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**Keywords:** Interprofessional Education; Pharmacy Education; Nursing Education; Medical Education; Survey; Roles and Responsibilities; Interprofessional Curricula

### Abstract

**Objective:** The purpose of this study was to evaluate health professions students' understanding of their own and others' roles on interprofessional (IP) teams, assess students' perceptions of their preparedness to practice in an IP team, and determine differences by type of learning institution and participation in interprofessional education (IPE).

**Methods:** Medical, nursing, and pharmacy students at three Ohio universities with unique IP learning models were surveyed. Descriptive statistics, analysis of variance (ANOVA), chi-square, and two sample t- tests were used to compare measures of knowledge, IPE participation, and preparedness.

**Results:** Of the 981 invited students, 273 completed the survey (27.8% response). Overall, 70.7% of participants felt prepared to work on an IP team. Those who reported participation in IPE were more likely to feel prepared to practice on an IP team compared to those who did not (76.8% [149/194] vs. 55.3% [42/76],  $p=0.0005$ ). Participation in IPE did not significantly affect knowledge scores (participants 79.6% vs. non-participants 81.0%,  $p=0.1731$ ). Those who had higher profession-specific knowledge scores were more likely to feel prepared to work with that specific profession.

**Conclusions:** Participation in IPE activities in the representative institutions was high, as was knowledge of professional roles. Both participation in IPE and increased knowledge of roles were associated with increased student-assessed preparedness. Advancement of skills and behaviors including knowledge of roles and other competencies may all be important. Pharmacy in particular should prioritize IPE as a means to elucidate our role on the patient care team.

### Introduction

Team-based models of health care, such as the Patient-Centered Medical Home, help to achieve improved health, better care and lower costs (Nielsen, Langer, Zema, Hacker, & Grundy, 2012). The Institute of Medicine defines team-based health care as the "provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively with patients and their caregivers – to the extent preferred by each patient – to accomplish shared goals within and across settings to achieve coordinated, high-quality, and patient-centered

care." (Morrison et al., 2012) To adequately prepare health professional students to practice in this collaborative environment, students must be taught and evaluated on their ability to work as part of an interprofessional (IP) team. Interprofessional education (IPE) is defined by the World Health Organization as students from two or more professions learning about, from and with each other to enable effective collaboration and improve health outcomes. ("Framework for Action," 2010). To this end, the Interprofessional Education Collaborative (IPEC), consisting of education associations from several health professions, was established to create competencies for interprofessional practice. IPEC developed four competency domains for interprofessional collaborative practice: (1) values/ethics for interprofessional practice, (2) roles/responsibilities, (3) interprofessional communication, and (4) teams and teamwork ("Core Competencies," 2011).

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Understanding team member's roles on the interprofessional team is necessary to provide quality patient-centered care ("Core Competencies," 2011). In the study by Suter and colleagues (2009), practicing health professionals identified understanding and appreciating professional roles and responsibilities as a major core competency for patient-centered collaborative practice. Reflective journaling from health professionals participating in collaborative care for the first time demonstrated that providers' not understanding role identity for all professions is a significant challenge (Makowsky et al., 2009). Though students may feel they understand their own role, there is evidence that shows they may not be able to describe that role to others (Lamb et al., 2008). Lack of knowledge about roles and the inability to communicate one's own professional identity may inhibit a patient care team from functioning effectively (Delva, Jamieson, & Lemieux, 2008), and thus not provide the safety and quality benefits of a highly collaborative team (Hickson & Entman, 2008; Manser, 2009; Morey et al., 2002). Published literature demonstrates that IPE can improve attitudes towards collaboration (Reeves et al., 2012; Robben et al., 2012; Wellmon, Gilin, Knauss & Inman, 2012), allow health professionals to gain insight into each other's viewpoints (Courtenay, 2013; Robben et al., 2012), enhance understanding of roles and responsibilities of other professionals, improve knowledge of the nature of interprofessional collaboration (Reeves et al., 2012), and facilitate the development of collaborative skills and behaviors (Reeves et al., 2012; Robben et al., 2012).

Pharmacy, nursing, and medicine accreditation standards (Accreditation Council for Pharmacy Education, 2014; American Association of Colleges of Nursing, 2008; Liaison Committee on Medical Education, 2014) all include interprofessional competencies, but with no preferred IPE model identified by the accrediting boards themselves. There are no published studies comparing students from different academic settings with variable exposure to interprofessional education/practice to determine which methods may better prepare students for IP practice. Two reviews of IPE literature (Abu-Rish et al., 2012; Brandt, et al., 2014) identified 496 and 83 articles, respectively. While some articles addressed knowledge of roles, none compared knowledge of roles across institutions on the same measurement tool. We expected that students who participated in IPE would be more knowledgeable about roles on an interprofessional team and therefore, feel more prepared to practice in that collaborative environment (Figure 1). The purpose of this research was to assess student knowledge of interprofessional roles. Specifically, our aims were to determine what relationships were relevant to preparedness for INTERPROFESSIONAL practice and if

differences existed among student cohorts based on profession, type of learning institution, and/or participation in IPE.

