed by the United Kingdom (U.K.) Centre for the Advancement of Interprofessional Education (CAIPE). The CAIPE was founded in 1987 and was instrumental in promoting IPE. CAIPE defined IPE as occurring *"when two or more professions learn with, from and about each other to improve collaboration and the quality of care. (CAIPE, 2002)"* We adopted the definition from CAIPE in this work.

Interprofessional competency domains.

With clearer definitions of IPE, academic and healthcare organizations attempted to implement IPE with goals of improving IPC and the quality of care. The first step was to identify competencies and skills required for effective IPC. International efforts defining competencies for effective IPC are expanding (Canadian Interprofessional Health Collaborative (CIHC), 2010; IPEC, 2011). In 2010, a national Interprofessional Competency Framework developed by the CIHC (2010) included six interprofessional competency domains in its framework (see Table 1.2). U.S. programs utilized these competencies to guide the development of their IPE programs and curricula until the IPEC published their own.

Two of the domains, team communication and patient/family-centered care, support and influence the other four (role clarification, team functioning, collaborative leadership, and interprofessional conflict resolution) competency domains. Learners and practitioners clearly

require interprofessional communication skills to communicate roles, knowledge, skills, and attitudes in order to accomplish effective teamwork. Patient/client/family/community-centered care means that patients/clients are treated as experts in their experiences, beliefs, and life style and as an integral part of the team. Figure 1.1 illustrates the CIHC framework and how interprofessional communication and patient/client/family/community-centered care domains encompass the other four CIHC domains.

In 2011, the IPEC published interprofessional competency domains for health professional students in the U.S. and they included four broad-based competency domains (Table 1.3) and 38 competency statements:

1) values/ethics for interprofessional practice
2) roles/responsibilities
3) interprofessional communication
4) teams and teamwork

The IPEC competency domains are similar to the CIHC's; however, IPEC considered patient-centered care to be the principal context for learning and practicing within the other domains. Regardless of differences in healthcare systems, the essential role of interprofessional communication and teamwork in IPP were identified as necessary competencies. Therefore, we focused on teaching interprofessional communication and teamwork skills through IPE to prepare pre-licensure health professional students for IPC.

Interprofessional teamwork and communication.

Before we started teaching and assessing interprofessional communication and teamwork skills, we needed to understand and define what interprofessional teamwork and communication are. The PACT tools were developed to assess team performance on interprofessional teamwork

and communication. In 2003, The Institute of Medicine (IOM) defined interprofessional teamwork as *"a collaborative interaction among interprofessional team members to provide quality, individualized care for patients (p. 55)."* A team training framework developed by the Agency for Healthcare Research and Quality (AHRQ) – Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) – summarized research from the past two decades and suggested, *"Teamwork is defined by a set of interrelated knowledge, skills, and abilities that facilitate coordinated, adaptive performance, supporting one's teammates, objectives, and mission"* (TeamSTEPPS® 06.1 Evidence-Base: Introduction, n.d., p. 1). Successful interprofessional teamwork requires communication within and across teams with diverse training, knowledge, attitudes, and cultures.

Communication is defined as the *"exchange of information between a sender and a receiver"*. More specifically, communication is *"the process by which information is clearly and accurately exchanged between two or more team members in the prescribed manner and with proper terminology and the ability to clarify or acknowledge the recipient of information"* (TeamSTEPPS® 06.1 Communication, n.d., p. 8). Communication occurs interpersonally and interprofessionally. Efficient interprofessional communication requires the sender shares the delegation of tasks, patient information, and care plan concisely with other members as well as the receiver accurately acknowledges the recipient of the request and information.

The importance of good interpersonal communication skills should not be overlooked because these skills underlie effective teamwork (Dunsford, 2009). Each profession often has its own professional language, which makes seamless interprofessional communication more difficult. Improving how various disciplines interact and communicate effectively remains a challenge. Learning to speak the same language in IPE programs makes communicating across

professions easier. Using TeamSTEPPS® as a common language for exchanging health information has been a useful framework to train health professional students and practitioners to effectively communicate among and across professions.

IPE in the Context of Patient Safety

In the landmark report "To Err is Human" in 1999, the IOM reported that between 44,000 and 98,000 Americans died and 1,000,000 excess injuries happened each year in American hospitals due to preventable medical errors. The actual number of medical errors is expected to be far greater than what was published in that report (Kohn, Corrigan, & Donaldson, 1999). Researchers have identified the lack of teamwork and interprofessional communication as major human factors contributing to medical errors (Carayon, 2010; Kanki & Palmer, 1993). In 2012, the Joint Commission reported that communication was one of leading root causes of sentinel events in all categories of medical errors based on reported sentinel events from 2004 to 2012 (The Joint Commission, 2012). A systematic review conducted by Reeves and colleagues (2008) summarized that successful teamwork and effective interprofessional communication leads to better organizational outcomes, including improved working culture, more collaborative behaviors, decreased error rates, and better patient satisfaction.

Recent studies (Blewett, Johnson, McCarthy, Lackner, & Brandt, 2010; Neily, et al., 2010) demonstrated that improving teamwork and communication skills in clinicians improved patient outcomes as a result of decreasing errors. Although longitudinal studies are still needed to show the direct impact of IPE for pre-licensure students on patient safety and clinical outcomes, students who are more competent in teamwork as they enter the workforce should function better in healthcare teams and hence improve the safety and quality of care.

Pedagogical Approaches to IPE

As IPE has become widely implemented in health sciences curricula, a variety of teaching methods have been employed. These methods, rooted in adult learning theory (Merriam, 2001; Lewis, 2012), include lectures, small group discussions, simulations (Bilodeau et al., 2010; Odegard et al., 2009), team-based cases and problem based learning (Philippon, Pimlott, King, Day, & Cox, 2005). However, a recent review of trends in IPE (Abu-Rish et al., 2012) concluded that best practices and strategies have yet to be established despite many efforts experimenting with different IPE approaches. In our training program, we incorporated the methods of lecture and simulation. The interprofessional teamwork and communication concepts and skills were introduced to students through lecture. Simulation provided a safe environment for students to practice/observe the newly learned skills. For the purpose of this paper, we will focus on the use of simulation as an approach to train and assess interprofessional students. The advantages of using simulation as a pedagogical approach are described below.

Simulation as a tool for teaching skills and assessing performance.

Studies have demonstrated the effectiveness of simulation in preparing health sciences students for clinical practice by providing authentic cases for teaching skills and assessing performance (Kim, Neilipovitz, Cardinal, Chiu, & Clinch, 2006; Ottestad, Boulet, & Lighthall, 2007; Lighthall et al., 2003). Mastering interprofessional teamwork and communication skills, like other clinical skills, require repeated practices in a realistic environment. Simulation allows pre-licensure students from different health professions to come together and practice the interprofessional teamwork and communication skills in a safe environment. Researchers have used high-fidelity simulators (manikins with abilities to realistically respond to learners actions) to analyze communication behaviors during a crisis and communication abilities of teams and

residents (Lighthall et al., 2003; Kim, Neilipovitz, Cardinal, Chiu, & Clinch, 2006; Ottestad, Boulet, & Lighthall, 2007). Lighthall and colleagues (2003) demonstrated the utility of simulation for understanding the relationship between communication and errors in the intensive care unit (ICU). Simulation serves as a great teaching tool and a venue to collect qualitative data about communication through debriefing and reflection. However, using simulation as a reliable assessment tool required more evidence to support such use. Kim and colleagues (2006) used simulation to assess communication abilities of ICU residents. They found that 3rd year medical residents performed better than 1st year residents. Reliability testing showed poor consistency in the observed ratings of communication performance. These results and a paucity of other work directly examining the use of simulation in IPE highlight a need for reliable and valid assessment tools for measuring effective communication and teamwork.

Local approaches to IPE at the University of Washington (UW).

In 2008, the UW Schools of Nursing and Medicine received funding from the Josiah Macy Jr. Foundation to develop simulation-based interprofessional training for pre-licensure health professional students (http://macyfoundation.org/grantees/profile/improving-communication-among-interprofessional-healthcare-teams). These simulation-based trainings utilized human patient simulators and standardized actors with authentic, unfolding cases focused on communication and teamwork skills. The cases were developed by an interprofessional group of faculty and students over a one-year period. The team training was developed to actively involve the learners in realistic clinical scenarios with debriefing and reflection at the end of each case. The conceptual framework used for the acute care team training was TeamSTEPPS®.

Evaluation of IPE

The evidence demonstrates that high functioning clinical teams that communicate and work well together improve the safety of patients and clinical outcomes (WHO, 2010; Reeves, et al., 2013). However, there is a paucity of evidence linking IPE in pre-licensure student training to improved teamwork and team communication skills. There is also a lack of standardization in reporting IPE interventions and assessments that makes summarizing the current IPE literature difficult (Abu-Rish, et al., 2012). Therefore, reliable and valid measures of IPE interventions in pre-licensure students are required to demonstrate the improved teamwork and team communication skills if any.

Currently, there is a gap in knowledge about the transference of IPE skills learned in the academic setting (classroom, simulation lab) at the pre-licensure level with skills needed in practice (post-licensure). Rigorous and longitudinal evaluation methodologies are needed to demonstrate that IPE interventions do improve team communication and teamwork at the pre-licensure level and that this training translates into improved outcomes of care in practice. Most evaluation studies of IPE report greater student satisfaction and attitudes, while other studies have compared student's performance or perception, knowledge and skills using pre-post quasi-experimental designs (Art et al., 2008; Curran, Sharpe, Flynn, & Button, 2010). Reeves and his colleagues (2013) in their updated Cochrane review concluded that the quality of the outcome's evidence judged by the GRADE Working Group grades of evidences is either "Low" or "Very low" quality. Low quality means the strength of the evidence is weak and future studies will have great effects on the current conclusions. Having "Very low" quality suggests the evidence is extremely weak and no conclusions can be made based on the results. These authors also identified studies assessing the effectiveness of IPE interventions compared to traditional,

uniprofessional interventions as the first of three gaps that needed to be addressed in the current literature. However, to accurately assess and compare the effectiveness of different interventions requires reliable and valid tools that assess knowledge, attitudes, and skills.

In the present study, a research team created a toolkit that consisted of the following: faculty teaching guides, scenario templates, and curriculum to standardize and assess IPE interventions. Learning objectives using the CIHC IPE competencies were utilized and tools were developed to assess students' knowledge, attitudes, and skills (performance), pre- and post-IPE interventions. The assessment tools were designed with pre-licensure students training in mind but with the hope of using the same tools to assess practitioners in future longitudinal studies.

1.2 Purposes

The aims of the study were 1) to identify existing measures for teamwork, 2) to develop psychometrically sound measures to assess teamwork and communication skills: Performance Assessment of Interprofessional Communication and Teamwork (PACT), 3) to collect data on the reliability of the PACT tools, and 4) to collect data, summarize and present construct validity evidence for the PACT tools.

This paper addressed the first two aims by describing the need to develop interprofessional team observation tools as well as the processes and challenges during the development stage. The next paper addressed the third and fourth aims by collecting reliability and validity data of the PACT tools. We hope we can promote collaboration and speed up the investigation on the effectiveness of IPE on IPC in the clinical setting by providing reliable and valid tools of measuring teamwork and communication skills.

1.3 Methods

Overview of IPE Intervention and Evaluation

A four-hour IPE curriculum utilizing simulation-based training was developed and implemented to improve role clarity, teamwork, and communication for pre-licensure students from medicine, pharmacy, nursing and the physician assistant (PA) program. Pilot assessment tools were developed to measure the effectiveness of the training. The overall plan was to design tools to assess changes in attitudes, knowledge, and skills related to teamwork and team communication. Tools were developed for students to assess themselves (self-reflection) and their peers (as novice observers), and for expert to assess team performance and use as a debriefing tool. Tools for expert faculty in teamwork were developed in order to assess team performance from both real-time and videotaped scenarios. A set of self-assessment tools including a measure of Attitudes, Motivation, Utility, and Self-Efficacy (AMUSE) and a checklist was administered pre- and post-team training at the UW. Some questions were administered only post-team training to gain a better understanding of skills learned (Brock et al, 2012). A program evaluation of the overall training was also developed for both students and faculty to provide feedback on the experience. A summary of the tools used to assess learners and evaluate programs for the overall study is presented in Table 1.4.

TeamSTEPPS® Conceptual Framework

We chose TeamSTEPPS as a framework to teach, measure, and evaluate behavior change following the IPE intervention. The UW was named a national training center for TeamSTEPPS® at the same time the Macy IPE grant was funded. The Macy IPE grant was funded to develop simulated training scenarios for IPE. TeamSTEPPS® was already used as a training program for interprofessional student teams and was being implemented across clinical staff in the UW

Medicine System (that includes an academic medical center, a level 1 trauma center, two community hospitals, and Airlift Northwest). In addition, Drs. Zierler and Ross, principal investigators for the Macy IPE intervention study, were also leading much of the UW TeamSTEPPS® training activities.

TeamSTEPPS® is a teamwork framework that was developed to improve interprofessional communication and teamwork skills with the primary goal of improving patient safety. The core constructs of TeamSTEPPS® are team structure, leadership, situation monitoring, mutual support, and communication (See Figure 1.2) Table 1.5 summarizes the definitions and provides sample behaviors for each of the five TeamSTEPPS® constructs. The original training materials were developed for acute medical situations. However, more modules that adopted TeamSTEPPS® training were developed for long-term and primary care in the recent years.

The five core TeamSTEPPS® constructs are intertwined. For example, effective communication is necessary for strong team leadership, situation monitoring, and mutual support. Each construct has a direct effect on the team results such as team performance and patient safety. These five constructs form the infrastructure of the tools that were developed at the UW. The scenarios developed for the UW student training incorporated aspects of each of the TeamSTEPPS® constructs, requiring students to form a team structure, identify a leader, and practice the interprofessional communication skills.

Development of the Scenarios

An interprofessional team of faculty, students, and staff were involved in the development of three case scenarios. The curricula across four schools were mapped to determine clinical knowledge for matching appropriate levels of students for the simulated scenarios. Each scenario was designed for student teams that had not previously worked together. Each scenario required

a team approach for managing the clinical condition and a hand-off of information from one team to another at the beginning and end of each scenario. Details of the processes and procedures for developing the cases are outlined in a subsequent paper. The scenarios and teaching guides are available at: http://collaborate.uw.edu/

Development of the PACT Tools

We first searched for available measures of teamwork; however, we were not able to identify reliable and valid tools that matched well with TeamSTEPPS®, our conceptual framework. We decided to develop tools that would satisfy our assessment needs. Nine steps were involved in the development and validation of the PACT tools. The nine steps included the following: 1) a systematic review of the literature to identify existing assessment tools; 2) a review of conceptual models to match training and evaluation goals; 3) a compilation of items from existing tools; 4) the development of new items missing from existing tools; 5) the reorganization of new tools matched to training sequence and end-users; 6) the determination of format and usability of the PACT tools; 7) the implementation of the pilot study; 8) the modification of the PACT tools based on the pilot results; and 9) the collection of validity evidence of the PACT tools. A detailed description of the first six steps (an iterative development phase; Table 1.6) will be presented in this paper and the remaining three steps (pilot study, modification and validation of the PACT tools) will be described in a subsequent paper. An assessment team comprised of a doctoral student (lead author of this paper), six faculty, two graduate students, and one staff member participated in bi-monthly meetings and for the purposes of this paper will be referred to as the "UW Macy Assessment Team." This team provided evaluation and assessment suggestions to the overall project and was instrumental in providing feedback and reviewing the PACT tools.

Step 1: A systematic review of the literature to identify existing assessment tools.

A search to identify existing tools designed to assess teamwork, team performance, and team communication was performed. The original intention was to identify existing reliable and valid tools. The PubMed, CINAHL Plus, PsychInfo and ERIC were searched. Search terms were "interprofessional", "multi-professional", "interdisciplinary", "multidisciplinary", "team", "teamwork", "communication", "crew source management", "TeamSTEPPS®", "evaluation", "assessment", and logical combinations of these terms were also searched. Sixteen tools were identified. The tools were designed to meet various objectives within different settings (Table 1.7; Duke University & University of North Carolina, 2008; Frankel, Gardner, Maynard, & Kelly, 2007; Guise et al., 2008; Luecht, Madsen, Taugher, & Petterson, 1990; Malec et al., 2007; Office of Interprofessional Education and Practice at Queen's University, nd; Parsell & Bligh, 1999; TeamSTEPPS®, nd; Thomas, Sexton, & Helmreich, 2004; Ward et al., 2008). More than half of the existing tools targeted attitudes/perceptions or knowledge. Only seven tools were designed for skills assessment. The Communication and Teamwork Scale (CATS) developed by Frankel and colleagues, TeamSTEPPS® Performance Observation Tool (TPOT) developed by AHRQ, Clinical Teamwork Scale (CTS) developed by Guise and colleagues, and the Mayo High Performance Teamwork Scale develop by Malec's group were the most cited and commonly used skills assessment tools. However, none of the tools met our specific needs to assess TeamSTEPPS®-specific teamwork and communication skills and strategies in a simulated case. The Macy Assessment Team concluded that it would be necessary to develop the tools to specifically address these needs. The Macy Assessment Team was an interprofessional team with experts in teamwork and assessment.

Step 2: A review of conceptual models and tools to match training and evaluation goals.

For the purpose of evaluating the effectiveness of a combination of TeamSTEPPS® training using a simulated case, a tool was developed according to the specific TeamSTEPPS® framework and team communication strategies. Ideally this tool would then provide more sensitive measures of team communication behavior than a tool developed based on other conceptual framework. The TPOT provided the best choice among the seven identified skills assessment tools. However, the TPOT combined some communication skills (such as SBAR and hand-off) into one item, making it difficult to differentiate specific skills used in the scenarios challenging. In addition, the TPOT would have been less sensitive in detecting potential changes in using specific TeamSTEPPS® communication skills.

Most of the tools evaluated teamwork skills/performance of practicing clinicians and were not clearly applicable to pre-licensure students. Students rarely work together purposefully in interprofessional team settings, and when they do, they typically focus more on clinical skills rather than teamwork and communication skills. Scales using clinicians' performance were deemed not suitable to assess student teams' performance.

The literature review also showed that most observational tools incorporated Crew Resource Management (CRM) principles as a conceptual framework. Aviation has employed CRM principles to help improve the safety of commercial aviation since 1979 and have proven successful (Helmreich & Wilhelm, 1991). Human factors and safety behaviors were the commonalities between aviation and acute healthcare settings (Pizzi, Goldfarb, & Nash, 2001). Although the constructs of CRM principles are similar to TeamSTEPPS® and TeamSTEPPS® was developed with CRM principles in mind, there are differences. The CRM principles can be

represented by four team behavior domains: task management, teamwork, situation awareness, and decision making. One of the identified tools was the CATS, which was developed based on the CRM principles, but its authors suggested additional validation needed to be completed (Frankel et al., 2007). Our goal was to assess the usage and quality of specific TeamSTEPPS® communication skills within a simulated case. The original items of CATS as well as other tools developed based on CRM principles were included in the item pools. Some items were modified to fit the purpose of the PACT tools.

Step 3: A compilation of items from existing tools.

All items identified in the published tools were entered in an Excel® spreadsheet. Members of the UW Macy Assessment Team were asked five questions about each item:

1) What domain is being measured (knowledge, attitudes, or skills)?

2) Should the item be included in the pre/post web assessment?

3) Should the item be included in the observation tool?

4) Does the item assess team or individual performance or both?

5) What TeamSTEPPS® construct does the item parallel?

The author (c.c.) then compiled the responses from the team members and kept items that were reported to measure skills, assess team performance, and paralleled TeamSTEPPS® constructs. Highly similar or duplicate items were removed from the list. The team then met weekly for two months to refine and update the item wordings.

Step 4: The development of new items missing from existing tools.

The UW Macy Assessment Team identified items that were parallel to the TeamSTEPPS® domains. However, the TeamSTEPPS® communication skills included in the didactic trainings were not specifically represented in the item pool. The primary author listed all the skills that

needed to be included in the tool. Verbs were then chosen to represent evidence of the specific skills introduced in the didactic session (e.g. demonstrate, apply and conduct). The primary author then developed items to parallel respective TeamSTEPPS® communication skills not represented in the current item set. The items were again reviewed and finalized by the UW Macy Assessment Team.

Step 5: The reorganization of new tools matched to training sequence and end-users.

The author built the first draft of an observation tool based on the responses to the five questions posed to the UW Macy Assessment Team and initial items were categorized under the TeamSTEPPS® construct based on responses received from the UW Macy Assessment Team members in Step 3. Teamwork and communication items were included in the initial observation tools if recommended by two or more members of the assessment team. This first draft of the PACT items included 31 behavioral markers that met the previously described criteria established by UW Assessment Team and 5 overall ratings of the 5 TeamSTEPPS® constructs. After a second review by the UW Macy Assessment Team, the number of items was reduced to 26 behavioral markers.

Our original goal was to develop a reliable and valid observation tool to assess the team performance before and after the simulation-based team training. Video-coding of the recorded scenarios was considered a relatively accurate method of observation. However, there was a need to use tools in real-time for learning, self-reflection, and debriefing of teamwork and communication behaviors during and after the team training for both students and faculty. Thus, the UW Macy Assessment Team utilized the framework of the original observation tool to develop different versions of PACT to suit the other purposes and different level of users.

Step 6: The determination of format and usability of PACT tools.

The original item set used a mix of scale types and anchors to assess frequency and quality of communication. The frequency scales described the following communication behaviors during the simulation:

Absence (A)-a behavior did not occur when it should;

Rare (R)-one or two rare examples of the behavior occurred;

Isolated (I)-there are isolated examples of a behavior throughout the observation;

Standard (S)-there are intermittent examples throughout the observation;

Consistent (C)-there were frequent/explicit examples of a behavior throughout the observation;

Not Applicable (NA)-there was no opportunity for the team to demonstrate such behavior.

The 5-point quality scales ranged from Poor to Excellent and they were developed so that communication and team behavior could be assessed both qualitatively and quantitatively. An invited group of faculty ("Advisory Group") expert in teaching and using a variety of evaluation methodologies piloted the initial PACT tools during an interprofessional student team simulation scenario and provided feedback on the format and usability of the tool. The Advisory Group recommended creating different versions of the PACT tools to meet different assessment needs. The organization and formatting of different versions of PACT tools were finalized based on the Advisory Group's review.

Description of the PACT Tools The PACT tools consist of three versions: PACT-Novice, PACT-Expert, and PACT-Video. Different versions of PACT were developed for observers with different levels of TeamSTEPPS® knowledge and experience and coding training.

The PACT-Novice (Appendix A) was designed for raters without TeamSTEPPS® training to perform a real-time assessment. Descriptions of the five TeamSTEPPS® constructs were provided on the form (Appendix A). The PACT-Novice tool contained an overall quality scale (Yes, Yes but, and No) for each of the five constructs and a column for comments or note taking. A list of definitions of key terms and concepts about team communication (Appendix B) was developed to accompany the PACT-Novice to help raters understand the key concepts of TeamSTEPPS®. In our pilot work, student observers completed the PACT-Novice while observing their classmates in the simulated scenarios.

The PACT-Expert (Appendix C) was designed for raters who were familiar with TeamSTEPPS® constructs. This form was completed in real-time and provided additional information for debriefing at the end of the scenario. The PACT-Expert tool contained 18 behavioral markers drawn from the 31 behavioral markers originally compiled for the first draft of the PACT-Video tool. Each item of the PACT-Expert judged quality of behavior, using a 5-point Likert-type scale (ranging from poor to excellent). This scoring system allowed for the creation of composite scores for each TeamSTEPPS® construct, as well as an overall aggregate.

The PACT-Video (Appendix D) was designed for experienced raters with training in using the PACT-Video form and TeamSTEPPS constructs. This version was developed for close, retrospective analysis of recorded scenarios. The PACT-Video form contained frequency and quality information for 26 individual behavioral markers selected from the original 31 behavioral markers, as well as quality assessments of the five TeamSTEPPS® constructs. The abbreviated terms of behavior markers were suggested by the Advisory Group to replace the completed description of the item in PACT-Video. The Advisory Group also suggested a summary of examples and a glossary of individual behavioral markers to aid in the coding process.

Faculty completed training in video coding using sample simulation-based cases from previous trainings. Rating for an individual recorded scenario required three viewings by faculty. After the first and the third viewings, raters were asked to judge the IPE team performance using a 4-point Likert-type scale (Need Improvement in Most Areas, Need Improvement in Some Areas, Satisfactory, and Excellent) for each of the five TeamSTEPPS® constructs. If there was not sufficient evidence to judge a specific construct, the rater was given the option of selecting "Not Enough Information." During the second viewing, the raters were asked to time stamp significant teamwork behaviors observed throughout the simulation. After completion of the second viewing, raters provided ratings for the frequency (Absent, Isolated, and Consistent) and quality (Poor, Need Improvement, Satisfactory, and Excellent) of each of the 26 behavioral markers. See Table 1.8 for a detailed description of the instrument. Steps 7-9 will be reported in a subsequent paper.

1.4 Discussion

Challenges

The challenges encountered during tool development were three-fold. The first set of challenges was related to defining a tool that would meet our needs for assessing the behaviors we were hoping to evoke through the simulated cases. As we defined the tool, the first question considered was: Are we assessing team or individual performances? We understood the importance of assessing individuals' competencies. However, we concluded that our goal was to develop a reliable tool to measure team performance. Good individual performances/teamwork skills usually lead to better teamwork; however, this was not always the case. In our observations, good individual performance could be associated with poor team communication and teamwork. We also had to ask ourselves, what targeted performance/behaviors could we expect from the

novice learners? In addition, we needed to determine the sensitivity of the tool in order to capture the differences between performances/behaviors of individuals from team behaviors. Finally, we needed to determine the burden of the assessment itself and find a balance between rater burden and richer data. The UW Macy Assessment Team debated all of these questions until we came to a consensus to trial the individual PACT Tools and reassess their usefulness, burden and sensitivity.

A second set of challenges was the logistics associated with tool implementation. We had to identify faculty raters, determine the appropriate amount of training needed to demonstrate competence in rating, and choose the clinical scenarios to pilot the tools. Because we wanted the tools to eventually be used in ongoing training or practice, they had to be developed for different levels of learners/assessors, different types of scenarios, and approaches that would be relevant and cost-effective for simulation-based training. Without external funding, most simulation labs do not have the time or capacity to use lengthy or expensive assessment tools. Our goal was to present an array of tools that educators/clinicians/researchers could choose from that met their needs as an efficient observation tool. We developed three different versions of the PACT tools for different levels of rater experience and purposes. We also would like to collaborate with other researchers to test the generalizability of the PACT tools in different populations and scenarios.

The third set of challenges was related to controlling the confounding variables in the environment where the tool was administered. We expected scenarios to unfold differently as a function of the individual team members. Several steps were taken to ensure that students within cases received equivalent training experiences. Case-specific storyboards and faculty facilitator guides were created to standardize training and to guide how the case was to unfold. The lead faculty for each scenario briefed the supporting faculty facilitators to ensure the level of

involvement and support for students. Students not familiar with the medical knowledge or skills required for the case were less likely to focus on the newly learned teamwork and communication skills. Faculty facilitators gave a short 5-minute talk on the diagnosis and common treatments that students should consider in the various scenarios and encouraged them to ask for help in managing the clinical case if necessary, allowing for students to focus on communication skills. We still observed the scenarios unfolded differently but students were able to focus on practicing the teamwork and communication skills because of the help with the clinical content.

Limitations

The effectiveness of pre-licensure IPE and teamwork training on later practice is still debatable with limited studies available. Our study design lacked baseline data for comparison of teamwork and communication skills before and after the training. We did not follow up with the cohort's performance in clinical setting. Longitudinal studies investigating the effectiveness of IPE and teamwork training on clinical medical team performance will solidify the importance of mandated IPE in health profession education.

Observer biases and discrepancies among scenarios were examples of unavoidable limitations. The author acknowledged the biases that each observer brought related to personality, past experience, professional background and understanding of teamwork. Observers using the PACT-Expert tool all received teamwork related training, including masters-level TeamSTEPPS® training. Raters for PACT-Video all received coder training that was developed for more standardized and consistent coding results. The data collection procedures did not allow for an assessment of intra-rater reliability. The PACT tools were developed to assess team performance based on TeamSTEPPS® constructs using acute care clinical scenarios in

simulation-based training, so they might not be generalizable to other environments or scenarios. Student participants from every profession received different amounts of interprofessional training and simulation-based training prior to this experience. The author also expected discrepancies among scenarios with efforts to standardize scenarios by providing guidelines and training for facilitating faculty.

Future Directions

This paper provided the background and a framework for developing performance assessment tools for the assessment of interprofessional teamwork and communication skills. Additional evidence-based studies are required in this field to form the foundation for future studies. With the PACT tools developed, we conducted a pilot study to collect data on the consistency and reliability of the PACT tools and to test the usability of different versions of PACT. The PACT tools were modified based on the results and feedback received from the pilot study. A large-scale tool administration was then conducted to collect the validity evidence for the PACT tools. The second paper will describe the pilot study and will present the validity evidence for the PACT tools.

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Table 1.1

Definitions of Interprofessional Education (IPE)

Source (Year)	**Definition of IPE**
World Health Organization (1988)	The process by which a group of students (or workers) from the health-related occupations with different educational backgrounds learn together during certain periods of their education, with interaction as an important goal, to collaborate in providing promotive, preventive, curative, rehabilitative and other health-related services.
Centre for the Advancement of Interprofessional Education (CAIPE) (2002)	Interprofessional Education occurs when two or more professions learn with, from and about each other to improve collaboration and the quality of care.
Reeves et al. (2008)	An IPE intervention occurs when members of more than one health and/or social care profession learn interactively together, for the explicit purpose of improving interprofessional collaboration and/or the health/wellbeing of patients/client.

Table 1.2

Interprofessional Competency Domains from CIHC (CIHC, 2010)

Competency Domain	**Competency Statement**
Interprofessional Communication	Learners/practitioners from different professions communicate with each other in a collaborative, responsive and responsible manner.
Patient/Client/Family/Community-Centered Care	Learners/practitioners seek out, integrate and value, as a partner, the input, and the engagement of the patient/client/family/community in designing and implementing care/services.
Role Clarification	Learners/practitioners understand their own role and the roles of those in other professions, and use this knowledge appropriately to establish and achieve patient/client/family and community goals.
Team Functioning	Learners/practitioners understand the principles of team work dynamics and group/team processes to enable effective interprofessional collaboration.
Collaborative Leadership	Learners/practitioners understand and can apply leadership principles that support a collaborative practice model. This domain supports shared decision-making as well as leadership but it also implies continued individual accountability for one's own actions, responsibilities and roles as explicitly defined within one's professional/disciplinary scope of practice.
Interprofessional Conflict Resolution	Learners/practitioners actively engage self and others, including the client/patient/family, in positively and constructively addressing disagreements as they arise.

Table 1.3

Interprofessional Collaborative Practice Competency Domains (IPEC, 2011)

Competency Domain	**General Competency Statement**
Values/Ethics for Interprofessional Practice	Work with individuals of other professions to maintain a climate of mutual respect and shared values.
Roles/Responsibilities	Use the knowledge of one's own role and those of other professions to appropriately assess and address the healthcare needs of the patients and populations served.
Interprofessional Communication	Communicate with patients, families, communities, and other health professionals in a responsive and responsible manner that supports a team approach to the maintenance of health and the treatment of disease.
Teams and Teamwork	Apply relationship-building values and the principles of team dynamics to perform effectively in different team roles to plan and deliver patient-/population-centered care that is safe, timely, efficient, effective, and equitable.

Table 1.4

The Overall Evaluation Plan

Tool Name	**Respondents**	**Time Administered**	**Area Assessed**
AMUSE (pre)	Students	One week before training	Knowledge, Attitudes, and Perception
PACT-Novice	Student Observers	During and after simulation scenario	Skills and Team Performance
PACT-Novice as a tool for self reflection	Team Members	After simulation scenario before debriefing	Self-reflected Skills and team Performance
PACT-Novice as a tool for debriefing	Faculty	After simulation scenario before debriefing	Skills and Team Performance
PACT-Expert	Trained Observers	During and after simulation scenario	Skills and Team Performance
Program Evaluation	Students	after the training	Level of Satisfactory and Quality of Training
Program Evaluation	Faculty	Immediately after the training	Level of Satisfactory and Quality of Training and Support
AMUSE (post)	Students	Immediately or one week after the training	Knowledge, Attitudes, Perceptions and Perceived Skills
PACT-Video	Trained Observers	After the training	Skills and Team Performance

Table 1.5

TeamSTEPPS Domains: Definitions, Significances and Sample Behaviors

Domain Name	**Definition**	**Significance**	**Sample Behaviors**
Team Structure	The delineation of fundamentals (e.g., team size, team membership, team leadership, team identification, and team distribution).	Team structure is the first step and an integral part of the teamwork process. Without a clearly defined team, teamwork would not happen. A properly structured team is an enabler for teamwork and the result of effective leadership, communication, situation monitoring, and mutual support.	- Identifies goals. - Assigns roles and responsibilities. - Holds members accountable.
Leadership	The ability to coordinate the activities of team members and teams by managing the resources available to team members and facilitating team performance by communicating plans, providing information about team performance through debriefs; and providing support to team members when needed.	Effective leaders foster an environment of collaboration.	- Utilizes resources. - Delegates tasks and balances workload. - Conducts briefs, huddles, and debriefs. - Empowers members to speak freely. - Facilitates team problem solving. - Seeks and evaluates information that impacts team functioning. - Clarifies team member roles. - Engages in preparatory meetings and feedback sessions with the team.
Situation Monitoring	The process of actively scanning and assessing elements of the situation to gain information or maintain an accurate awareness or understanding of the situation in which the team functions.	Continual monitoring of the situation enables the team to anticipate and predict the needs of patients and team members, allowing the team to be more adaptive and flexible. Continual situation monitoring also allows the team to recognize and respond to deviations in the plan of care or potential problems. Teams are able to correct the deviations more easily, compensate for team members, and reallocate resources with effective situation monitoring. Effective teams have established goals and possess a shared mental model (understanding of the way a procedure or plan should be carried).	- Includes patient/family in communication. - Cross monitors members and applies STEP process. - Fosters communication. - Provides feedback regarding team member actions in order to facilitate self-correction.

Table 1.5 (Cont'd)

TeamSTEPPS Domains: Definitions, Significances and Sample Behaviors

Domain Name	**Definition**	**Significances**	**Sample Behaviors**
Mutual Support	The ability to assess and anticipate other team member's needs through accurate knowledge about their responsibilities, task load and core capabilities and in response to shift workload among members to achieve balance during high or low periods of workload or pressure.	Mutual support is essential for teamwork and prevents team members from becoming overloaded, which might lead to errors or a reduction in the effectiveness of the team.	- Advocates for the patient. - Resolves conflict using Two-Challenge rule, CUS, and DESC script. - Works collaboratively. - Recognized by potential back-up providers that there is a workload distribution problem involving their team. - Shifts work responsibilities to underutilized team members. - Completes the whole task or parts of tasks by other team members.
Communication	The process by which information is clearly and accurately exchanged among team members.	Communication serves as a supporting structure for teamwork. Communication skills impact leadership, situation monitoring, and mutual support directly. Effective communication skills help convey clear information, provide awareness of roles and responsibilities, keep the team informed, and explain how performance impacts outcomes. Communication with patients is also important as the patient is the central part of the team.	- Provides brief, clear, specific and timely information. - Seeks and communicates information from all available sources. - Uses SBAR, call-outs, check-backs, and handoff techniques. - Follows up with team members to ensure message was received. - Acknowledges that a message was received. - Clarifies with the sender of the message that the message received is the same as the intended message sent.