## Methods

### *Participants*

We conducted a cross-sectional survey of health professional students aged eighteen years and older prior to entering the major experiential components of their professional training. Specifically, second- year medical and nursing students and third year pharmacy students were included, which coincides with student transitions from primarily didactic curricula to the experiential learning where they often interact with other health professionals on a team. Students from three universities with different professional programs of study with unique approaches to IP learning (Table 1) were invited to participate: (1) medical, nursing, and pharmacy students at The Ohio State University (OSU); (2) medical and nursing students at Ohio University (OU); and (3) medical and pharmacy students at Northeast Ohio Medical University (NEOMED).

### *Data Collection*

A survey was adapted from published research (Azhar, Hassali, Mohamed Ibrahim, Saleem, & Siow, 2012; Vrontos, Kuhn, & Brittain, 2011) and reviewed for face validity by approximately 20 practicing professionals and non-included students from all three professions; the focus of the initial review was for appropriateness, readability, ease of use, and timing. The final survey (Appendix A) was distributed online via Qualtrics (Provo, Utah), and required approximately ten to fifteen minutes to complete. Emails containing the anonymous survey link were sent out to student cohorts by faculty representatives at each institution. The survey was open for four weeks (January 17 – February 14, 2013). A modified version of the Dillman Tailored Design Method (Dillman, 2000) was utilized, with a survey announcement sent out three days prior to the initial survey invitation and two reminder emails sent on days 9 and 26. Respondents were incentivized to participate through a drawing for gift cards. This research was determined to be exempt by the human subjects institutional review board of The Ohio State University and partner institutions.

### *Survey Measures*

The survey contained four sections. Part one, the knowledge test, was an objective assessment of students' knowledge of physicians', pharmacists', and nurses' roles specifically related to 19 distinct health care tasks or services in the outpatient setting. An overall score and three knowledge subscores, one for each profession, were calculated for each respondent. The structure of the knowledge test portion of

the survey (Vrontos, Kuhn, & Brittain, 2011) and examples of health care related activities (Azhar, Hassali, Mohamed Ibrahim, Saleem, & Siow, 2012; Vrontos, Kuhn, & Brittain, 2011) were adapted from previous studies. The next two sections were original survey questions developed by the research team. Part two consisted of five questions regarding student experiences with IPE in their program of study, including types of IPE activities and the different professions that participated. Part three contained six questions related to student's perceptions of their preparedness to practice on an interprofessional team. Students were asked to rate themselves on a four point scale regarding their understanding of roles, ability to communicate roles, and preparedness to work on an interprofessional team. These measures were dichotomized for data analysis. Students were also asked to select which specific professions they felt ready to work with on an interprofessional team. Finally, part four collected participant demographics, including age, gender, program of study, and institution.

#### Data Analysis

All demographic and survey items were summarized using descriptive statistics. Categorical variables were expressed using frequencies and percentages. Continuous variables were expressed using means and standard deviations. An analysis of variance (ANOVA) test was used to compare knowledge test scores between the three university groups. Chi-square tests were used to identify relationships between university, profession, or IPE participation with student reported preparedness and understanding. Two sample t-tests were used to compare knowledge test scores and subscores by IPE participation or student perceptions of preparedness. All analyses were conducted in SAS version 9.2 (Cary, North Carolina). A p-value of <0.05 was considered to be statistically significant.

#### Results

A total of 273 of 981 invited students responded, providing an overall response rate of 27.8%; respectively, Northeast Ohio Medical University (NEOMED) 25.0% (46/184), Ohio University (OU) 31.7% (76/240), and The Ohio State University (OSU) 27.1% (151/557). However, the number of responses varies for each question as every respondent did not answer all the questions. Three respondents did not answer the question related to preparedness for interprofessional practice and thus were not included in analyses requiring that response. Of the 273 respondents, 58 were nursing students (21.2%), 74 were pharmacy students (27.1%), and 141 were medical students (51.6%). Student demographics by institution are reported in Table 2.

#### Survey Measures

*Participation in Interprofessional Education.* Among all respondents, 71.8% (196/273) had participated in IPE. The majority of students reported participation in an interprofessional activity as an educational requirement. If there was not a program of study for that profession at their institution, students were less likely to receive formal education on the role of a profession. Table 3 summarizes students' participation in IPE by university and type of IPE.

*Knowledge of Roles.* The overall average score on the knowledge test was 79.6% for NEOMED, 78.6% for OU, and 80.8% for OSU ( $p=0.1990$ ). Students who reported that they understood their own profession's role on an interprofessional team were not significantly different between the three universities (93.5% [43/46], 83.8% [62/74] and 84.0% [126/150] of students at NEOMED, OU, and OSU, respectively;  $p=0.2444$ ). Cronbach's alpha (a measure of internal consistency) for the overall score was calculated to be 0.83.