Adapted from TeamSTEPPS http://teamstepps.ahrq.gov/

Table 1.6

Flowchart of PACT Tool Development

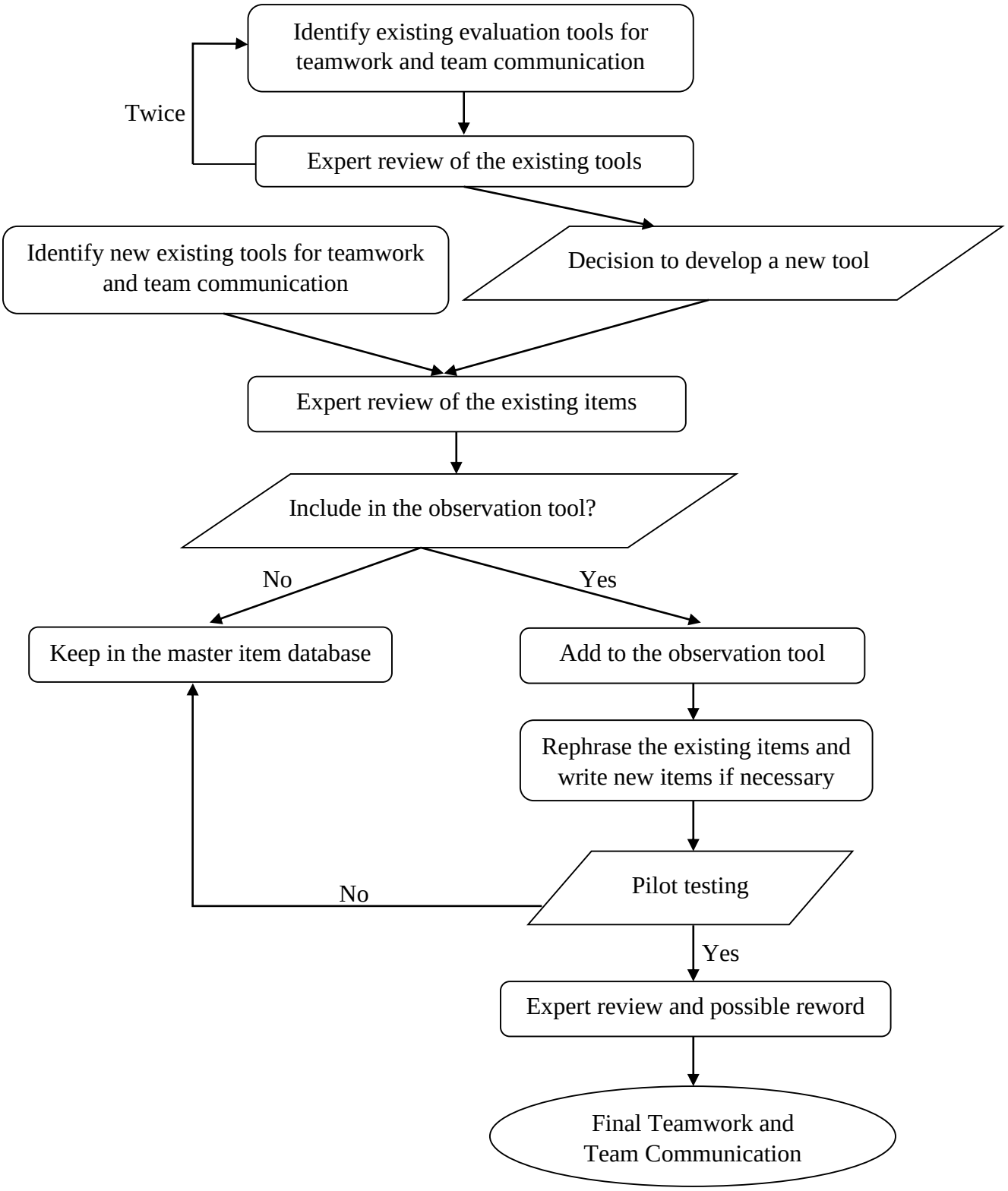

Table 1.7

List of IPE and Teamwork Tools

Tool Name	**Area Evaluated**	**Participants**	**Source**
Readiness for Interprofessional Learning Scale (RIPLS)	Attitudes/Perceptions	Students	Parsell & Bligh, 1999
Interdisciplinary Education Perception Scale (IEPS)	Perceptions	Students	Luecht et al., 1990
Collaborative Practice Assessment Tool (CPAT)	Self-perceptions	Students	Queen's University
Semi-Mayo Teamwork Video Rating Scale	Skills/Performance	Not specified	Duke University & University of North Carolina
Teamwork Knowledge Test	Knowledge	Clinicians	Duke University & University of North Carolina
Behavioral Markers of Neonatal Resuscitations (BMNR)	Skills/Performance	Clinicians	Thomas et al., 2004
Clinical Teamwork Scale (CTS)	Skills/Performance	Not specified	Guise et al., 2008
Mayo High Performance Teamwork Scale	Skills/Performance	Clinicians	Malec et al., 2007
Jefferson Scale of Attitude toward Physician-Nurse Collaboration (JSAPNC)	Attitudes	Clinicians	Ward et al., 2008
Attitudes, beliefs and values of students entering health professions	Attitudes/Perceptions	Students	University of Auckland
Communication and Teamwork Skills (CATS)	Skills/Performance	Clinicians	Frankel et al., 2007
Non-technical scale in Ottestad et al. study	Skills/Performance	Clinicians	Qttestad et al., 2007
TeamSTEPPS® Learning Benchmarks	Knowledge	Clinicians	TeamSTEPPS® website
Team Assessment Questionnaire	Perceptions	Clinicians	TeamSTEPPS® website
Team Performance Observation Tool	Skills/Performance	Clinicians	TeamSTEPPS® website
TeamSTEPPS® Teamwork Attitudes Questionnaire	Attitudes	Clinicians	TeamSTEPPS® website

Table 1.8

Description of Different Versions of PACT

Version	Description	Number of Items	Observer Training Level	Time of Administration
PACT-Novice	PACT-Novice contains the 5 TeamSTEPPS® constructs and sample behaviors of constructs are provided on the tool. Raters are asked to rate the constructs using a 3-point Likert scale (Yes, Yes but, and No) and to record notes in the "comment" column. A list of definitions of key terms and concepts describing team communication was developed to accompany the PACT-Novice tool in order to help raters understand key concepts of TeamSTEPPS®.	5	Novice observers (student observer)	Real-time
PACT-Expert	PACT-Expert contains 18 behavioral markers that were drawn from the original draft of PACT-video. These 18 behavioral markers were representative of the behavioral markers observed in the videos of effective team communication. Raters are asked to use a 5-point Likert scale of quality (Poor to Excellent) to assess each behavioral marker.	18	Experienced observers	Real-time
PACT-Video	PACT-Video contains 4-6 behavioral markers under each domain (26 behavioral markers in total). Coders are asked to review the video for 3 times. After the first viewing, the coders are to record the initial quality ratings for each of the 5 TeamSTEPPS® domains Need Improvement in Most Areas, Need Improvement in Some Areas, Satisfactory, and Excellent). During the second viewing, the coders are to time stamp and record the behaviors that are demonstrated or should have been demonstrated. After completing the second viewing, coders are asked to complete the frequency (Absent, Intermittent, and Consistent) and quality scales (Poor, Need Improvement, Satisfactory, and Excellent). After watching the complete scenario three times, coders are asked to fill out the quality scale for the 5 TeamSTEPPS® domains again.	26	Experienced observers	Retrospective through videos

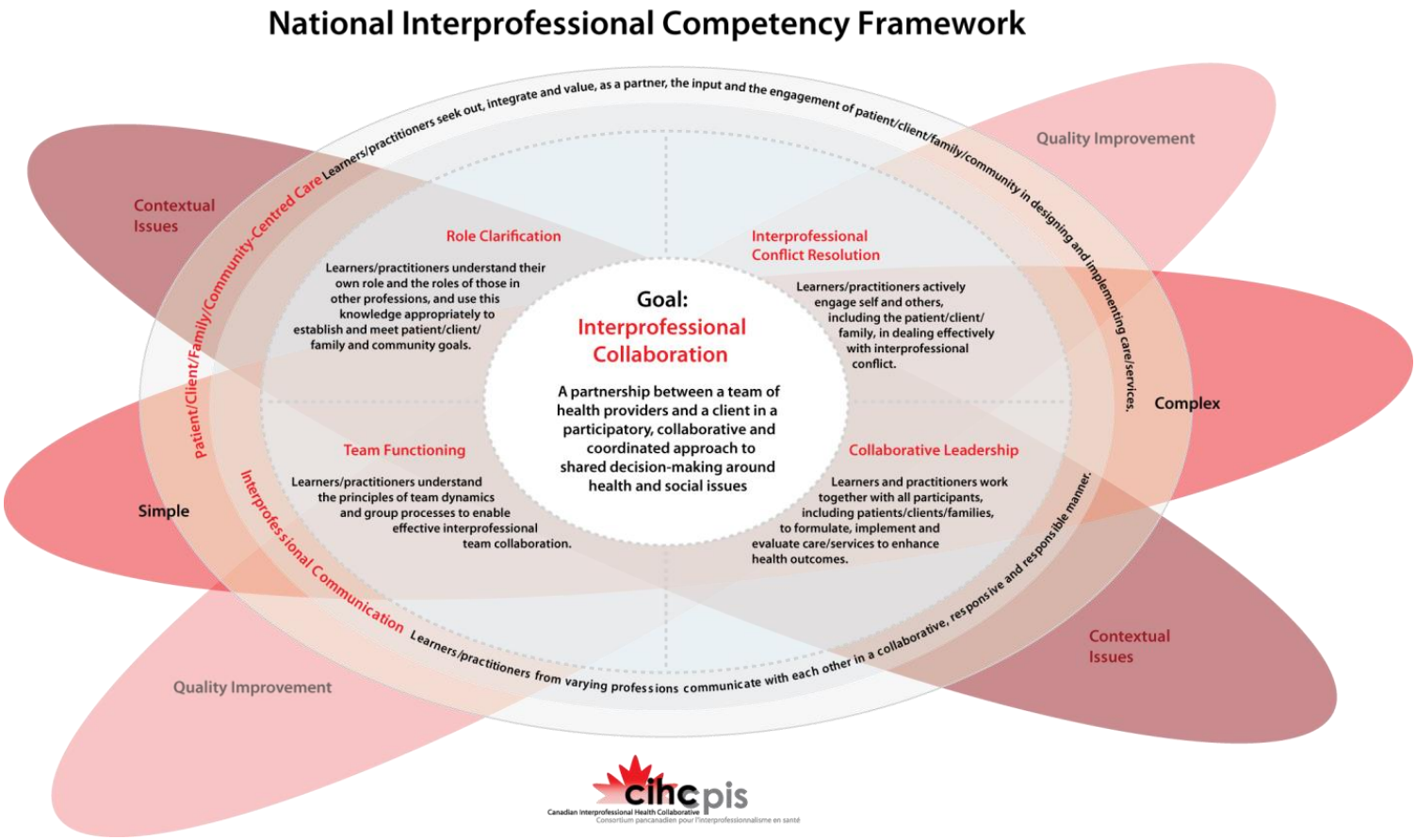

Figure 1.1. National Interprofessional Competency Framework from CHIC

From: http://www.cihc.ca/files/CIHC_IPCompetencies_Feb1210r.pdf

Figure 1.2. TeamSTEPPS® Conceptual Framework

From: http://TeamSTEPPS®.ahrq.gov/TeamSTEPPS®logo.htm

CHAPTER 2

The Validity Evidence for Performance Assessment Tools for Interprofessional Communication and Teamwork (PACT)

This is the second in a series of two papers describing the development and validation of Performance Assessment for Interprofessional Communication and Teamwork (PACT); tools to assess pre-licensure interprofessional student teams' performance in acute simulated scenarios. The first paper focused on the processes and challenges associated with the development of the PACT tools. This paper presents reliability and validity evidence for the PACT tools.

2.1 Background

The University of Washington (UW) Macy grant team chose Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) developed by the Agency for Healthcare Research and Quality (AHRQ) as the training framework for large-scale interprofessional education (IPE) simulation training. The UW Macy Assessment team reviewed the literature for validated tools to assess teamwork and communication skills acquired by health professional students. The Assessment team was able to identify some tools with preliminary reliability and validity evidence but was not successful in finding specific tools that would address our aims.

In the first paper of this series, the rationale for creating a new observational assessment tool was described. In addition, the processes and challenges experienced during the development of the PACT tools were summarized. A total of nine steps were involved in developing the PACT and steps 1-6 were described in the first paper. This second paper will focus on presenting the methods and results from steps 7-9 (*). These steps included:

1) a systematic review of the literature to identify existing assessment tools;

2) a review of conceptual models to match training and evaluation goals;

3) a compilation of items from existing tools;

4) the development of new items missing from existing tools;

5) the reorganization of new tools matched to training sequence and end-users;

6) the determination of format and usability of PACT tools;

*7) the implementation of the pilot study;

*8) the modification of the PACT tools based on the pilot results; and

*9) the collection of validity evidence for the PACT tools.

Summary of the first six steps

The primary author searched four major medical and educational databases with key terms and identified 16 existing assessment tools for interprofessional teamwork. The author compiled all 354 items from the tools. Some items were selected and modified to fit the assessment needs of the UW Macy grant team. Additional items were developed to assess specific teamwork and communication strategies built into the simulated scenarios. Paper 1 described the detailed processes and challenges experienced during the development process (steps 1-6) of the PACT tools.

Description of the initial PACT tools

The PACT tools were developed based on TeamSTEPPS® framework, which included five constructs: Team Structure, Leadership, Situation Monitoring, Mutual Support and Communication. The PACT tools consisted of three versions: PACT-Novice, PACT-Expert, and PACT-Video. Different versions of PACT were created for observers with different levels of TeamSTEPPS® knowledge, teamwork experience and coding training.

The PACT-Novice (Appendix A) was designed for raters without formal TeamSTEPPS® training to perform a real-time assessment of students in a simulated scenario. Descriptions of the five TeamSTEPPS® constructs were provided on the assessment tool to act as a quick guide for raters (Appendix A). The PACT-Novice tool used a 3-point quality scale to assess whether the student teams addressed the constructs. Raters reported (Yes, Yes but, and No) for demonstration of each of the TeamSTEPPPS® constructs. A column for comments or note taking was also provided, allowing raters to describe "Yes, but" responses. A glossary of key terms and concepts describing team communication (Appendix B) was developed to accompany the PACT-Novice tool to help raters understand the key concepts of TeamSTEPPS®.

The PACT-Expert (Appendix C) was designed for raters who were familiar with TeamSTEPPS® constructs. This tool was completed in real-time by the rater and allowed debriefing on specific communication behaviors. The PACT-Expert tool contained 18 behavioral markers drawn from the 31 behavioral markers. These 18 items represented the 5 TeamSTEPPS® constructs that were taught to students. Each item of the PACT-Expert tool required the rater to judge the quality of teamwork and team communication using a 5-point Likert-type scale (ranging from poor to excellent: 1-5). This scoring system allowed for the creation of composite scores for each TeamSTEPPS® construct, as well as an overall aggregated score.

The PACT-Video (Appendix D) was the most sophisticated tool and was designed for experienced raters trained to use the PACT-Video tool. This particular tool was developed for close, retrospective analysis of recorded scenarios of student team training. The PACT-Video tool contained 26 individual behavioral markers for which the rater judged the frequency and quality of the observed behaviors. It also included global quality scales for each of the five TeamSTEPPS® constructs.

Coding of each individual recorded scenario required three viewings by an experienced rater. Following the first viewing of the video, the rater was asked to judge interprofessional team performance using a 4-point scale (1=Need Improvement in Most Areas, 2=Need Improvement in Some Areas, 3=Satisfactory, and 4=Excellent) for each TeamSTEPPS® construct. If there was not sufficient evidence to judge a specific construct, the rater was given the option of selecting "Not Enough Information." During the second viewing of the recording, the rater was asked to time stamp significant teamwork behaviors observed throughout the simulation. Following the second review of the video recording, the rater was asked to provide ratings for the frequency of each behavioral marker (1=Absent, 2=Isolated, and 3=Consistent) and quality of it (1=Poor, 2=Needs Improvement, 3=Satisfactory, and 4= Excellent). After the third viewing, the rater again was asked to rate the interprofessional team performance using the same 4-point scale used following the first viewing of the recorded scenario. See Table 1 for a detailed description of the instrument.

Validity in performance assessment

Traditional validity theory divided validity into three categories: content, construct and criterion validity (Cook & Beckman, 2006). The distinctions of the three traditional views of validity were ambiguous and did not take the social consequences to the evaluated groups/individuals and interpretation of the scores into account. Therefore, the unifying concept of "construct validity" was proposed. Messick (1995) provided a more comprehensive framework to evaluate construct validity of performance assessment/observation tools based on six distinguishable aspects: 1) content, 2) substantive, 3) structural, 4) generalizability, 5) external, and 6) consequential. The content aspect of the construct validity included evidence of content relevance, representativeness, and technical quality. The content of the assessment tool

needed to reflect the construct that one intended to measure and nothing else. The substantive aspect referred to theoretical rationales for the observed consistencies in test responses, especially providing appropriate sampling of the construct domain in addition to the general coverage of construct domain content. The structural aspect of construct validity was to demonstrate the reflection of the construct domain structure in the structure of the assessment. The theory of the construct domain guided both the selection of relevant assessment tasks and the scoring model. The generalizability aspect was to ensure the score meaning/interpretation was not limited to the sampled assessed tasks but was generalizable to the broader construct domain. The score interpretation also needed to be generalizable across time, occasions, and raters. The external aspect of the construct validity referred to the relationships between current tools and other measures. The level of association should vary depending on the evaluated construct. The consequential aspect of the construct validity referred to both positive and negative consequences to the individual or group evaluated. Table 2 provides summary descriptions for these six aspects of Messick's framework that is the basis for this paper.

Reliability is established by evidence that multiple measurements can be expected to produce similar results under consistent conditions and is a necessary condition for validating any assessment tool. However, evidence of reliability alone does not provide sufficient support for the use of the tool. There are many ways to describe reliability. In this study estimates of internal consistency (Cronbach's alpha) and inter-rater reliability (intraclass correlation) were used to assess reliability.

Two studies were described in this paper: a pilot study in 2010 and a validity study in 2011. Step 7 summarized the purposes and results of the pilot study. Step 9 presented the methods and results of the validity study.

Step 7: The Implementation of the pilot study.

The purposes of the pilot study were to: 1) collect data on the reliability of the PACT tools; 2) test the usability of different versions of the PACT tools; and 3) confirm our hypothesis that different versions of PACT tools were needed to meet the varying assessment demands and rater experience in IPE. All procedures (Table 3) and tools (Appendix A, C, and D) were reviewed by the University of Washington (UW) Internal Review Board (IRB). A certificate of exemption was granted by the UW IRB prior to the pilot study.

Forty-nine students from the schools of medicine, nursing, pharmacy, and the physician assistant (PA) program participated in the pilot study in June, 2010. Students participated in a four-hour training including didactic session about teamwork, simulation scenarios followed by debriefings emphasizing on teamwork and communication skills, and group debriefing. The results of the pilot study (Table 4) demonstrated adequate internal consistency (Cronbach's alpha) and inter-rater reliability (intraclass correlations) of the PACT tools. The pilot study also helped to shape the implementation of the assessment plan for the subsequent student team training held in 2011.

Step 8: The modification of the PACT tools based on the pilot results.

The PACT-Novice and PACT-Expert tools were piloted real-time and the PACT-Video was piloted using the recorded scenarios from the 2010 pilot study. Expert-raters and faculty debriefed after the pilot study. Based on feedback they provided and the results from the pilot data analyses, the PACT tools were modified. The modified versions were used to collect validation data in 2011 for similar scenarios but larger samples. See Table 5 for a summary of the final PACT tools. The final PACT tools and the modifications made to the PACT tools based on the pilot results were described below.

Description of the final PACT tools

The PACT-Novice Tool. Based on the pilot data analysis, the author found the original PACT-Novice to be reliable (Table 4). However, there was insufficient information on team performances to compare among teams where the team performances were heterogeneous. The final PACT-Novice (Appendix E) uses a 5-point Likert-type scale with 3 anchors (Poor to Average to Excellent) instead of the original 3-point scale (Yes, Yes but, and No) to obtain richer information for data analysis. The PACT-Novice tool includes the five TeamSTEPPS® constructs that were part of our team training curriculum.

The PACT-Expert Tool. The initial PACT-Expert included 18 items without global quality ratings for the TeamSTEPPS® constructs. Expert observers using the PACT-Expert tool generally reported its length to be manageable, but still too long. The final PACT-Expert tool (Appendix F) contains 13 behavioral makers that were chosen following the steps described below: 1) Based on the learning objectives, students should have been able to demonstrate newly acquired TeamSTEPPS® teamwork and communication skills in the simulated scenarios. Only behavioral markers associated with specific TeamSTEPPS® skills from the original PACT-Expert remained in the final version. One behavioral marker was added to the "mutual support" construct to capture a specific TeamSTEPPS® skill (CUS/Two-Challenge Rule) from the scenario. 2) A key component of the "team structure" construct (recognize a leader) was inadvertently omitted in the original PACT-Expert tool, but was added to the final version. 3) Multiple items related to the concept of "ask for clarification" were removed to avoid redundancy. 4) In order to achieve a balanced scale four of the TeamSTEPPS® constructs were reduced from five to two behavioral markers each. All five behavioral markers related to the communication construct remained because of the need to assess specific communication skills.

5) The final selection of behavioral markers was based on the results of an item analysis of effects on the internal consistency, expert review and how well the behavioral markers related to the construct.

The initial PACT-Expert tool was the only PACT tool without global quality ratings for the five TeamSTEPPS® constructs. Results from the pilot study suggested that the global quality scale for each of the five TeamSTEPPS® constructs was reliable. The global quality ratings of 4-point Likert-type scales (Need Improvement in Most Areas, Need Improvement in Some Areas, Satisfactory, and Excellent) of the five TeamSTEPPS® constructs were added to allow for a summary of information and an opportunity to compare the ratings between expert and novice observers.

During debriefing, expert raters reported some behavioral markers did not occur in the scenarios. A frequency scale (Present, Absent, and Not Applicable) was added to individual behavioral markers to enable raters to record the absence of a behavioral marker. Expert raters also reported the tendency to choose the middle score (e.g. 3 in a 5-point scale) when a judgment of quality was difficult to make. The UW Macy Assessment Team recommended to change the 5-point quality scales of individual behavioral markers to 4-point Likert-type scales (Poor, Need Improvement, Satisfactory and Excellent). This change forced raters to decide if the behavior warranted a rating of "Satisfactory". The final PACT-Expert tool consists of 4-point quality scales of 13 behavioral markers and 4-point global quality ratings of the five TeamSTEPPS® constructs.

The PACT-Video Tool. Eight expert raters in teamwork evaluated three simulated scenario videos (from the pilot study) using the initial PACT-Video tool and protocols. Discussions with raters and a review of these initial data suggested that the second coding step

requiring faculty to time stamp individual behaviors was too labor intensive. The data did provide rich quantitative and qualitative information for each scenario and enabled the primary author to explore how scenarios unfolded through each rater's perspective. The time stamp step proved invaluable for tool development, provided evidence that while each rater reported the presence and timing of behaviors very differently, individual raters demonstrated consistency in their global ratings. However, the time stamp procedure was removed in the final version due to the large time commitment involved. The final PACT-Video tool (Appendix G) contains frequency and quality information for 26 individual behavioral markers, as well as global quality scales for the five TeamSTEPPS® constructs. The PACT-Video tool was available in both paper-and-pencil and online formats.

The final PACT-Video tool asks raters to view each video three times. After the first viewing, the raters judge the IPE team performance in each of the five TeamSTEPPS® constructs using a 4-point Likert-type scale (Need Improvement in Most Areas=1, Need Improvement in Some Areas=2, Satisfactory=3, and Excellent=4). We eliminated the "Average" performance midpoint commonly seen in a 5-point scale. Five-point scales can provide for more reliable assessment; however, the 4-point scale forced the rater to make a decision on the quality of a specific TeamSTEPPS® construct instead of allowing them to choose a non-committal "middle category" (Hernández, Drasgow, & González-Romá, 2004). If there is not sufficient evidence to judge a specific domain, the rater is given the option of selecting "Not Enough Information". After the second viewing, raters record the frequency of an expected behavior (Absent=1, Isolated=2, Consistent=3 and Not Applicable=0) and to judge the quality of the behavior (Poor=1, Needs Improvement=2, Satisfactory=3, Excellent=4 and Not Applicable=0) of each behavioral marker. After the third viewing, the raters are again asked to judge the IPE team

performance in each of the five TeamSTEPPS® constructs as a final global quality scale. In our pilot study we found some significant differences between the two (initial and final) global quality scales. We decided to use the final quality scales to calculate the total composite scores because the judgments were made after more detailed observations and additional viewings. Table 6 describes the coding protocol for the PACT-Video tool.

After the modification of the PACT tools, the final PACT tools were then used for students training in 2011 to collect validity evidence.

2.2 Methods

Step 9: The collection of validity evidence for the PACT tools.

Procedures of Student Training

Three hundred and six interprofessional students (medicine: 174, nursing: 88, pharmacy: 32, PA: 12) with similar level of training in clinical skills participated in the team training (4-hour curricula). The training was held at the Institute for Simulation and Interprofessional Studies (ISIS) simulation laboratories (UW Medical Center and Harborview Medical Center locations, Seattle, WA) during the annual medical capstone event which was a week-long event designed for graduating medical students. Students from the nursing, pharmacy, and PA programs were recruited by faculty from their respective professions. Training consisted of a didactic group session highlighting the TeamSTEPPS® constructs, followed by three simulated team exercises, and concluded with a group debriefing. Students consented to be video-recorded during the team training exercises. All procedures and activities were approved by the UW IRB.

Participants received cognitive training related to the TeamSTEPPS® conceptual framework prior to the simulation exercises. The cognitive training included a 30-minute lecture and two small group activities. The small group activities were designed to allow students an

opportunity to practice the TeamSTEPPS® teamwork and communication skills and strategies in a non-medical scenario, e.g. building a paper-chain as a team (need to add reference for skills transferring). At the end of the didactic session, students were provided instructions in the use of the PACT-Novice tool. Students participated in three scenarios, either as a member of a simulated team or as an observer when the team size was at a maximum. Participant observers not actively engaged in the simulation were asked to use the PACT-Novice tool to assess team performance of the group carrying out the simulation. Faculty explained how observing others was an important part of learning and how using the tool to assess their classmates would help them better observe interprofessional teamwork/communication behaviors in the scenario.

We strived to create simulated scenarios representing real-life clinical situations. Three sets of simulated scenarios were created to meet students' training needs and expectations. Students with clinical interests in pediatrics or obstetrics (OB) completed simulations in these respective domains. The remainder of students, a majority, completed adult acute care simulations. Students were able to choose the set in which they wanted to participate. All students participated as part of an interprofessional team that provided care to a human patient simulator or standardized patient in three acute simulation scenarios. One group of students completed asthma, chronic heart failure (CHF), and supraventricular tachycardia (SVT) scenarios (in no specific order). Two separate groups of students completed either three OB scenarios or three pediatric scenarios. Each simulation scenario took approximately 15 minutes to complete. At the scenario's conclusion, faculty facilitators, student participants and observers, and the standardized patients came together to debrief (15 minutes) about this learning experience. All students reconvened after completing each of the three scenarios for an end-of-

day wrap-up debrief and evaluation of the program activities. Table 3 summarizes the 4-hour curriculum and provides a more detailed description of the training.

Data collection

The PACT tools were completed after each simulation scenario by the following groups: 1) student observers not actively participating in the simulation scenario completed the tool (PACT-Novice) as a peer evaluator, 2) student team members (PACT-Novice) participating in the scenario completed the tool as a self-evaluation, 3) facilitating faculty who were not trained in TeamSTEPPS® completed the PACT-Novice tool of the student teams, and 4) expert faculty in teamwork and graduate students who had completed TeamSTEPPS® training and had observed the simulation training completed the PACT-Expert tool. The assessment forms were collected and sent to the primary author. A graduate student entered all the PACT-Novice data into an Excel® spreadsheet, which was transferred to PASW SPSS Statistics 18 for analysis by the primary author. The primary author entered the PACT-Expert data in SPSS.

Two digital cameras and microphones were set up to record the SVT and asthma scenarios. Digital cameras and microphones were set up to record CHF, OB and pediatric scenarios; however, the quality of the videos for the CHF, OB and pediatric scenarios were not good enough for coding. A total of 40 digital recordings of SVT and asthma were edited and uploaded to a secure server for streaming. Video links were sent to assigned raters via email. Raters include two graduate students and seven faculty members (three nursing, two medical education, one pharmacy and one PA). All raters participated in a three-hour PACT-Video training session prior to rating videos. The training consisted of reviewing video clips of the communication and teamwork strategies, becoming familiar with the PACT-Video tool, viewing a sample video, rating the sample video, and discussing the results and standards. Two graduate

students rated all 40 videos. Every faculty member was assigned 6 videos to ensure every video was rated by the faculty. Online coding was completed through a Catalyst WebQ survey tool if the rater chose to compete the coding online. The paper-pencil data were entered into Catalyst WebQ by the author. All data were transferred into SPSS 18 for analysis. After the video coding was complete, the digital recordings were deleted as required by the IRB application. Table 7 listed PACT tools administered by location and scenario.

2.3 Results

The statistical findings and validity evidence for the PACT tools will be presented using the Messick (1995) framework. The meanings and implications of the statistical findings will be discussed in greater detail in the "Discussion" section.

The total numbers of records for PACT-Novice, PACT-Expert and PACT-Video were 934, 85, and 120, respectively. Data for PACT-Novice and PACT-Expert were collected from all scenario types. However, PACT-Video was only used for 20 asthma and 20 SVT scenarios due to the poor video or audio quality of other scenario types. Records with missing values (incomplete ratings) were excluded in the analysis for PACT-Novice and PACT-Video. Missing values were treated differently for PACT-Expert. After closer review of the PACT-Expert data, it was noted that missing values in the quality scale were often associated with "Absent" or missing in the frequency scale. If the frequency scale was rated "Absent", the rater was supposed to rate the quality scale of the behavioral marker as "Not Applicable". Missing values were replaced with zero (the same coding as "Not Applicable") when performing analysis for PACT-Expert.

Reliability evidence

Reliability evidence was examined prior to assessing validity evidence. Cronbach's alphas and intraclass correlations (ICCs) were calculated to assess the internal consistency and the inter-rater reliability of the PACT tools. A one-way random effects model was chosen for ICCs because not all the raters rated the same scenarios. The ICC of PACT-Novice was .85 (n=904, F=6.46, $p < .001$). The ICC of PACT-Expert was .76 (n=85, F=4.09, $p < .001$). The ICC of PACT-Video was .90 (n=112, F=9.63, $p < .001$). Table 8 summarizes the ICCs and Cronbach's alphas calculated for the three PACT tools.

Content Evidence

The PACT tools needed to demonstrate content relevance and representativeness. The development of PACT tools followed the recommended steps of a literature search, expert review, pilot testing and data collection. The target construct domain was interprofessional teamwork in acute simulated clinical scenarios. Based on the TeamSTEPPS® conceptual framework, interprofessional teamwork can be explained by the five TeamSTEPPS® constructs. The cognitive training provided before the simulations used TeamSTEPPS® conceptual framework and terminology. The PACT-Novice consisted of five quality scales for the five TeamSTEPPS® constructs which theoretically defined the target construct domain. The PACT-Expert included 13 behavioral markers representing the five TeamSTEPPS® constructs, plus the global quality ratings of the five TeamSTEPPS® constructs. Two behavioral markers represented four of the five constructs. The exception was the communication construct, which was represented by five behavioral markers. This emphasis of the communication construct was designed to capture the specific communication skills taught in the didactic cognitive training session. The PACT-Video was developed based on the TeamSTEPPS® framework as well, and

included 26 behavioral markers representing the 5 TeamSTEPPS® constructs, plus the global quality ratings of the five TeamSTEPPS® constructs.

Substantive Evidence

Observed consistencies in test responses provided evidence of substantive validity. The scenarios unfolded under direction of the faculty facilitators to ensure the consistency between scenarios. Much effort went into providing sufficient support in the form of "coaching" of the students if they were unclear as to how to clinically manage the patient. The coaching enabled the students to focus on communication and teamwork skills. The UW Macy assessment team chose behavior markers that represented specific constructs. The observing and coding processes of the PACT-Novice and PACT-Expert tools were built into the post-scenario debriefing. The PACT-Novice and its scoring system were introduced to the student raters at the end of the didactic session. Raters using the PACT-Video tool followed a coding protocol developed by the author. Video raters also received a 3-hour rater training to ensure the consistency of the rating process.

Structural Evidence

Evidence of structural validity required the demonstration of how well the test structure reflected the theoretical structure of the target construct. We approached the structural evidence with two methods, internal consistencies of the subscales and an exploratory factor analysis. The internal consistencies helped us to understand how well the behavioral markers within one subscale represented the same construct. Cronbach's alphas and ICCs were calculated for subscales in PACT-Expert and PACT-Video to determine the level of internal consistencies of the subscales. However, four of the five subscales in PACT-Expert were too short with only two behavioral markers. Cronbach's alphas were not reported for these subscales. The ICCs of the

subscales in PACT-Video ranged from .54 to .84 (F=2.18-6.36, $p < .001$). Table 9 summarizes the ICCs and Cronbach's alphas for subscales in PACT-Expert and PACT-Video.

The exploratory factor analysis provided information to examine how well the data we gathered fit the theoretical structure. The Kaiser-Meyer-Olkin (KMO) measurement of sampling adequacy and Bartlett's Test of Sphericity were performed to determine if these data were suitable for factor analysis. Both PACT-Expert (KMO=.788, n=85) and PACT-Video (26 quality ratings of each behavioral markers, KMO=.863, n=120) had appropriate KMO sampling adequacy and significant Bartlett's test results. Although the sample size (n) was small for performing factor analysis, we examined trends and explored the possibility of future model building to detect underlying structure. Principal axis factoring with Varimax rotation was conducted to extract underlying factors. Factors were extracted if Eigen values were greater than 1. Four factors were extracted for PACT-Expert and accounted for 62.76% of the total variance explained. Six factors were extracted for PACT- Video and accounted for 66.13% of the total variance explained. The results of the exploratory factor analysis were presented in the forms of correlation matrix and rotated factor matrix for PACT-Expert (Table 10) and PACT-Video (Table 11).

Preliminary Generalizability Evidence

Ideally, we would like to see that the PACT tools could be used to assess teamwork and communication skills in different scenarios by different raters at different times. One-Way ANOVA results of the PACT-Expert showed no significant differences in 9 of 13 (69%) behavioral markers among the different scenarios types. The four behavioral markers demonstrated significance among different scenario types: 1) item 2: Refer to protocols and checklists (F=6.37, $p < .001$), 2) item 7: Ask for assistance prior to task overload (F=6.77, $p <$

.001), 3) item8: Use Two Challenge rule or CUS (F=10.79, $p < .001$), and 4) item 13: Demonstrate closed-loop communication (F=3.32, $p < .05$). One of five construct scores demonstrated significance difference (Mutual Support, F=2.44, $p < .05$) among different scenario types.

One-Way ANOVA results of the PACT-Video tool demonstrated no significant differences in total scores, all five final construct scores, and 22 of the 26 (85%) behavioral markers between the different scenario types (SVT and Asthma only). Though we found no differences between scenarios, further studies are required to investigate the generalizability of the PACT tools.