*Preparedness for Interprofessional Practice.* Overall, 70.7% (191/270) of students felt prepared to work on an interprofessional team. More NEOMED students indicated that they felt prepared to provide patient care as a part of an interprofessional team, at 86.7% (39/45), as compared with OU and OSU (62.2% [46/74] and 70.2% [106/151], respectively). The differences in proportions of students reporting preparedness for practice between universities was statistically significant ( $p=0.0169$ ).

#### Associations Between Survey Measures

A comparison of hypothesized and actual associations between survey measures are demonstrated in Figure 1.

*IPE and Preparedness.* There was a significant association between participation in IPE and preparedness. Students who reported participation in interprofessional activities were more likely to feel somewhat prepared/very prepared to provide patient care as a part of an interprofessional team compared to those who did not participate in IPE (76.8% [149/194] vs. 55.3% [42/76],  $p=0.0005$ ). When only students who participated in IPE were included, there was no statistically significant differences in those who felt prepared between university groups (86.7% [39/45] for NEOMED, 69.4% [34/49] for OU, and 76.0% [76/100] for OSU,  $p=0.1349$ ).

Students who received formal education about a profession's role were more likely to feel prepared to work with that profession to provide patient care than those who did not

receive formal education about that profession's role (Figure 2).

*Knowledge and Preparedness.* There was an association between knowledge of professional roles and perceptions of preparedness for interprofessional practice. For all respondents, those who reported feeling prepared to work with a given profession scored significantly higher on that profession's subscore on the knowledge test compared to those who did not feel prepared to work with that profession (Figure 3).

Among all respondents, 55.9% (148/265) felt they could explain a pharmacist's role on an interprofessional team, 74.6% (200/268) felt they could explain a nurse's role, and 87.0% (234/269) felt they could explain a physician's role. Those who reported that they could explain a pharmacist's role scored significantly higher on the pharmacist portion of the knowledge test than those who reported they could not explain a pharmacist's role (81.7% vs. 73.2%,  $p < 0.0001$ ). A similar trend was seen with those who could and could not explain a nurse's role on the nurse subscore of the knowledge test (76.7% vs. 73.3%,  $p = 0.0491$ ). This finding was not noted for physician data.

*Knowledge and IPE.* On the knowledge test, there was no statistically significant difference in mean overall score between students who did and did not participate in IPE (Figure 4). When all respondents are considered, those who received formal education about a pharmacist's role scored significantly higher on the pharmacist subscore than those who did not receive formal education about a pharmacist's role ( $p < 0.0001$ ). However, this trend was not seen between those who were and were not educated about nurse or physician roles among all respondents ( $p = 0.1530$  and  $p = 0.2459$ , respectively).

## Discussion

In our study, student knowledge and IPE exposures were both positively associated with health professions students' perceived preparedness for interprofessional collaboration. However, IPE participation itself was not significantly associated with improved knowledge scores. Previous studies have shown that specific IPE interventions can improve knowledge of health professional roles (Vrontos et al., 2011). In the study by Vrontos, et al, students who attended a university-wide interprofessional day were more knowledgeable about pharmacist-provided services. The students included in our study reported varying exposure with IPE and the specific interprofessional activities differed by institution and professional program. It is not known

whether our participants' IPE activities emphasized knowledge of roles.

Of interest, knowledge of pharmacist roles did appear to be related to IPE. Students who received formal education on the role of a pharmacist scored significantly better on the pharmacist subscore than those who did not receive formal education. This may be due to the fact that the profession of pharmacy is undergoing significant changes, with more widespread transition of pharmacists into providing non-dispensing related patient care services in the outpatient setting (e.g., medication management, immunizations, etc.). Students who were not educated about these changes may have relied on limited knowledge of the traditional dispensing role of a pharmacist and thus scored lower. A similar result was found in a study of North Carolina physicians' attitudes and perceptions of pharmacists as immunizers, where only 25% of physicians were aware that pharmacists could immunize and the overall attitude index showed a general lack of physician support. However, more than 75% of those physicians agreed that the role of the pharmacist is becoming more important in patient care (Welch, Ferreri, Blalock, & Caiola, 2005).

Nursing professionals have faced similar challenges in the past with expansion of nurse practitioner roles. Nasaif and colleagues (2012) reported a high correlation between primary care providers' knowledge and attitudes toward the nurse practitioner (NP) role after implementing an intervention to educate them on NPs' abilities. Banahan and Sharpe (1979) also found that previous knowledge was a major factor influencing physicians' support of NPs and was significantly associated with higher acceptance of NPs. This emphasizes the importance of educating health professionals and students about knowledge of roles, particularly in disciplines undergoing practice transitions. IPE is one method for doing so and may provide benefits beyond more traditional education methods (eg. learning only within one's profession) as IPE gives students the opportunity to work with each other. Students may also come into IPE activities with more prior knowledge or experience with some professions. This should be taken into consideration when designing IPE activities, in order to maximize learning exposure to those professions where understanding of practice roles requires greater development.