Cautions on Generalizability

Based on a One-Way ANOVA test, the PACT-Novice tool scorings of Mutual Support (F=3.351, $p < .05$) and Communication (F=2.748, $p < .05$) differed significantly between raters from different professions. There were also significant differences in construct scores based on whether the rater was a student observer, a student participant, or faculty facilitator (F values ranged from 6.06 to 8.85, $p < .05$). Significant differences were also found in all five construct scores between different scenario types (Team Structure, F=25.05, $p < .001$; Leadership, F=11.53, $p < .001$; Situation Monitoring, F=4.15, $p < .05$; Mutual Support, F=2.61, $p = .05$; Communication, F=3.45, $p < .05$). Different scenario types were asthma, CHF, SVT, OB and pediatric.

The PACT-Novice tool was a 5-point scale. The PACT-Novice was embedded in the PACT-Expert and PACT-Video as the overall quality ratings of the constructs (4-point scale). The overall quality ratings of the constructs from the PACT-Expert and the PACT-Video tools were rescaled from 4-point scale to 5-point scale before combining with and comparing to the

PACT-Novice tool. The reason of our decision to rescale the 4-point scale to 5-point scale for comparison instead of the other way around was to maintain the amount of information in the 5-point scale. By stretching the end of the 4-point scale to 5, the total distance increased from 4 to 5. The intervals between anchors increased from 1 to 1 and 1/3 (1=1, 2=2.33, 3=3.67, and 4=5). The significant differences in all five construct scores between novice (PACT-Novice) and expert (PACT-Expert and PACT-Video) groups using One-Way ANOVA (Table 17; Team Structure: $F=52.14$, $p < .001$; Leadership: $F=80.96$, $p < .001$; Situation Monitoring: $F=23.92$, $p < .001$; Mutual Support: $F=28.31$, $p < .001$; Communication: $F=106.15$, $p < .001$) suggested that novices and experts scored differently using PACT tools. Figure 1 shows that ratings by experts were generally lower than ratings made by novices.

External Evidence

Evidence of external validity requires comparison or correlation between the PACT tools with measures of similar constructs. Existing measures of team behavior were not considered to be sufficiently valid for use in the study and subsequently alternative measures were not administered. Behavioral markers in PACT-Video, which were identical to PACT-Expert behavioral markers, were extracted to form a subset as a parallel measure to PACT-Expert. The overall quality ratings of the five TeamSTEPPS® constructs were also included in the subset. The results of the subset were compared to the PACT-Expert. One-Way ANOVA results demonstrated significant differences between the PACT-Expert and the parallel measure in two construct scores: Leadership ($F=5.05$, $p < .05$) and Communication ($F=11.62$, $p < .001$) and two behavioral markers: item 4: Empowers team members to speak freely and ask questions ($F=3.89$, $p = .05$) and item 7: Ask for assistance prior to task overload ($F=4.34$, $p < .05$).

Consequential Evidence

There were no real-time scores calculated during debriefing. Hence, no scores were available for interpretation. The consequential evidence was not applicable in this study design.

2.4 Discussion

It is important to remember that the reliability and validity properties we report represent a single set of sampled responses, and do not necessarily represent the properties of the tools themselves. Reliability and validity properties could change when the tools are used with a different sample of participants, environment and time, or for a different purpose. Test validity is not a simple description that a measure is valid or invalid. Validity is a spectrum and process of collected evidence to support specific uses and interpretations of the tool. The validity evidence we collected suggested that the PACT tools were reliable to use and offered some preliminary validity evidence in some (content, substantive and structural) aspects for the PACT tools. There are still gaps in the construct validity that need to be addressed in the future (e.g. test-retest reliability, generalizability, external and consequential aspects of validity evidence). The following summarizes the validity evidence gathered for the PACT tools.

Content evidence.

The PACT tools were developed based on the TeamSTEPPS® conceptual framework that proposed five TeamSTEPPS® constructs defining interprofessional teamwork. All five TeamSTEPPS® constructs were represented by overall ratings of constructs and by specific behavioral markers in PACT tools. The PACT-Novice was developed to assess teamwork of pre-licensure health professional students' teams in acute simulated scenarios. The PACT-Expert and PACT-Expert were developed for the purpose of assessing pre-licensure health professional students' team performances with the focus on communication skills in acute simulated scenarios. We followed the recommended steps of tool development including literature search,

expert review, pilot testing and data collection for reliability and validity evidence. The literature search and expert review of the development processes were described in the first paper. This paper summarized the information of pilot testing as well as the reliability and validity evidence for the PACT tools.

Substantive evidence.

The PACT tools demonstrated consistent responses and processes. The scenarios were designed to minimize the complexity of the patient situation. In this way individual's level of technical knowledge and skills had minimal impact on the team performance. We developed supporting documents and guides to ensure the similarity of scenarios and standardized processes of rating. The PACT tools and their scoring systems were introduced to the raters before they used the tools to ensure consistency of the scoring standards and processes. The PACT-Novice and PACT-Expert were administered immediately following the simulated scenarios and prior to the debriefings. The raters of the PACT-Video received coder training to get familiarized with the tool and to practice scoring. The PACT-Video also came with scoring procedure for the raters to follow in order to maintain the consistent scoring processes.

Structural evidence.

We presented the internal consistencies of subscales and the results of an exploratory factor analysis as the preliminary structural evidence for the PACT-Expert and PACT-Video. Internal consistencies of subscales provided information on how the behavioral markers related to one another within the subscale. Low Cronbach's alpha indicated the behavioral markers were not measuring the same construct. However, with a few behavioral markers in one subscale, behavioral markers needed to measure different aspects of the construct for comprehensive coverage of the construct. We expected to see moderate Cronbach's alphas for the subscales

because in theory they measure the same construct but with different angles. Acceptable internal consistencies of the subscales served as the preliminary substantive evidence for the Communication construct of PACT-Expert (Cronbach's alpha: .67) and PACT-Video (Cronbach's alphas: .63-.85) tools. The Cronbach's alphas were not meaningful to report for the Team Structure, Leadership, Situational Monitoring, and Mutual Support constructs of PACT-Expert due to the extremely short subscale (two behavioral markers in each construct).

The results of exploratory factor analysis performed for PACT-Expert and PACT-Video provided information on the pattern of how the behavioral markers represented the constructs. The correlation matrix of PACT-Expert revealed low to moderate correlations among behavioral markers. The correlations were acceptable because we expected similarities as well differences between behavioral markers. We assumed the similarities were the target construct (teamwork) and the differences might be the results of different aspects of the construct, other constructs we did not intend to measure, or measurement errors. Though one would expect behavioral markers to correlate strongly with behavioral markers in the same construct, this was not always the case based on our data. Table 10 presented the rotated factor matrix for the PACT-Expert. Factor 1 was support by several behavioral markers from Communication construct and one behavioral marker from Situation Monitoring construct. Factor 2 was supported by both behavioral markers from Leadership construct and "Recognize team leader" from Team Structure construct. Factor 3 was support by both behavioral markers from the Mutual Support construct. Factor 4 was supported by behavioral markers "Hand-off" and "SBAR" from the Communication construct. The structural evidence demonstrated a different, but in some ways similar, structure to the original five TeamSTEPPS® constructs.

The correlation matrix of PACT-Video also demonstrated low to moderate correlations among the behavioral markers. The correlations among behavioral markers in PACT-Video (above 0.6: 2.46%; between 0.6 and 0.3: 49.23%; below 0.3: 48.31%) were stronger than they were in PACT-Expert (above 0.6: 0%; between 0.6 and 0.3: 37.18%; below 0.3: 62.82%). Exploratory factor analysis of PACT-Video extracted 6 factors. Factor 1 was nicely supported by all the six behavioral markers from the Communication construct. Factor 2 was supported by several behavioral markers from the Team Structure and the Leadership constructs. These behavioral markers all related to leadership. Factor 3 was supported by a mixture of behavioral markers from Leadership, Situation Monitoring, and Mutual Support constructs. The behavioral markers all had an element of team members' participation and involvement. Factor 4 was mainly supported by behavioral markers related to errors (identifying or reacting to potential errors). Factor 5 was mostly supported by the behavioral markers from the Situation Monitoring construct. Factor 6 was mainly supported by two behavioral markers from the Team Structure construct. Although the loadings and groupings of the behavioral markers were not perfectly aligned with the five TeamSTEPPS® constructs, we can see a merging pattern of the underlying structure. More studies are needed to provide stronger evidence for the structural aspect of the validity for PACT-Expert and PACT-Video.

Generalizability evidence.

This study did not provide strong generalizability evidence for the PACT tools. Preliminary generalizability evidence was examined by comparing differences between different rater characteristics and scenario types. Comparison between different rater characteristics was not conducted for the PACT-Expert and PACT-Video because of the small group of raters we were able to recruit. Based on the results of the comparison between different scenario types for

the PACT-Expert and PACT-Video tools, these two tools might be used to assess teamwork and interprofessional education in different acute simulated scenarios that were developed utilizing a TeamSTEPPS® framework. However, demonstrating no significant differences between scenario types was only the first step to providing such evidence. More evidence such as correlation between results from other studies with different group of raters or different simulated scenario types is needed to support this hypothesis.

We suggested to exercise cautions in comparing the results of the PACT-Novice. Significant rating differences were exhibited between different rater roles, different rater professions, and different scenario types. Subsequently, it may not be appropriate to compare the results of the PACT-Novice tool across different professions, different roles, and different scenario types for evaluation and research purposes. We also found the expert ratings of PACT-Novice were generally higher than the ratings of novices. The discrepancies between expert and novice ratings can be explained several ways. We proposed the differences among the tools used and the amount of training received resulted in this discrepancy. The PACT-Novice was included in the PACT-Expert and PACT-Video in the form of overall quality ratings of the five TeamSTEPPS® constructs. The PACT-Expert and PACT-Video tools contained specific behavioral markers for the experts to observe the scenario in a detailed manner before they rated the overall quality ratings of the five TeamSTEPPS® constructs (PACT-Novice). The PACT-Video also allowed the raters to observe the scenario multiple times before making the final judgment. The expert raters had more extensive TeamSTEPPS® and coding training. It was more difficult for the novice raters to identify specific behaviors.

External evidence.

There was no gold standard measurement available for interprofessional team performance focusing on communication skills. No alternative measures were included in the study design to provide external aspect of construct validity. However, comparison between the PACT-Expert and the subset drawn from the PACT-Video suggested that the PACT-Expert tool could potentially be used as a reliable real-time measure of interprofessional teamwork in place for PACT-Video if video-recording is not feasible. Future studies with design incorporated parallel measures are needed to provide external evidence for the PACT tools.

Consequential evidence.

This study did not calculate any scores or interpret any results that may have consequences to the student groups evaluated. We were not able to provide consequential evidence for the PACT tools. Future studies are needed to examine the consequential aspect of construct validity of the tools.

However, we proposed a potential way to use the PACT-Video for evaluating pre-licensure student teams performances. We calculated total score with the formula: Total Score = sum of each behavioral marker score (product of global frequency and global quality scores)/number of observed behavioral markers + sum of Final Global Quality scores/number of scored constructs. This formula was developed with combining the results of detailed observation and the overall ratings in mind. Because not all behavioral markers would be present in every scenario, we summarized the information by adding the average score for individual markers to the average score for constructs. Comparing the reference points (Table 12) to the real data (Table 13) for PACT-Video, the range of the data (2.68-16) was close to the true possible range (1-16). The mean was 9.47 (better than 8 which means consistently need improvement or inconsistently satisfactory). This actually was the level of performance we expected from an

average student team. The score of the 10th percentile was 5.46. It is a bit below 6 (inconsistently need improvement behaviors). It was the level of some poor performing student teams that may need further training or practices. We were delighted to see the top 10 percent teams (scored 12.46) were able to reach the level of consistently satisfactory team performance. The scores require caution in their interpretation, with consideration of the training received, knowledge level and clinical experience of participants, and the expectations for the teams. We did not use the scores as an evaluation method for competencies. However, the total scores of PACT-Video may be of value for evaluating or grading student team performances in the future. We acknowledged the calculation of the total score was not the best or the only way to summarize the data. Different formula may be considered for different purposes and the consequential evidence needs to be established with the specific use.

Limitations

We acknowledge that this study has limitations. Rater trainings were done to ensure video raters understood the standards of different levels of quality. However, we did not have enough raters from different professions to determine the effect of different professions on the results of PACT-Video. The results from the PACT-Novice suggested there might be differences among professions in rating the PACT-Novice. More studies are required to confirm the rater effects on PACT-Novice.

Improved quality of the videotaped simulated scenarios may improve the quality of rater coding. Although we made some improvements based on the 2010 pilot videos (e.g., students were in different professional clothing to help raters identify their professions, microphones were strategically positioned at where we expected the team would gather, more than one camera were set up to capture different angels), raters still heard out-of-sight conversations or missed crucial

communication among team members. Sometimes the views were blocked. These obstacles may prevent the raters from making fair judgments. Raters inevitably brought their own biases through their professional training, perceptions and expectations of professional roles in a team, and previous level of understanding of the TeamSTEPPS® constructs and skills.

Although the developers of the PACT tools were from various professions, many professions were represented by one single individual. If other expert teams or individuals could review the PACT tools, it will improve the level of the content aspect of the construct validity. We collected data only from one site in 2011. The characteristics of the students and interprofessional faculty at University of Washington in 2011 may be different from the students and faculty at a different institution or graduated in a different year. It would increase our confidence level on the generalizability aspect of the construct validity if we can combine our efforts with other institutions and collect data longitudinally.

Missing data was another limitation in our study. Some responses from the tools were not complete, especially the PACT-Novice and the PACT-Expert which were administered in real-time. Though the decision of how to treat or replace the missing data was thoroughly thought out, we might have missed information embedded in the missing data. Another limitation regarding the missing data was we were not able to treat all missing data the same way due to the small sample size of PACT-Expert. This might pose an issue when we compare or combine the results among the tools.

Scenarios unfolded very differently and the involvement of faculty facilitators varied greatly. We were limited by the number of records we had to build a theory and perform confirmatory analysis. Because of the lack of gold standard measurement in the field of study, no

other tools were administered for comparison. The PACT tools needed more data and evidence to support its external validity.

Future Directions

Incorporating other widely used observational tools for teamwork and communication will establish a stronger case for PACT tools' external validity. More data are needed to support inter-rater reliability (e.g. Kappa) estimates as well as intra-rater reliability estimates, which we were not able to conduct in this study. Recruiting raters from different health professions will also help us understand the impact of rater professions on the PACT-Video results.

The real student videos we used to collect reliability and validity data were realistic but there were no "correct" answers for the frequency and quality of the behaviors. We suggest the use of standardized videos to assess inter-rater and intra-rater reliability in the rater training program.

The data we collected were not sufficient to perform a reliable structural equation modeling (SEM) or confirmatory factor analysis (CFA). Future researchers, perhaps combining efforts across studies, creating a larger dataset, could perform SEM or CFA and provide more evidence for the structural aspect of validity.

Our training occurred at the end of the students' programs. We suggest researchers create baseline performance expectations of student teams in early IPE encounters/courses for comparison. A longitudinal study to follow up the retention of the learned skills in the clinical setting would be ideal.

We hope to speed up the process of proving the effectiveness of IPE on interprofessional teamwork and communication skills by providing reliable and valid tools. We invite researchers

in this field to use the PACT tools and provide us with data and ideas to modify and strengthen the validity of the tools.

2.5 References

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Table 2.1

Summary and Description of Initial PACT

Version	Description	Number of Items	Observer Training Level	Time of Administration
PACT-Novice	PACT-Novice (2010) contains the 5 TeamSTEPPS constructs and sample behaviors of constructs are provided on the tool. Raters are asked to rate the constructs using a 3-point Likert scale (Yes, Yes but, and No) and to record notes in the "comment" column. A list of definitions of key terms and concepts describing team communication was developed to accompany the PACT-Novice tool in order to help raters understand key concepts of TeamSTEPPS.	5	Novice observers (student observer)	Real-time
PACT-Expert	PACT-Expert (2010) contains 18 behavioral markers that were drawn from the first draft of PACT-Video. These 18 behavioral markers were representative of the behavioral markers observed in the videos of effective team communication. Raters are asked to use a 5-point Likert scale of quality (Poor to Excellent) to assess each behavioral marker.	18	Experienced observers	Real-time
PACT-Video	PACT-Video contains 4-6 behavioral markers under each domain (26 behavioral markers in total). Raters are asked to review the video for 3 times. After the first viewing, the raters are to record the initial quality rating for each of the 5 TeamSTEPPS constructs (Need Improvement in Most Areas, Need Improvement in Some Areas, Satisfactory, and Excellent). During the second viewing, the raters are to time stamp and record the behaviors that are demonstrated or should have been demonstrated. After completing the second viewing, raters are asked to complete the frequency (Absent, Intermittent, and Consistent) and quality scales (Poor, Need Improvement, Satisfactory, and Excellent). After watching the complete scenario three times, raters are asked to fill out the quality scale for the 5 TeamSTEPPS constructs again.	26	Experienced observers	Retrospective through videos

Table 2.2

Aspects of Validity Evidence (Messick's Model)

Aspect	Definition	Description
Content	Content Relevance and Representativeness	Specify the boundaries of the construct domain and determine the tasks to be assessed. These tasks need to be relevant and representative of the construct domain. Traditional way to ensure the quality of content validity is through expert professional judgment. Increasing performance standards should reflect increases in complexity of the construct, not sources of construct-irrelevant difficulty.
Substantive	Substantive Theories, Process Models, and Process Engagement	Provide information on the extent of which the scores reflect the internal structure of the assessment. The tasks need to be appropriately sampled to represent domain processes, not only domain content. Move to gather empirical evidence that the respondents were engaged in task performance. The evidence can include response consistencies or performance regularities reflecting the processes.
Structural	Scoring Models as Reflective of Task and Domain Structure	Structural fidelity refers to the relation of the assessment structure to the domain structure. The theory of construct domain should guide both the selection of tasks and the scoring models. The internal structure of the assessment should reflect the internal structure of the construct domain.
Generalizability	Generalizability and the Boundaries of Score Meaning	Address the boundaries of score meaning. In order to generalize the score interpretation to the construct domain instead of sampled tasks, performance assessment needs provide representative coverage of the content and processes of the construct domain. Limits of score meaning are not only affected by the generalizability across task but also by the generalizability across time, occasions, or observers of the task performance.
External	Convergent and Discriminant Correlations With External Variables	Refer to how the assessment scores relate to other measures, behaviors, criteria. The relationships between the assessment scores and criterion measures of selection (e.g. licensure, placement and program evaluation) are especially important. Empirical evidence of these high-stake relationships can support the use of the assessment scores for the specific purpose.
Consequential	Consequences as Validity Evidence	Demonstrate positive/negative, intended/unintended and short-tem/long-term social effects of score interpretation. The key is to avoid negative impact on groups/individuals caused by assessment invalidity.