Timing for IPE may also be important, as students with inaccurate or incomplete knowledge of roles and abilities of other health professionals may be unprepared to collaborate in the advanced experiential components of their training. Our research suggests that inclusion of specific activities to improve knowledge of roles for professions undergoing



transitions may be important to include prior to experiential components of the curriculum. Currently, students may be unaware of non-dispensing roles for pharmacists and thus may not be prepared to interact with pharmacists functioning in these roles. This could negatively affect learning outcomes and ultimately reduce the quality of patient care.

This study focused on the IPEC core competency related to roles and responsibilities ("Core Competencies," 2011). Our results suggested that knowledge of roles and responsibilities was associated with increased student perception of preparedness. It is likely that other IPEC competencies contribute (and may contribute more) to preparedness than knowledge of roles alone. For example, skills related to interprofessional communication and team-building were not assessed in this study, but could have been learned through IPE and contributed to students' self-perceptions. Previously published studies of pre-licensure health professionals have shown the benefit of IPE on the development of collaborative skills (Reeves, Goldman, Burton, & Sawatzky-Girling, 2010). Individual student characteristics like confidence and willingness to participate (again not measured in our study) likely also play an important role. Furthermore, it is plausible that one or both may be enhanced through knowledge-based or exposure-based IPE instruction. In our study, no differences in preparedness between universities were found when only students who participated in IPE were included. This may suggest that the type of IPE is not as important as the opportunity to interact with peers.

NEOMED was chosen as one of the study universities because IPE is included in their professional programs for all medicine and pharmacy students. This effort currently includes several structured interprofessional courses and a variety of learning activities primarily taking place during the first two years of the curriculum. Our study was unable to discern differences in knowledge outcomes between the IPE curriculum (NEOMED) and the comparison schools; however, only a small number of NEOMED students responded to our survey invitation (n=46). The study was not powered a priori to detect statistically significant differences in knowledge between universities.

Our study has several limitations. Our response rate was lower than anticipated, which led to a smaller sample size, especially from the model IPE school. With survey research there is always the potential for response bias and it could be that only students who were interested in IPE completed the survey. We also acknowledge that our study population was limited to three universities in the state of Ohio, which may limit application elsewhere. However, the schools in our sample did represent different types of institutions with

unique approaches to IPE and thus may speak to the overall impact of IPE rather than confounding due to a specific learning approach.

This study used self-reported participation in IPE and student perceptions of preparedness as a means of measuring IPE effect on preparedness for interprofessional practice. The survey instrument contained information that would prime participants as to what qualified as IPE, however there was no way to confirm their self-assessment due to the anonymous nature of responses. Furthermore, the literature shows that accuracy of self-assessments among health professionals tends to be poor (Davis, 2006). Despite this, our study results suggest that students were at least somewhat able to predict their abilities. Those who were more knowledgeable, determined by objective scores on the knowledge test, ranked their ability to explain roles higher than those who scored lower on the knowledge test (as expected).

A final limitation to this research is that our survey had not been previously validated and may have introduced unintended variables. Unfortunately, no current instrument exists that has been validated for assessing knowledge of roles. This remains an excellent area for exploratory research. The knowledge test was reviewed by practicing professionals in each field for face validity, to ensure completeness of health care related activities and accuracy of correct responses. Cronbach's alpha demonstrated an acceptable value for reliability at 0.83.

### Conclusion

Interprofessional education may contribute to student perceptions of preparedness for collaborative practice through a variety of activities and exposures, as described in our study. Participation in IPE activities in the representative institutions was high, as was knowledge of professional roles. Both participation in IPE and increased knowledge of roles were associated with increased student-assessed preparedness. However, participation in IPE was not associated with increased knowledge of roles. (Figure 1) In this research, it appears that advancement of skills and behaviors including *and* in addition to those pertaining to knowledge of roles and responsibilities may be especially important. Pharmacy in particular should prioritize IPE as a means to help other care professions advance their understanding of our role on the patient care team, especially in regard to non-dispensing patient care services. Future exploration of experience-based learning activities also seems warranted, with student experiences that include or target specific domains such as communication, team dynamics, and others likely contributing to interprofessional preparedness in

significant ways. The survey tool used in this study could be further validated for use as a measure of interprofessional knowledge of roles. Future studies should be planned to evaluate IPE programs in more detail, with a focus on best practices that have been successfully implemented and assessed.

*Ethical approval:* This research was determined to be exempt by the human subjects institutional review board of The Ohio State University (#2012E0687; November 27, 2012) and at partner institutions.

*Previous presentations:* This research was presented at American Association of Colleges of Pharmacy Annual Meeting, Grapevine, TX in July, 2014, Ohio Pharmacy Resident Conference, Ada, OH in May 2013, Ohio Pharmacists Association Annual Conference and Tradeshow, Columbus, OH in April 2013 and American Pharmacists Association Annual Meeting, Los Angeles, CA in March 2013.