Derived from Messick, S. (1995). Standards of validity and the validity of standards in performance assessment. *Educational Measurement: Issues and Practice*, 14, 5-8.

Table 2.3

Description of the Training (Four-Hour Curricula)

Activity	**Time**	**Description of activity**
Introductions	5 minutes	A brief to students so they know the flow of the program
Brief Lecture	30 minutes	TeamSTEPPS concepts, strategies, and skills are introduced in this session
Introduction to the Observational Tool (PACT-Novice)	5 minutes	A brief description of the benefits of observation and how to use the PACT-Novice.
Team Building Exercises	10 minutes	Team building exercises were broken into two parts and wrapped around the brief lecture. The exercise before the lecture was an icebreaker as well as a discussion starter around teamwork. The exercise after the lecture was an opportunity for students to practice teamwork skills learned during the lecture and reflect on how the skills helped with team performance.
Simulated Cases (each group rotated but completed all 3 simulation scenarios)	40 minutes per scenario	Each simulation scenario included: 1. Introduction to the simulator and the simulation environment (5min) 2. Content didactic about clinical skills and procedure/protocol needed in the scenario (5min) 3. Scenario unfolded (15min): 6 students actively participated in the scenario; the rest of the students observed the scenario and completed the PACT-Novice 4. Debrief (15min): Faculty facilitator challenged students to reflect on the scenarios what went well and what did not. The focus of the debrief as on teamwork.
Wrap-up of overall training	30 minutes	All faculty and students get together debrief and dis cuss lessons learned and how the training would impact their practice in the future. Everyone then filled out the program evaluation before leaving.

A sample curriculum agenda can be retrieved at http://collaborate.uw.edu/educators-toolkit/interprofessional-simulation-team-training-faculty-toolkit/sample-agenda.html.

Table 2.4

Reliability and Internal Consistency of PACT Tools from Pilot Study (2010)

Version	Number of Valid Records	Number of Items	ICC	F	Cronbach's Alpha
PACT-Novice	47	5	.80*	4.87**	.81
PACT-Expert	14	18	.82*	5.43**	.84
PACT-Video	5	26	.95*	18.36**	.97
	25	5 (Initial Global Quality)	.50*	1.985***	.57
	25	5 (Final Global Quality)	.60*	2.51**	.64

* ICC(1,k) was calculated with one-way random effects model where people effects are random. ICC for Average Measures was reported.
** F is significant $p < .001$
*** F is significant $p < .01$

Table 2.5

Summary and Description of Final PACT

Version	Description	Number of Items	Observer Training Level	Time of Administration
PACT-Novice	PACT-Novice (2011) contains the 5 TeamSTEPPS constructs and sample behaviors of constructs are provided on the tool. Raters are asked to rate the constructs using a 5-point quality scale (Poor to Excellent) and to record notes in the "comment" column. A list of definitions of key terms and concepts describing team communication was developed to accompany the PACT-Novice tool in order to help raters understand key concepts of TeamSTEPPS.	5	Novice observers (student observer, team member, faculty)	Real-time
PACT-Expert	PACT-Expert (2011) contains 13 behavioral markers that were modified from PACT-expert (2010). Every TeamSTEPPS construct (other than Communication construct which has 5 behavioral markers) has 2 representing behaviors. The raters are asked to record both the frequency (Present, Absent, or Not Applicable) and quality of specific behavioral markers (Poor, Need Improvement, Satisfactory, and Excellent). The qualities of the 5 TeamSTEPPS constructs are reported using a 4-point quality scale (Need Improvement in Most Areas, Need Improvement in Some Areas, Satisfactory, and Excellent).	13	Experienced observers	Real-time
PACT-Video	PACT-Video (2011) contains 4-6 behavioral markers under each domain (26 behavioral markers in total). Raters are asked to review the video for 3 times. After the first viewing, the raters are to record the initial quality rating for each of the 5 TeamSTEPPS constructs (Need Improvement in Most Areas, Need Improvement in Some Areas, Satisfactory, and Excellent). During the second viewing, the raters are free to record behaviors that are demonstrated or should have been demonstrated in the comments. After completing the second viewing, raters are asked to complete the frequency (Absent, Intermittent, and Consistent) and quality scales (Poor, Need Improvement, Satisfactory, and Excellent). After watching the complete scenario three times, raters are asked to fill out the quality scale for the 5 TeamSTEPPS constructs again.	26	Experienced observers	Retrospective through videos

Table 2.6

Coding Protocol for PACT-Video

- Before starting the coding process, training for raters is recommended. Stop here if you have not received your training.
- Read the description of the behavioral markers carefully. Refer to the glossary if necessary.
- Read the instructions on the coding sheet. Make sure you understand the definition of the anchors for both frequency and quality scales.
- Have the coding sheet and pen ready (we may change it to the electronic format). Fill out your name (or rater number), the date of coding, the date of the scenario, and the name of the scenario.
- Watch the video for the first time without stopping it so you can have a general sense of the scenario. Score the (Team Structure, Leadership, Situation Monitoring, Mutual Support, and Communication).
- Go through each behavioral marker and score the Initial Global Quality scale.
- Watch the video for the second time. Stop the video when an event occurs or a need for recording (e.g. the absence of an event that should have occurred). Feel free to write down your comments.
- If a team member's performance deviated from the rest of the team (performing differently from the rest of the team members and the individual's performance affected the team performance), stop the video and make remarks at the end of the coding sheet.
- After watching the whole scenario for the second time, go through each behavioral marker and score the Global Frequency scale.
- Score the Global Quality scale for each behavioral marker.
- Watch the video for the third time without stopping it. Then, score the Final Global Quality scale for each of the five domains.
- Make sure you put the coding sheet in the "Completed" folder (or submit your responses if using online tool.)
- The coding process is now complete.

When you watch the video for…	**During video viewing**	**After video viewing**
The **FIRST** time	• Watch without stops • Get general sense of the quality of the five domains	• Score the Initial Global Quality for the five domains
The **SECOND** time	• Stop and rewind the video when necessary • Write down comments if necessary	• Score the Global Frequency scale for each behavioral marker • Score the Global Quality scale for each behavioral marker
The **THIRD** time	• Watch without stops	• Score the Final Global Quality for the five domains

Table 2.7

Summary of Participants, Scenarios, Locations and PACT Tools Administered (2010 & 2011)

	2010			**2011**				
Student Participants	49			306				
Location	ISIS-HMC*			ISIS-HMC*			ISIS-UWMC**	
Scenario	SVT	CHF	Asthma	SVT	CHF	Asthma	OB	Pediatric
PACT-Novice by student observers	Yes			Yes				
PACT-Novice by team members	No			Yes				
PACT-Novice by faculty facilitators	No			Yes				
PACT-Expert	Yes (Day 2 Only)			Yes				
PACT-Video	Yes			Yes	Yes	No	No	

*Institute for Simulation and Interprofessional Studeis (ISIS) – Harborview Medical Center (HMC)
**ISIS-University of Washington Medical Center (UWMC)

Table 2.8

Reliability and Internal Consistency of PACT Tools from 2011

Version	Number of Valid Records	Number of Items	ICC	F	Cronbach's Alpha
PACT-Novice	904	5	.85*	6.46**	.85
PACT-Expert	85	13	.76*	4.09**	.79
PACT-Video	112	26	.90*	9.63**	.91

* ICC(1,k) was calculated with one-way random effects model where people effects are random. ICC for Average Measures was reported.

** F is significant $p < .001$

Table 2.9

Internal consistency of Subscales of PACT Tools from 2011

Version	Subscale	Number of Valid Records	Number of Items	ICC	F	Cronbach's Alpha
PACT-Expert	Team Structure	60	2	.21*	1.26	-
	Leadership	71	2	.66*	2.94**	-
	Situation Monitoring	70	2	.56*	2.29**	-
	Mutual Support	54	2	.44*	1.77***	-
	Communication	62	5	.66*	2.91**	.67
PACT-Video	Team Structure	119	6	.66*	2.94**	.70
	Leadership	118	5	.69*	3.19**	.77
	Situation Monitoring	118	4	.55*	2.21**	.63
	Mutual Support	118	5	.54*	2.18**	.65
	Communication	118	6	.84*	6.36**	.85

* ICC(1,k) was calculated with one-way random effects model where people effects are random. ICC for Average Measures was reported.
** F is significant $p < .001$.
*** F is significant $p < .05$.

Table 2.10

Exploratory Factor Analysis of PACT-Expert: Correlation Matrix

	Q01	**Q02**	**Q03**	**Q04**	**Q05**	**Q06**	**Q07**	**Q08**	**Q09**	**Q10**	**Q11**	**Q12**	**Q13**
Q01	1.000												
Q02	.200	1.000											
Q03	.496	.327	1.000										
Q04	.574	.089	.464	1.000									
Q05	.315	.355	.410	.353	1.000								
Q06	.338	.169	.203	.330	.287	1.000							
Q07	.193	.267	.144	.308	.264	.268	1.000						
Q08	-.181	.169	-.006	-.081	-.027	-.181	.298	1.000					
Q09	.145	.205	.307	.296	.325	.209	.162	.304	1.000				
Q10	.214	.259	.317	.333	.420	.272	.310	.230	.490	1.000			
Q11	.266	-.072	.156	.276	.097	.098	.226	-.047	.074	.224	1.000		
Q12	.420	.107	.312	.352	.444	.275	.146	-.120	.266	.521	.417	1.000	
Q13	.203	.237	.284	.286	.457	.239	.266	.215	.433	.454	.146	.375	1.000
Communalities	.649	.318	.429	.545	.523	.228	.264	.855	.371	.587	.405	.653	.431

Table 2.10 (Cont'd)

Exploratory Factor Analysis of PACT-Expert

Rotated Factor Matrix*

	Factor**			
	1	2	3	4
10. Repeat back instructions or clarifications.	.673			
5. Applies the STEP process.	.627	.355		
13. Demonstrates closed-loop communication.	.597			
12. Demonstrates SBAR.	.544			.520
9. Verbalize their activities aloud.	.524			
2. Refer to protocols and checklists.	.362			
3. Conducts briefs/huddles/debriefs.	.326	.565		
1. Recognize a leader		.769		
4. Empowers team members to speak freely and ask questions.		.658		
6. Patient/Family is included.		.363		
8. Use Two Challenge rule or CUS.			.889	
7. Ask for assistance prior to task overload.			.353	
11. Hands off to another team member.				.597

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

*Rotation converged in 7 iterations.

**Only values > 0.3 were displayed.

Table 2.11

Exploratory Factor Analysis of PACT-Video: Correlation Matrix

	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26
Q01	1.00																									
Q02	.584	1.00																								
Q03	.404	.565	1.00																							
Q04	.143	.329	.291	1.00																						
Q05	.065	.139	.396	.225	1.00																					
Q06	.366	.469	.422	.313	.230	1.00																				
Q07	.564	.615	.349	.186	.009	.439	`.00																			
Q08	.356	.265	.502	.081	.119	.396	.355	1.00																		
Q09	.663	.485	.537	.126	.208	.463	.481	.421	1.00																	
Q10	.256	.235	.376	.163	.374	.566	.245	.270	.514	1.00																
Q11	.195	.266	.482	.121	.390	.564	.247	.451	.373	.668	1.00															
Q12	.270	.273	.414	.014	.057	.260	.165	.184	.380	.187	.101	1.00														
Q13	.271	.246	.422	.124	.224	.363	.245	.230	.448	.346	.481	.243	1.00													
Q14	.197	.295	.470	.284	.454	.264	.156	.266	.311	.355	.383	.080	.578	1.00												
Q15	.222	.159	.341	-.005	.293	.314	.154	.290	.396	.466	.459	.263	.401	.386	1.00											
Q16	.221	.309	.410	.248	.450	.311	.272	.407	.351	.259	.284	.282	.245	.468	.292	1.00										
Q17	.370	.433	.365	.220	.277	.594	.397	.451	.429	.489	.484	.227	.407	.366	.230	.291	1.00									
Q18	-.001	.072	.291	.224	.785	.121	-.070	.063	.132	.336	.368	.066	.180	.347	.204	.417	.202	1.00								
Q19	.198	.176	.264	.069	.246	.401	.238	.286	.325	.368	.365	.101	.286	.157	.240	.088	.398	.211	1.00							
Q20	-.092	-.061	.199	.123	.405	.041	-.060	.182	.048	.142	.290	-.032	.174	.293	.090	.296	.147	.499	.153	1.00						
Q21	.380	.397	.378	.205	.190	.500	.449	.392	.511	.344	.352	.313	.304	.388	.239	.427	.417	.204	.152	.262	1.00					
Q22	.377	.394	.308	.179	.157	.488	.409	.365	.450	.343	.305	.244	.276	.343	.221	.463	.399	.177	.175	.175	.712	1.00				
Q23	.441	.324	.306	.049	.230	.459	.431	.409	.416	.381	.426	.185	.250	.197	.303	.337	.465	.275	.278	.285	.612	.515	1.00			
Q24	.188	.197	.243	.017	.286	.241	.246	.263	.258	.328	.319	.173	.235	.400	.233	.349	.386	.296	.100	.163	.421	.373	.482	1.00		
Q25	.181	.183	.435	.176	.508	.402	.106	.360	.380	.458	.503	.190	.423	.535	.351	.484	.424	.415	.196	.303	.568	.488	.442	.478	1.00	
Q26	.417	.489	.403	.272	.298	.597	.490	.405	.481	.431	.481	.288	.384	.398	.260	.460	.514	.296	.243	.193	.642	.678	.534	.404	.487	1.00
Communalities	.615	.714	.617	.390	.748	.704	.561	.343	.679	.587	.693	.225	.485	.714	.428	.491	.521	.867	.312	.328	.735	.647	.656	.353	.636	.667

Table 2.11 (Cont'd)

Exploratory Factor Analysis of PACT-Video

Rotated Factor Matrix*

	Factor**					
	1	2	3	4	5	6
21. VERBALIZE activities	.767					
22. REPEAT BACK	.721					
23. HAND OFF	.625		.341			
26. CLOSED-LOOP COMMUNICATION	.608	.303	.310			
25. Ask for CLARIFICATION	.491			.369	.435	
24. SBAR	.470					
16. Acknowledge STATEMENT	.391			.401		
6. SHARE IMFORMATION	.361		.635			.316
17. ALL PARTICIPATE	.346		.520			
7. Delegate TASKS	.335	.558				
8. BRIEFS/HUDDLES/DEBRIEFS	.316	.349				
1. Recognize LEADER		.726				
9. AUTHORITY VS PARTICIPATION		.670	.329			
2. Understand ROLE		.664				.459
3. Understand TEAM GOALS		.539			.379	
12. STEP PROCESS		.400				
11. SPEAK UP			.707			
10. COLLECTIVE INPUT			.657			
19. ASK FOR HELP			.515			
15. PATIENT included			.363		.405	
13. Attend to INDICATORS			.342		.545	
18. Call ATTENTION to error causing actions				.908		
5. Respond to potential ERRORS				.800		
20. CUS/Two-Challenge rule/DESC Script				.491		
14. Maintain SITUATION AWARENESS					.697	
4. Refer to PROTOCOLS/CHECKLISTS						.581

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

* Rotation converged in 8 iterations.

**Only values > 0.3 were displayed.

Table 2.12

Reference Points for Total Score Interpretation

Reference Points	Total Score	Description
Lowest Possible	1	Absence of all behavioral markers. Need Improvement in Most Areas in all 5 constructs.
Inconsistent/Need Improvement	6	All behavioral markers scored with inconsistent frequency and need improvement quality. Need Improvement in Some Areas in all 5 constructs.
Consistent /Need Improvement or Inconsistent/Satisfactory	8	All behavioral markers scored with combination of consistent need improvement behaviors and/or inconsistent satisfactory behaviors. Need Improvement in Some Areas in all 5 constructs.
Consistent/Satisfactory	12	The team performed all behavior markers consistently with satisfactory quality. Satisfactory in all 5 constructs.
Consistent/Excellent	16	The team performed all behavior markers consistently with excellent quality. Excellent in all 5 constructs.

Table 2.13

Descriptive Statistics of Total Score from PACT-Video 2011 Data

N	Valid	103
	Missing	17
Mean		9.4687
Std. Error of Mean		.25024
Median		9.8400
Mode		10.20
Std. Deviation		2.53967
Variance		6.450
Minimum		2.68
Maximum		16.00
Percentiles	10	5.4593
	20	7.6028
	25	8.0923
	50	9.8400
	75	11.2000
	80	11.5344
	90	12.4572

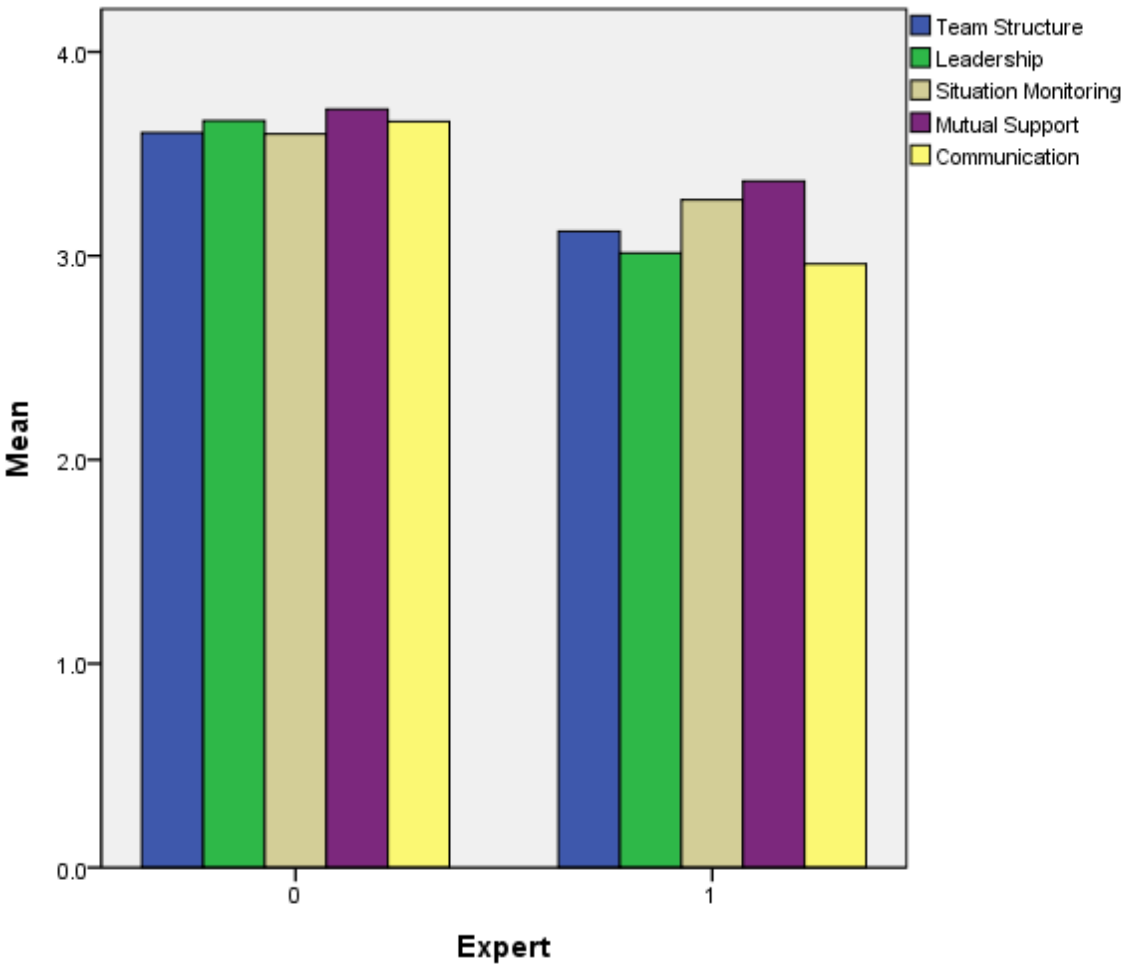

Figure 2.1. Differences in ratings between Novice (0) and Expert (1).

Appendix A

Initial Performance Assessment of Interprofessional Communication and Teamwork – Novice

School: ❑ SOM ❑ Nursing ❑ Pharm ❑ MEDEX

Case: ❑ CHF ❑ SVT ❑ Asthma

Sim: ❑ 1st ❑ 2nd ❑ 3rd

Overall Ratings	No	Yes, but	Yes	Comments?
Team Structure identifies goals, assigns roles and responsibilities, holds members accountable	❑	❑	❑	
Leadership utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely	❑	❑	❑	
Situation Monitoring includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication	❑	❑	❑	
Mutual Support advocates for the patient, resolves conflict using Two-Challenge rule, CUS and DESC Script, works collaboratively	❑	❑	❑	.
Communication provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques	❑	❑	❑	

No: Multiple critical behaviors absent or poorly performed.

Yes, but: Most critical behaviors present but some performed unacceptably.

Yes: All critical behaviors present and performed acceptably.

Appendix B

Definitions of Key Terms and Concepts for Team Communication

Team Communication: Key Terms and Concepts		
Teamwork	**Definition**	**Behavioral Examples**
Team Structure	Delineates fundamentals such as team size, membership, leadership, composition, identification and distribution.	• Identifies goals • Assigns roles and responsibilities • Holds members accountable
Leadership	Ability to coordinate the activities of other team members by ensuring team actions are understood, changes in information are shared, and that team members have the necessary resources. Characteristics include: assess team performance, assign tasks, develop team KSAs, motivate team members, plan and organize, and establish a positive atmosphere.	• Utilizes resources • Delegates tasks and balances workload, • Conducts briefs, huddles, and debriefs • Empowers members to speak freely • Facilitate team problem solving. • Seek and evaluate information that impacts team functioning. • Clarify team member roles. • Engage in preparatory meetings and feedback sessions with the team.
Situation Monitoring (aka: Mutual Performance Monitoring)	Process of actively scanning and assessing situational elements to gain information, understanding, or maintain awareness to support functioning of the team. Overall, the ability to develop common understandings of the team environment and apply appropriate task strategies in order to accurately monitor teammate performance.	• Includes patient/family in communication • Cross monitors members and applies STEP process • Fosters communication • Provides feedback regarding team member actions in order to facilitate self-correction.
Mutual Support (aka: Back-up Behavior)	Ability to anticipate and support other team member's needs through accurate knowledge about their responsibilities and workload. The ability to shift workload among members to achieve balance during high periods of workload or pressure.	• Advocates for the patient • Resolves conflict using Two-Challenge rule, CUS, and DESC script • Works collaboratively • Recognition by potential back-up providers that there is a workload distribution problem involving their team. • Shifting of work responsibilities to underutilized team members. • Completion of the whole task or parts of tasks by other team members.
Communication	Process by which information is clearly and accurately exchanged among team members. The exchange of information between a sender and a receiver, irrespective of the medium.	• Providing brief, clear, specific and timely information • Seeking and communicating information from all available sources • Using SBAR, call-outs, check-backs, and handoff techniques • Following up with team members to ensure message was received. • Acknowledging that a message was received. • Clarifying with the sender of the message that the message received is the same as the intended message sent.

Appendix B (Cont'd)

Definitions of Key Terms and Concepts for Team Communication

Definitions of Key Team Communication Terms:

Brief: Short planning session prior to start to discuss team formation; assign essential roles; establish expectations and climate; anticipate outcomes and likely contingencies

Huddle: Ad hoc problem solving planning to reestablish situation awareness; reinforcing plans already in place; and assessing the need to adjust the plan.

Debrief: Informal information exchange session designed to improve team performance and effectiveness; after action review.

Step Process: A tool for monitoring situations in the delivery of health care. Components of STEP situation monitoring include:

1) Status of the patient (S): patient history, vital signs, medications, physical exam, plan of care, psychosocial
2) Team members (T): fatigue, workload, task performance, skill, stress
3) Environment (E): facility information, administrative information, human resources, triage acuity, equipment
4) Progress toward goal (P): status of team's patients, established goals of team, tasks/actions of team, plan still appropriate.

Two-Challenge Rule: When an initial assertion is ignored it is your responsibility to assertively voice concern at least two times to ensure it has been heard. The team member being challenged must acknowledge. If outcome still not acceptable take a stronger course of action or use chain of command.

CUS: Statement of: I am Concerned, I am Uncomfortable, This is a Safety Issue!

DESC Script: Approach to managing and resolving conflict.

1) Describe the specific situation or behavior; provide concrete data
2) Express how the situation makes you feel/what your concerns are
3) Suggest other alternatives and seek agreement
4) Consequences should be stated in terms of impact on established team goals; strive for consensus

SBAR: Technique for communicating critical information that requires immediate attention and action concerning a patient's condition: 1) Situation (what is going on with the patient?), 2) Background (what is the clinical background or context?), 3) Assessment (what do you think the problem is?), 4) Recommendation and Request (what would I do to correct it?).

Call-Out: Strategy used to communicate important or critical information. E.g. Team Leader Calls out ="Airway status?", Assessing Clinician Response= "Airway status clear"

Check Back: Process of employing closed-loop communication to ensure that information conveyed by the sender is understood by the receiver as intended. E.g. Team leader "Give 25 mg Benadryl IV push", Clinician: "25 mg Benadryl IV push", Team Leader "That's correct"

Hand-Off Techniques: Transfer of information (along with authority and responsibility) during transitions in care across the continuum; to include an opportunity to ask questions, clarify, and confirm.

Appendix C

Initial Performance Assessment of Interprofessional Communication and Teamwork – Expert

Scenario: ___ SVT ____ CHF ____ Asthma

Capstone Day 2
June 4, 2010

Simulation: _____1st _____ 2nd ____3rd

Behavioral Markers	Poor				Excellent
1- Team members verbalize their activities aloud when they are actively involved with the patient.	❑	❑	❑	❑	❑
2- Team members repeat back or paraphrase instructions and clarifications to indicate that they heard them correctly.	❑	❑	❑	❑	❑
3- Team member A hands off the patient's case to team member B, and team member B assumes responsibility for the patient.	❑	❑	❑	❑	❑
4- The team demonstrates efficient communication skills, including patient Situation, Background, Assessment, and Recommendation (SBAR).	❑	❑	❑	❑	❑
5- Team members ask questions of the team for clarification.	❑	❑	❑	❑	❑
6- Team members demonstrate closed-loop communication such as check-backs.	❑	❑	❑	❑	❑
7- The team leader conducts briefs, huddles, and/or debriefs.	❑	❑	❑	❑	❑
8- The team leader makes final decisions after collective input.	❑	❑	❑	❑	❑
9- The team leader empowers team members to speak freely and ask questions.	❑	❑	❑	❑	❑
10- When directions are unclear, team members acknowledge their lack of understanding and ask for repetition and clarification.	❑	❑	❑	❑	❑
11- All members of the team participate in the activity.	❑	❑	❑	❑	❑
12- Team members acknowledge statement directed at avoiding or containing errors or seeking clarification.	❑	❑	❑	❑	❑
13- Team members ask each other for assistance prior to or during periods of task overload.	❑	❑	❑	❑	❑
14- The patient/family is included in communication.	❑	❑	❑	❑	❑
15- The team applies the STEP process when monitoring the situation.	❑	❑	❑	❑	❑
16- Team members refer to established protocols and checklists for the procedure/intervention.	❑	❑	❑	❑	❑
17- Team members respond to potential errors or complications with procedures that avoid the error or complication.	❑	❑	❑	❑	❑
18- Team members actively share information with each other.	❑	❑	❑	❑	❑

Appendix D

Initial Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF

Video Coding Sheet for Performance Assessment for Communication and Teamwork (PACT)

Please review the definition and description of each behavioral marker and anchors before you start. After the first viewing, record the Initial Global Quality for the 5 domains. During the second viewing, please stop the video and record the time and description of the behavior marker happened in the Note column. If a behavior should have occurred but did not, please stop the video and record the time and description of the missed behavior in the Note column. After the second viewing, complete the Global Frequency and Global Quality scales for each behavioral marker without referencing your notes. After watching the complete scenario three times, please fill out the Final Global Quality for the five domains. Using the following scales to record the performance of the TEAM:

1) How well did the team perform in each of the five domains throughout the scenario? Circle (**Need Improvement in Most areas (NIM), Need Improvement in Some areas (NIS), Satisfactory (S), Excellent (E), Not Enough Information to Answer (NEI)**).
2) If a behavior was observed, how well did the team perform? Circle (**Poor (P)**-The team performed poorly; **Need Improvement (NI)**-The team performed okay but there is still space for growth; **Satisfactory (S)**-The team performance met expectation but the quality can be better; **Excellent (E)**-The team performed flawlessly; **Not Applicable (NA)**-The team did not demonstrate such behavior or there was not enough information to judge the quality of the behavior.) Note that this item focuses on the quality of the task. Please do NOT take the frequency into account.
3) How frequent the task was observed in the scenario? Circle the number (**Absent (A)**-a behavior did not occur when it should; **Isolated (I)**-there are isolated examples of a behavior throughout the observation; **Consistent (C)**-there were frequent/explicit examples of a behavior throughout the observation; **Not Applicable (NA)**-there was no opportunity for the team to demonstrate such behavior).
4) If a team member's performance deviated from the rest of the team, make remarks at the end of the coding sheet.

(Coders do **NOT** need to calculate the total composite score!)

After completing the video coding, use the attached scoring sheet and follow the steps below to calculate the total composite score (TCS):

1) Score for Global Frequency scale: A (0), I (1), C (2), NA (Discard)
2) Discard the behavioral markers with NA in the Global Frequency scale.
3) Score for Initial and Final Global Quality scales of each domain: NIM (1), NIS (2), S (3), E (4), NEI (Discard)
4) Score for Global Quality scale of each behavioral marker: P (1), NI (2), S (3), E (4), NA (Discard)
5) Calculate score of each behavioral marker: Final Global Quality score x Global Frequency scale
6) Calculate TCS = sum of each behavioral marker score/number of observed behavioral markers
   + sum of Final Global Quality scores of five domains/number of scored domains

Appendix D (Cont'd)

Initial Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF

After the **first** viewing without stopping, please record the Initial Global Quality for the five domains using the scale below:

Global Quality scale for domains:

NIM: Need Improvement in Most areas
NIS: Need Improvement in Some areas
S: Satisfactory
E: Excellent
NEI: Not Enough Information to Answer

Definition of the domains:

Team Structure - identifies goals, assigns roles and responsibilities, holds members accountable
Leadership - utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely
Situation Monitoring - includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication
Mutual Support - advocates for the patient, resolves conflict using Two-Challenge rule, CUS, and DESC Script, works collaboratively
Communication - provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques

Domain Name	Initial Global Quality				
Team Structure	NIM	NIS	S	E	NEI
Leadership	NIM	NIS	S	E	NEI
Situation Monitoring	NIM	NIS	S	E	NEI
Mutual Support	NIM	NIS	S	E	NEI
Communication	NIM	NIS	S	E	NEI

Appendix D (Cont'd)

Initial Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF

As you view the video the second time, note any specific behaviors you'd like to draw attention to or the absence of an important behavior in the corresponding cell for each behavior. You can stop the video anytime when there is a behavior occurring or missing. Remember to record the time stamp whenever you stop the video. If there is an individual behaving differently from the rest of the team, record it in the box at the end of this page.

Behavioral Markers	*Note*
Team Structure	
1. Recognize LEADER	
2. Understand ROLE	
3. Understand TEAM GOALS	
4. Refer to PROTOCOLS/CHECKLISTS	
5. Respond to potential ERRORS	
6. SHARE IMFORMATION	
Leadership	
7. Delegate TASKS	
8. BRIEFS/HUDDLES/DEBRIEFS	
9. AUTHORITY VS PARTICIPATION	
10. COLLECTIVE INPUT	
11. SPEAK UP	
Situation Monitoring	
12. STEP PROCESS	
13. Attend to INDICATORS	
14. Maintain SITUATION AWARENESS	
15. PATIENT included	
Mutual Support	
16. Acknowledge STATEMENT	
17. ALL PARTICIPATE	
18. Call ATTENTION to error causing actions	
19. ASK FOR HELP	
20. CUS/Two-Challenge rule/DESC Script	
Communication	
21. VERBALIZE activities	
22. REPEAT BACK	
23. HAND OFF	
24. SBAR	
25. Ask for CLARIFICATION	
26. CLOSED-LOOP COMMUNICATION	

Individual Ratings	*Note*
27. Was there an individual who differed significantly from the rest of the team? What was the task # _____ and how would you describe the behavior?	

Appendix D (Cont'd)

Initial Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF

After the **second** viewing, please fill out the Global Frequency and Global Quality scales for each behavioral marker using the scales below:

Global Frequency scale:

Absent (A)-a behavior did not occur when it should
Isolated (I)-there are isolated examples of a behavior throughout the observation
Consistent (C)-there were frequent/explicit examples of a behavior throughout the observation
Not Applicable (NA)-there was no opportunity for the team to demonstrate such behavior

Global Quality scale:

Poor (P)-The team performed poorly
Need Improvement (NI)-The team performed okay but there is still space for growth
Satisfactory (S)-The team performance met expectation but the quality can be better
Excellent (E)-The team performed flawlessly
Not Applicable (NA)-The team did not demonstrate such behavior or there was not enough information to judge the quality of the behavior.

Behavioral Markers	*Global Frequency*				*Global Quality*				
Team Structure									
1. Recognize LEADER	A	I	C	NA	P	NI	S	E	NA
2. Understand ROLE	A	I	C	NA	P	NI	S	E	NA
3. Understand TEAM GOALS	A	I	C	NA	P	NI	S	E	NA
4. Refer to PROTOCOLS/CHECKLISTS	A	I	C	NA	P	NI	S	E	NA
5. Respond to potential ERRORS	A	I	C	NA	P	NI	S	E	NA
6. SHARE IMFORMATION	A	I	C	NA	P	NI	S	E	NA
Leadership									
7. Delegate TASKS	A	I	C	NA	P	NI	S	E	NA
8. BRIEFS/HUDDLES/DEBRIEFS	A	I	C	NA	P	NI	S	E	NA
9. AUTHORITY VS PARTICIPATION	A	I	C	NA	P	NI	S	E	NA
10. COLLECTIVE INPUT	A	I	C	NA	P	NI	S	E	NA
11. SPEAK UP	A	I	C	NA	P	NI	S	E	NA
Situation Monitoring									
12. STEP PROCESS	A	I	C	NA	P	NI	S	E	NA
13. Attend to INDICATORS	A	I	C	NA	P	NI	S	E	NA
14. Maintain SITUATION AWARENESS	A	I	C	NA	P	NI	S	E	NA
15. PATIENT included	A	I	C	NA	P	NI	S	E	NA
Mutual Support									
16. Acknowledge STATEMENT	A	I	C	NA	P	NI	S	E	NA
17. ALL PARTICIPATE	A	I	C	NA	P	NI	S	E	NA
18. Call ATTENTION to error causing actions	A	I	C	NA	P	NI	S	E	NA
19. ASK FOR HELP	A	I	C	NA	P	NI	S	E	NA
20. CUS/Two-Challenge rule/DESC Script	A	I	C	NA	P	NI	S	E	NA
Communication									
21. VERBALIZE activities	A	I	C	NA	P	NI	S	E	NA
22. REPEAT BACK	A	I	C	NA	P	NI	S	E	NA
23. HAND OFF	A	I	C	NA	P	NI	S	E	NA
24. SBAR	A	I	C	NA	P	NI	S	E	NA
25. Ask for CLARIFICATION	A	I	C	NA	P	NI	S	E	NA
26. CLOSED-LOOP COMMUNICATION	A	I	C	NA	P	NI	S	E	NA

Individual Ratings	*Quality*				
27. If there was an individual who differed significantly from the rest of the team, record the task # _____ and the quality rating for the individual's behavior.	P	NI	S	E	NA

Appendix D (Cont'd)

Initial Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF

After the **third** viewing without stopping, please record the Final Global Quality for the five domains using the scale below:

Global Quality scale for domains:

NIM: Need Improvement in Most areas
NIS: Need Improvement in Some areas
S: Satisfactory
E: Excellent
NEI: Not Enough Information to Answer

Definition of the domains:

Team Structure - identifies goals, assigns roles and responsibilities, holds members accountable
Leadership - utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely
Situation Monitoring - includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication
Mutual Support - advocates for the patient, resolves conflict using Two-Challenge rule, CUS, and DESC Script, works collaboratively
Communication - provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques

Domain Name	Final Global Quality				
Team Structure	NIM	NIS	S	E	NEI
Leadership	NIM	NIS	S	E	NEI
Situation Monitoring	NIM	NIS	S	E	NEI
Mutual Support	NIM	NIS	S	E	NEI
Communication	NIM	NIS	S	E	NEI

Additional Comments: _____

Appendix E

Performance Assessment of Interprofessional Communication and Teamwork – Novice

University of Washington Simulation Observational Tool

Novice Observer Form

School (please circle your profession): SOM SON Pharm PA Other:_____ **Date:**_____

Scenario: 1st 2nd 3rd **Scenario Type/Location:**_____ **Session:** AM PM

From your perspective as an observer how would you describe the perfomance of this team? You are not describing the performance of specific team members. Instead you are describing the functioning of the team as a whole.