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Table 1: Comparison of Participating Institutions and IPE in their Curricula, 2012-2013

Institution*	Description of Institution	IPE Requirements	IPE Electives
NEOMED	Public Community-based Interprofessional Health Sciences University with Colleges of Pharmacy and Medicine	First professional year medical and pharmacy students (M1/P1) engage in a one week interprofessional course introducing them to the role of the healthcare professional and preparing them for the rigorous curriculum of a graduate program. This course has various interprofessional activities including a journal club, video presentations, and various small group discussions.	Pharmacy and medicine students may participate in a Bioethics Certificate program at NEOMED that is interprofessional in nature and offers credit through the College of Graduate Studies.
		M1 and P1 students participate together in foundational science courses including physiology, biochemistry, and immunology and the Evidence Based Medicine sequence (parts 1 and 2).**	
		M1 and P1 students complete the Community Experience course in which students are grouped into interprofessional teams and are required to develop, implement, and evaluate a community project.	
		For the Interprofessional Team Project (ITP), occurring during the second professional year for medical and pharmacy students (M2/P2), groups of 4-5 students participate in a three part sequence that utilizes team-based learning with vertical and horizontal integration to other curricular content to address relevant team based care topics. The three part project focuses on: (1) utilizing evidence based medicine skills to determine the effectiveness of team based care, discharge planning, and strategies to reduce readmission rates.; (2) identifying best practices for effective transitions of care, and; (3) defining the different roles and responsibilities for various providers within a patient centered medical home (PCMH).	

Institution*	Description of Institution	IPE Requirements	IPE Electives
OU	Public Rural University with Osteopathic Medical College and College of Health Sciences, including a Nursing Program	A portion of second year medical student class has case based learning facilitated by a pharmacist and Advanced Pharmacy Practice Experience (APPE) pharmacy students.	Elective course in which teams of students from several health disciplines come together at a nursing and rehabilitation center to learn about other disciplines while discussing patient care.
			The Global Health Certificate Program is a 19 credit hour program that offers an interprofessional opportunity for students interested in gaining a global perspective on healthcare through coursework and a 2-week capstone/field experience.
OSU	Large Research-intensive University with an Academic Medical Center and Seven Health Science Colleges, including Medicine, Pharmacy, and Nursing	First professional year medical students and second professional year pharmacy students participate in a 2-hr small group workshop on medication adherence.	Semester long elective course on Patients in Poverty (various professions). In this course, students work in interprofessional teams on patient case studies throughout the semester, present about their profession, and various small group activities/discussions.
			One 2-3 hour high-fidelity patient simulation (various professions) where interprofessional student groups are working as a team to develop a plan and treat the patient(s).

\*NEOMED = Northeastern Ohio Medical University, OU = Ohio University, OSU = The Ohio State University

\*\* In this situation, the students from two different professions sitting in class together does not constitute IPE according to the WHO definition. However, learning activities exist within each foundational science courses at varying levels that students from pharmacy and medicine are working together and learning from and with each other.

**Table 2: Demographic Characteristics of Survey Respondents by Student Profession and University**

Characteristic	University		
	NEOMED*	OU*	OSU*
	n (% of 46)	n (% of 76)	n (% of 151)
Student Profession			
Nursing	0 (0.0)	22 (28.9)	36 (23.8)
Pharmacy	25 (54.3)	0 (0.0)	49 (32.5)
Medicine	21 (45.7)	54 (71.1)	66 (43.7)
Age (years)			
18-20	0 (0.0)	18 (23.7)	16 (10.6)
21-25	32 (69.6)	43 (55.3)	110 (72.8)
26-30	7 (15.2)	11 (14.5)	20 (13.3)
>30	7 (15.2)	5 (6.6)	5 (3.3)
Gender			
Female	25 (54.3)	48 (63.2)	111 (74.0)

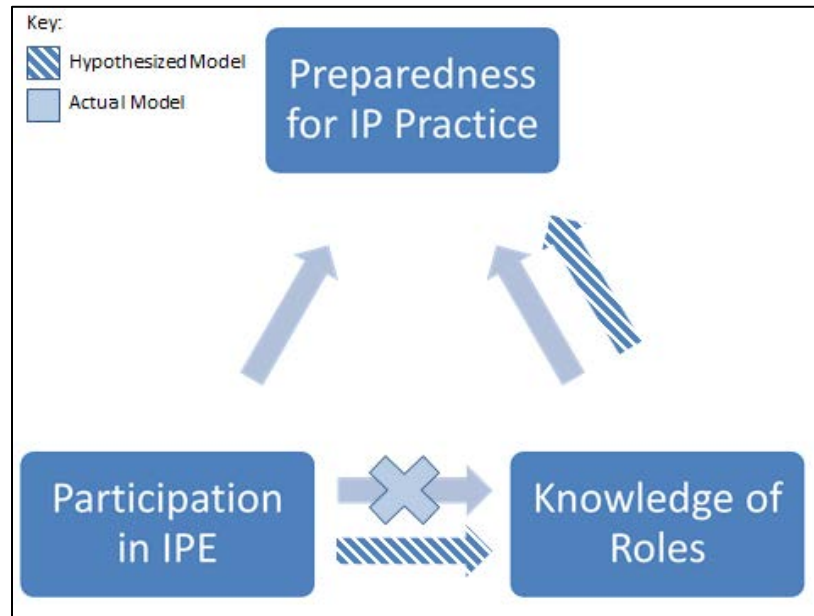
\*NEOMED = Northeastern Ohio Medical University, OU = Ohio University, OSU = The Ohio State University