TeamSTEPPS Skill Domains	Poor		Average		Excellent	Comments?
Team Structure	❑	❑	❑	❑	❑	
identifies goals, assigns roles and responsibilities, holds members accountable						
Leadership	❑	❑	❑	❑	❑	
utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely						
Situation Monitoring	❑	❑	❑	❑	❑	
includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication						
Mutual Support	❑	❑	❑	❑	❑	
advocates for the patient, resolves conflict using Two-Challenge rule, CUS and DESC Script, works collaboratively						
Communication	❑	❑	❑	❑	❑	
provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques						

Use the following ratings. Remember, you are not describing an expert team, you are describing a student team.

Poor: Multiple critical behaviors absent or not performed well.

Average: Most behaviors present and adequately performed.

Excellent: All critical behaviors present and performed well.

Appendix F

Performance Assessment of Interprofessional Communication and Teamwork – Expert

Coder: _____
Date: _____ Session: ☐ AM ☐PM
Simulation: ☐ 1st ☐ 2nd ☐ 3rd

Scenario Type: ☐ Asthma ☐ Pediatric ☐ CHF ☐ SVT ☐ OB ☐ _____

Performance Assessment for Communication and Teamwork (PACT) – Long Form for experienced observers

Please score the team performance by circle the anchors in the scale.

Frequency scale:

Present (P -The behaviors is present.
Absent (A)-The behavior is absent.
Not Applicable (NA)-There was no opportunity for the team to demonstrate such behavior.

Quality scale:

Poor (P)-The team performed poorly.
Need Improvement (NI)-The team performed okay but there is still space for growth.
Satisfactory (S)-The team performance met expectation but the quality can be better.
Excellent (E)-The team performed well.
Not Applicable (NA)-The team did not demonstrate such behavior or there was not enough information to judge the quality of the behavior.

Additional comments:

_____
_____
_____
_____
_____
_____
_____

Behavioral Markers	Frequency			Quality				
Team Structure								
1. Team members recognize a leader.	P	A	NA	P	NI	S	E	NA
2. Team members refer to established protocols and checklists for the procedure/intervention.	P	A	NA	P	NI	S	E	NA
Leadership								
3. The team leader conducts briefs, huddles, and/or debriefs.	P	A	NA	P	NI	S	E	NA
4. The team leader empowers team members to speak freely and ask questions.	P	A	NA	P	NI	S	E	NA
Situation Monitoring								
5. The team applies the STEP process when monitoring the situation. STEP-Status of the Patient, Team Members, Environment, Progress Towards Goal	P	A	NA	P	NI	S	E	NA
6. The patient/family is included in communication.	P	A	NA	P	NI	S	E	NA
Mutual Support								
7. Team members ask each other for assistance prior to or during periods of task overload.	P	A	NA	P	NI	S	E	NA
8. Team members use the Two-Challenge rule or CUS to resolve conflict.	P	A	NA	P	NI	S	E	NA
Communication								
9. Team members verbalize their activities aloud when they are actively involved with the patient.	P	A	NA	P	NI	S	E	NA
10. Team members repeat back or paraphrase instructions and clarifications to indicate that they heard them correctly.	P	A	NA	P	NI	S	E	NA
11. Team member A hands off the patient's case to team member B, and team member B assumes responsibility for the patient.	P	A	NA	P	NI	S	E	NA
12. The team demonstrates efficient communication skills, including patient Situation, Background, Assessment, and Recommendation (SBAR).	P	A	NA	P	NI	S	E	NA
13. Team members demonstrate closed-loop communication such as check-backs.	P	A	NA	P	NI	S	E	NA

Appendix F (Cont'd)

Performance Assessment of Interprofessional Communication and Teamwork – Expert

Coder: _____
Date: _____ Session: ☐ AM ☐PM
Simulation: ☐ 1st ☐ 2nd ☐ 3rd

Scenario Type: ☐ Asthma ☐ Pediatric ☐ CHF ☐ SVT ☐ OB ☐ _____

After you observe the scenario, please record the Global Quality scores for the 5 domains using the scale below:

Global Quality scale for domains:

NIM: Need Improvement in Most areas
NIS: Need Improvement in Some areas
S: Satisfactory
E: Excellent
NEI: Not Enough Information to Answer

Domain Name	Global Quality					Comments
Team Structure	NIM	NIS	S	E	NEI	
identifies goals, assigns roles and responsibilities, holds members accountable						
Leadership	NIM	NIS	S	E	NEI	
utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely						
Situation Monitoring	NIM	NIS	S	E	NEI	
includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication						
Mutual Support	NIM	NIS	S	E	NEI	
advocates for the patient, resolves conflict using Two-Challenge rule, CUS, and DESC Script, works collaboratively						
Communication	NIM	NIS	S	E	NEI	
provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques						

Appendix G

Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF
☐ _____

Video Coding Sheet for Performance Assessment for Communication and Teamwork (PACT)

Please review the definition and description of each behavioral marker and anchors before you start. After the first viewing, record the Initial Global Quality for the 5 domains. During the second viewing, please stop the video anytime when necessary to make a note to yourself in the additional comments session (on the 5th page, not required) for any observed behavior or a behavior should have occurred but did not. After the second viewing, complete the Global Frequency and Global Quality scales for each behavioral marker without referencing your notes. After watching the complete scenario three times, please fill out the Final Global Quality for the five domains. Using the following scales to record the performance of the TEAM:

1) How well did the team perform in each of the five domains throughout the scenario? Circle (**Need Improvement in Most areas (NIM), Need Improvement in Some areas (NIS), Satisfactory (S), Excellent (E), Not Enough Information to Answer (NEI)**).
2) If a behavior was observed, how well did the team perform? Circle (**Poor (P)**-The team performed poorly; **Need Improvement (NI)**-The team performed okay but there is still space for growth; **Satisfactory (S)**-The team performance met expectation but the quality can be better; **Excellent (E)**-The team performed flawlessly; **Not Applicable (NA)**-The team did not demonstrate such behavior or there was not enough information to judge the quality of the behavior.) Note that this item focuses on the quality of the task. Please do NOT take the frequency into account.
3) How frequent the task was observed in the scenario? Circle the number (**Absent (A)**-a behavior did not occur when it should; **Isolated (I)**-there are isolated examples of a behavior throughout the observation; **Consistent (C)**-there were frequent/explicit examples of a behavior throughout the observation; **Not Applicable (NA)**-there was no opportunity for the team to demonstrate such behavior).
4) If a team member's performance deviated from the rest of the team, make remarks at the end of the coding sheet.

(Coders do **NOT** need to calculate the total composite score!)

After completing the video coding, use the attached scoring sheet and follow the steps below to calculate the total composite score (TCS):

1) Score for Global Frequency scale: A (1), I (2), C (3), NA (Discard)
2) Discard the behavioral markers with NA in the Global Frequency scale.
3) Score for Initial and Final Global Quality scales of each domain: NIM (1), NIS (2), S (3), E (4), NEI (Discard)
4) Score for Global Quality scale of each behavioral marker: P (1), NI (2), S (3), E (4), NA (0)
5) Calculate score of each behavioral marker: Global Frequency score x Global Quality score
6) Calculate TCS = sum of each behavioral marker score/number of observed behavioral markers
   + sum of Final Global Quality scores of five domains/number of scored domains

Appendix G (Cont'd)

Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF
☐ _____

First viewing for coding: Watch the video of the scenario without stopping. Then record the Initial Global Quality scores for the 5 domains using the scale below:

Global Quality scale for domains:

NIM: Need Improvement in Most areas

NIS: Need Improvement in Some areas

S: Satisfactory

E: Excellent

NEI: Not Enough Information to Answer

Examples of the domains:

Team Structure - identifies goals, assigns roles and responsibilities, holds members accountable

Leadership - utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely

Situation Monitoring - includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication

Mutual Support - advocates for the patient, resolves conflict using Two-Challenge rule, CUS, and DESC Script, works collaboratively

Communication - provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques

Domain Name	Initial Global Quality				
Team Structure	NIM	NIS	S	E	NEI
Leadership	NIM	NIS	S	E	NEI
Situation Monitoring	NIM	NIS	S	E	NEI
Mutual Support	NIM	NIS	S	E	NEI
Communication	NIM	NIS	S	E	NEI

Appendix G (Cont'd)

Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT ☐ Asthma ☐ CHF ☐ _____

Second viewing for coding: After viewing for specific behaviors, please complete the scores for Global Frequency and Global Quality scales for each behavioral marker using the scales below:

Global Frequency scale:

Absent (A)-a behavior did not occur when it should
Isolated (I)-there are isolated examples of a behavior throughout the observation
Consistent (C)-there were frequent/explicit examples of a behavior throughout the observation
Not Applicable (NA)-there was no opportunity for the team to demonstrate such behavior

Global Quality scale:

Poor (P)-The team performed poorly
Need Improvement (NI)-The team performed okay but there is still space for growth
Satisfactory (S)-The team performance met expectation but the quality can be better
Excellent (E)-The team performed flawlessly
Not Applicable (NA)-The team did not demonstrate such behavior or there was not enough information to judge the quality of the behavior.

Behavioral Markers	*Global Frequency*				*Global Quality*				
Team Structure									
1. Recognize LEADER	A	I	C	NA	P	NI	S	E	NA
2. Understand ROLE	A	I	C	NA	P	NI	S	E	NA
3. Understand TEAM GOALS	A	I	C	NA	P	NI	S	E	NA
4. Refer to PROTOCOLS/CHECKLISTS	A	I	C	NA	P	NI	S	E	NA
5. Respond to potential ERRORS	A	I	C	NA	P	NI	S	E	NA
6. SHARE IMFORMATION	A	I	C	NA	P	NI	S	E	NA
Leadership									
7. Delegate TASKS	A	I	C	NA	P	NI	S	E	NA
8. BRIEFS/HUDDLES/DEBRIEFS	A	I	C	NA	P	NI	S	E	NA
9. AUTHORITY VS PARTICIPATION	A	I	C	NA	P	NI	S	E	NA
10. COLLECTIVE INPUT	A	I	C	NA	P	NI	S	E	NA
11. SPEAK UP	A	I	C	NA	P	NI	S	E	NA
Situation Monitoring									
12. STEP PROCESS	A	I	C	NA	P	NI	S	E	NA
13. Attend to INDICATORS	A	I	C	NA	P	NI	S	E	NA
14. Maintain SITUATION AWARENESS	A	I	C	NA	P	NI	S	E	NA
15. PATIENT included	A	I	C	NA	P	NI	S	E	NA
Mutual Support									
16. Acknowledge STATEMENT	A	I	C	NA	P	NI	S	E	NA
17. ALL PARTICIPATE	A	I	C	NA	P	NI	S	E	NA
18. Call ATTENTION to error causing actions	A	I	C	NA	P	NI	S	E	NA
19. ASK FOR HELP	A	I	C	NA	P	NI	S	E	NA
20. CUS/Two-Challenge rule/DESC Script	A	I	C	NA	P	NI	S	E	NA
Communication									
21. VERBALIZE activities	A	I	C	NA	P	NI	S	E	NA
22. REPEAT BACK	A	I	C	NA	P	NI	S	E	NA
23. HAND OFF	A	I	C	NA	P	NI	S	E	NA
24. SBAR	A	I	C	NA	P	NI	S	E	NA
25. Ask for CLARIFICATION	A	I	C	NA	P	NI	S	E	NA
26. CLOSED-LOOP COMMUNICATION	A	I	C	NA	P	NI	S	E	NA

Individual Ratings	*Quality*				
27. If there was an individual who differed significantly from the rest of the team, record the task #____ and the quality rating for the individual's behavior.	P	NI	S	E	NA

Appendix G (Cont'd)

Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF
☐ _____

Third viewing for coding: Review the scenario for a third time, again without stopping; then complete the scores for the Final Global Quality for the five domains using the scale below:

Global Quality scale for domains:

NIM: Need Improvement in Most areas
NIS: Need Improvement in Some areas
S: Satisfactory
E: Excellent
NEI: Not Enough Information to Answer

Examples of the domains:

Team Structure - identifies goals, assigns roles and responsibilities, holds members accountable
Leadership - utilizes resources, delegates tasks and balances workload, conducts briefs, huddles, and debriefs, empowers members to speak freely
Situation Monitoring - includes patient/family in communication, cross monitors members and applies the STEP process, fosters communication
Mutual Support - advocates for the patient, resolves conflict using Two-Challenge rule, CUS, and DESC Script, works collaboratively
Communication - provides brief, clear, specific and timely information, seeks and communicates information from all available sources uses SBAR, call-outs, check-backs and handoff techniques

Domain Name	Final Global Quality				
Team Structure	NIM	NIS	S	E	NEI
Leadership	NIM	NIS	S	E	NEI
Situation Monitoring	NIM	NIS	S	E	NEI
Mutual Support	NIM	NIS	S	E	NEI
Communication	NIM	NIS	S	E	NEI

Additional Comments: _____

Appendix G (Cont'd)

Performance Assessment of Interprofessional Communication and Teamwork – Video

Coder: _____
Date of Coding: _____
Date of Scenario: _____
Team: ☐ Team1 ☐ Team2 ☐ Team3

Scenario Type: ☐ SVT
☐ Asthma
☐ CHF
☐ _____

Final Score Sheet

Behavioral Markers	*Global Frequency Score*				*Global Quality Score*					*Final Global Quality Score*				*Score*	*Domain Score*
Team Structure										NIM(1)	NIS(2)	S(3)	E(4)		
1. Recognize LEADER	A(1)	I(2)	C(3)	NA (Discard)	P(1)	NI(2)	S(3)	E(4)	NA (0)						
2. Understand ROLE	A	I	C	NA	P	NI	S	E	NA						
3. Understand TEAM GOALS	A	I	C	NA	P	NI	S	E	NA						
4. Refer to PROTOCOLS/CHECKLISTS	A	I	C	NA	P	NI	S	E	NA						
5. Respond to potential ERRORS	A	I	C	NA	P	NI	S	E	NA						
6. SHARE IMFORMATION	A	I	C	NA	P	NI	S	E	NA						
Leadership										NIM	NIS	S	E		
7. Delegate TASKS	A	I	C	NA	P	NI	S	E	NA						
8. BRIEFS/HUDDLES/DEBRIEFS	A	I	C	NA	P	NI	S	E	NA						
9. AUTHORITY VS PARTICIPATION	A	I	C	NA	P	NI	S	E	NA						
10. COLLECTIVE INPUT	A	I	C	NA	P	NI	S	E	NA						
11. SPEAK UP	A	I	C	NA	P	NI	S	E	NA						
Situation Monitoring										NIM	NIS	S	E		
12. STEP PROCESS	A	I	C	NA	P	NI	S	E	NA						
13. Attend to INDICATORS	A	I	C	NA	P	NI	S	E	NA						
14. Maintain SITUATION AWARENESS	A	I	C	NA	P	NI	S	E	NA						
15. PATIENT included	A	I	C	NA	P	NI	S	E	NA						
Mutual Support										NIM	NIS	S	E		
16. Acknowledge STATEMENT	A	I	C	NA	P	NI	S	E	NA						
17. ALL PARTICIPATE	A	I	C	NA	P	NI	S	E	NA						
18. Call ATTENTION to error causing actions	A	I	C	NA	P	NI	S	E	NA						
19. ASK FOR HELP	A	I	C	NA	P	NI	S	E	NA						
20. CUS/Two-Challenge rule/DESC Script	A	I	C	NA	P	NI	S	E	NA						
Communication										NIM	NIS	S	E		
21. VERBALIZE activities	A	I	C	NA	P	NI	S	E	NA						
22. REPEAT BACK	A	I	C	NA	P	NI	S	E	NA						
23. HAND OFF	A	I	C	NA	P	NI	S	E	NA						
24. SBAR	A	I	C	NA	P	NI	S	E	NA						
25. Ask for CLARIFICATION	A	I	C	NA	P	NI	S	E	NA						
26. CLOSED-LOOP COMMUNICATION	A	I	C	NA	P	NI	S	E	NA						
													Total	(A)	(B)

Discard domain(s) received NEI and behavior marker(s) received NA in the frequency scale.
Number of observed/rated behavioral markers: _____(C) **Number of scored domains:** _____(D)
Total Composite Score (TCS): _____(A)/_____(C) + _____(B)/_____(D) = _____