**Table 3. Participation in Interprofessional Education (IPE) by University**

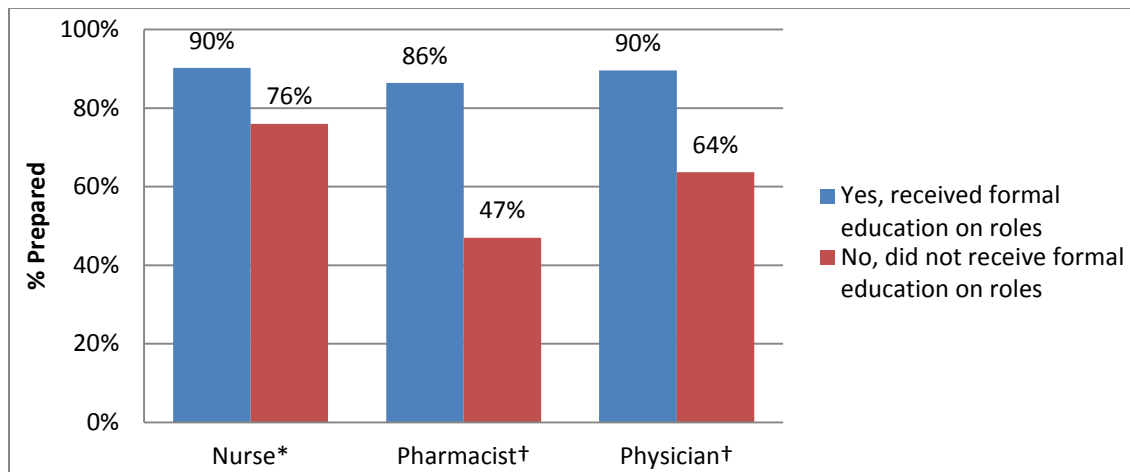
All Respondents	University		
	NEOMED*	OU*	OSU*
	n (% of 46)	n (% of 76)	n (% of 151)
Participation in IPE as a requirement	46 (100.0)	50 (65.8)	100 (66.2)
Didactic lecture	46/46 (100.0)	30/50 (60.0)	40/100 (40.0)
Patient case activity	45/46 (97.8)	20/50 (40.0)	50/100 (50.0)
Other group activity	41/46 (89.1)	38/50 (76.0)	71/100 (71.0)
Elective or Extracurricular Interprofessional Activity	12 (26.1)	21 (28.0)	39 (25.8)
Received formal education about the role of a:			
Nurse	19 (41.3)	36 (47.4)	77 (51.0)
Physician	40 (87.0)	38 (50.0)	105 (69.5)
Pharmacist	42 (91.3)	12 (15.8)	70 (46.4)
Taught by a:			
Nurse	33 (71.7)	47 (61.8)	55 (36.4)
Physician	45 (97.8)	55 (72.4)	112 (74.2)
Pharmacist	45 (97.8)	28 (36.8)	94 (62.3)

\*NEOMED = Northeastern Ohio Medical University, OU = Ohio University, OSU = The Ohio State University

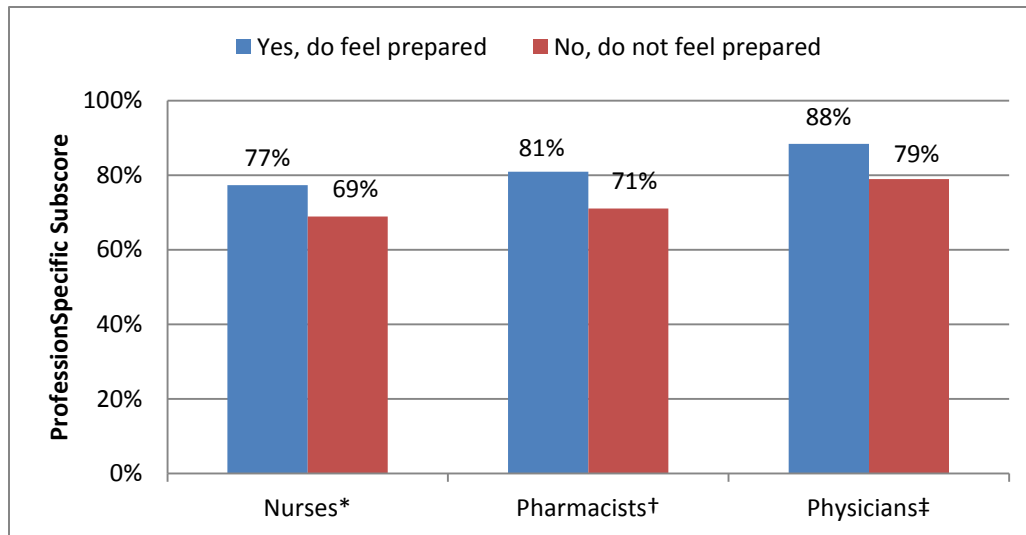
Figure 1. Hypothesized and Actual Associations Between Survey Measures



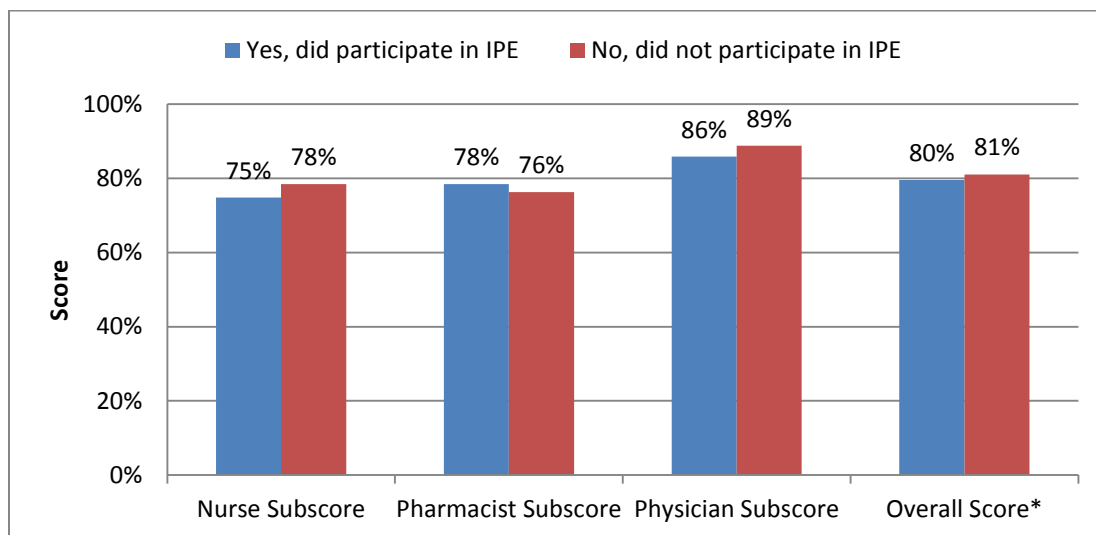
**Figure 2.** Percentage of all survey respondents reporting preparedness to work with nurses, pharmacists, and physicians, respectively, by formal education on roles. All respondents were asked to indicate whether they felt prepared to work with each profession on a team, regardless of their own profession. These results indicate the percentage of respondents who feel prepared to work with each respective profession based on their exposure to formal education about that profession's role on an interprofessional team. \* $p=0.0018$  † $p<0.0001$



**Figure 3.** Knowledge test subscores by preparedness to work with nurses, pharmacists, and physicians, respectively. All respondents were asked to indicate whether they felt prepared to work with each profession on a team, regardless of their own profession. Knowledge test subscores reflect student's knowledge of each profession's ability to provide 19 health-care related activities. \* $p=0.0022$  † $p<0.0001$  ‡ $p=0.0056$



**Figure 4.** Knowledge test subscores and overall score by participation in interprofessional education. Subscores reflect student's knowledge of each profession's ability to provide 19 health-care related activities. Overall score is a combination of all three subscores. \* $p=0.1731$ .





## Appendix A: Survey

**PART ONE**

In the outpatient setting (in regards to practice in the state of Ohio), please select the appropriate health professional(s) whose license allows them to provide each healthcare related activity (check all that apply).

**\*The correct answers are filled in here.**

		Registered Nurse	Physician	Pharmacist
1.	Prescribe medications		X	
2.	Dispense medications		X	X
3.	Administer medications	X	X	
4.	Counsel patients on the safe and effective use of medications	X	X	X
5.	Administer immunizations (if properly trained)	X	X	X
6.	Provide point-of-care testing (ex: finger stick glucose, lipids, A1c, etc)	X	X	X
7.	Draw blood (venipuncture)	X	X	
8.	Triage patients upon presentation	X	X	X
9.	Take vital signs (including blood pressure, pulse, temperature, and respiratory rate)	X	X	X
10.	Perform a complete physical examination		X	
11.	Utilize principles of differential diagnosis to diagnose patients		X	
12.	Bill for direct patient care services	X	X	X
13.	Practice under a standing order/protocol from a physician (ex: change medication dose, order tests for monitoring purposes, etc)	X	N/A	X
14.	Provide a comprehensive medication review (complete review of all medications to identify, assess, and resolve medication errors)	X	X	X
15.	Identify drug-related problems/medication errors	X	X	X
16.	Provide drug information to other health care providers	X	X	X
17.	Provide education on health and wellness	X	X	X
18.	Provide disease-state management (coordinated health-care interventions and communications for patients with certain illnesses, for example, diabetes, asthma, smoking cessation)	X	X	X
19.	Pursue post-graduate training (residency/fellowship/specialization)	X	X	X

Please consider the following question in regards to practicing in the outpatient setting in the state of Ohio. Working within an interprofessional team, which of the following licensed health professionals' area of expertise, in your opinion, makes them the best resource for providing each healthcare related activity?  
(check the most appropriate response)

		Registered Nurse	Physician	Pharmacist
1.	Prescribe medications			
2.	Dispense medications			
3.	Administer medications			
4.	Counsel patients on the safe and effective use of medications			
5.	Administer immunizations (if properly trained)			
6.	Provide point-of-care testing (ex: finger stick glucose, lipids, A1c, etc)			
7.	Draw blood (venipuncture)			
8.	Triage patients upon presentation			
9.	Take vital signs (including blood pressure, pulse, temperature, and respiratory rate)			
10.	Perform a complete physical examination			
11.	Utilize principles of differential diagnosis to diagnose patients			
12.	Bill for direct patient care services			
13.	Practice under a standing order/protocol from a physician (ex: change medication dose, order tests for monitoring purposes, etc)			
14.	Provide a comprehensive medication review (complete review of all medications to identify, assess, and resolve medication errors)			
15.	Identify drug-related problems/medication errors			
16.	Provide drug information to other health care providers			
17.	Provide education on health and wellness			
18.	Provide disease-state management (coordinated health-care interventions and communications for patients with certain illnesses, for example, diabetes, asthma, smoking cessation)			

**PART TWO**

Questions 1-3 are in regards to the requirements of your program:

- 1) Besides your own discipline, have you participated in any interprofessional activity as a part of your didactic or experiential requirements? (i.e. attending lectures, group class work, etc)?
  - a) Yes – with nursing students
  - b) Yes – with medical students
  - c) Yes – with pharmacy students
  - d) Yes – with other health professional not listed
  - e) Yes – with more than one discipline
  - f) No

If yes – What activities? (select all that apply)

- a) didactic lecture
- b) group activity - patient case
- c) group activity - other

- 2) Have you had formal instruction about any of the following health professionals' role on an interprofessional team? (check all that apply, including your own professional role, if applicable)
  - a) Nurse
  - b) Physician
  - c) Pharmacist
  - d) Other (specify)
- 3) Which of the following licensed health professionals have taught you within your required professional classwork (excluding rotations)? (check all that apply, including your own profession, if applicable)
  - a) Nurse
  - b) Physician
  - c) Pharmacist
  - d) Other (specify)
- 4) Have you participated in any interprofessional activity OUTSIDE of your curriculum? (i.e. a Student Interprofessional Society, Student Government Association, electives, etc.)?
  - a) Yes If so, which one(s) (open ended)?
  - b) No

- 5) Have you interacted with any of the following health professionals while working or on a clinical experience? (select all that apply)
  - a) Nurse
  - b) Physician
  - c) Pharmacist (if yes, then #6; if no, skip to #7)
  - d) Other (specify)
- 6) Have you ever worked with a pharmacist who provided clinical services (ie. pharmacy services other than dispensing medications) (ex. on rotations, shadowing experience, etc.)?
  - a) Yes
  - b) No

**PART THREE**

- 7) How prepared do you feel to provide patient care as a part of an interprofessional team?
  - a) 1 (Very unprepared)
  - b) 2
  - c) 3
  - d) 4 (Very prepared)
- 8) How well do you understand your profession's role on an interprofessional team?
  - a) 1 (I do not understand at all)
  - b) 2
  - c) 3
  - d) 4 (I understand very well)
- 9) How well can you explain a nurse's role on an interprofessional team to a different healthcare professional?
  - a) 1 (I cannot explain at all)
  - b) 2
  - c) 3
  - d) 4 (I can explain very well)
- 10) How well can you explain a physician's role on an interprofessional team to a different healthcare professional?
  - a) 1 (I cannot explain at all)
  - b) 2
  - c) 3
  - d) 4 (I can explain very well)

- 11) How well can you explain a pharmacist's role on an interprofessional team to a different healthcare professional?
- 1 (I cannot explain at all)
  - 2
  - 3
  - 4 (I can explain very well)
- 12) Which of the following professions do you feel prepared to work with to provide patient care? (check all that apply)
- Nurse
  - Physician
  - Pharmacist
  - Other (specify)
  - None of the above
- PART FOUR**
- 13) Do you have a family member or close friend who is a health professional? (check all that apply)
- Yes – Nurse
  - Yes – Physician
  - Yes – Pharmacist
  - Yes – other health professional not listed
  - No
- 14) Which of the following disciplines is your current area of study?
- Nurse
  - Physician
  - Pharmacist
- 15) Have you been trained in any other health discipline?
- Yes (please explain)
  - No
- 16) At which University are you currently a student?
- Northeast Ohio Medical University
  - The Ohio State University
  - Ohio University
- 17) What is your expected year of graduation?
- 18) Please indicate your gender.
- Male
  - Female
- 19) What is your age?
- 18-20
  - 21-25
  - 26-30
  - > 30