INNOVATIONS in pharmacy

Volume 7 | Number 3 Article 13

10-12-2016

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Cover Page Footnote
Notes on Contributors MR, AG, AB, and GD conceived and designed this study while MR was a PGY2 pharmacotherapy resident at University of the Sciences, Philadelphia, PA. LP analyzed the data. All authors contributed to the writing and critical revision of the manuscript and approved the final manuscript for publication. Acknowledgements The authors would like to acknowledge Dr. Anna Headly for aiding in the coordination of the simulated patient case activity and the administration of the SPICE instrument and Dr. Joseph Zorek for advising on the data analysis and critically reviewing the manuscript.

A Cross-Sectional Study Evaluating the Impact of One Year versus Two Years of Exposure to Interprofessional Education on Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education (SPICE)

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Disclosures: We declare no conflicts of interest or financial interests that the authors or members of their immediate families have in any product or service discussed in the manuscript, including grants (pending or received), employment, gifts, stock holdings or options, honoraria, consultancies, expert testimony, patents and royalties.

Abstract

Background: *Evaluating student perceptions of interprofessional education (IPE) is important to meet accreditation standards. The objective of this study was to evaluate the impact of one year versus two years of exposure to IPE on student perceptions, as well as evaluate differences between professions.*

Methods: *In this cross-sectional study, first and second year medical and pharmacy students enrolled in an interprofessional experiential course series at each of their respective institutions completed a perceptions instrument prior to a standardized objective behavioral assessment. Student demographics and perception scores were summarized using descriptive statistics. Chi-squared tests and Cochran-Mantel-Haenszel tests were used to assess differences in demographic variables. Between-group differences in perception scores were assessed using Wilcoxon Rank-Sum tests.*

Results: *155 students completed the instrument out of the 163 students enrolled in the course series. Overall, the median scores were ≥4 (4=Agree, 5=Strongly Agree) for all SPICE items and factors. No significant differences were observed between first and second year students in response to any of the SPICE items or factors. When comparing professions, significant differences were observed between pharmacy students and medical students that IPE "enhances my education" (p=0.003), "improves patient satisfaction" (p=0.001), and "enhances my future ability to collaborate" (p=0.001). Significant differences were also observed between pharmacy students and medical students for 2 of the 3 factors: teamwork (p=0.001) and patient outcomes (p=0.005). For all of the differences in items and factors, pharmacy students reported higher levels of agreement.*

Conclusions: *Two years of exposure to IPE compared to one year (i.e. second year students vs. first year students) did not result in higher levels of agreement; however, agreement was high across all students which may have limited the ability to detect a difference. When perceptions are high early in the curriculum, maintaining the same level of agreement longitudinally may be a more appropriate educational outcome. Pharmacy students had higher levels of agreement compared to medical students for certain items. Further research is needed to determine if these differences have an impact on interprofessional collaboration.*

Keywords: interprofessional education, perceptions, SPICE, assessment

Background

Interprofessional education (IPE) has become an increasingly important aspect of health profession education and has been suggested as a key element in improving the United States (U.S.) healthcare system.[1] The National Center for Interprofessional Practice and Education is an organization designated by the U.S. Department of Health and Human Services to lead, coordinate, and study the advancement of collaborative, team-based health profession education and patient care.[2] Their vision is to align education and practice "to create a new shared responsibility," which they call the "Nexus." The National Center aims to positively impact the Institute for Healthcare Improvement (IHI)'s Triple Aim: "improving the patient experience of care, improving the health of populations, and reducing per capita costs of healthcare."[2,3] To guide the development of IPE experiences, the Interprofessional Education Collaborative (IPEC) and the Canadian Interprofessional Health Collaborative (CIHC) independently developed similar competency frameworks.[4,5] Additionally, accrediting bodies, such as the Accreditation Council for Pharmacy Education (ACPE), the Association of

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American Medical Colleges (AAMC) through the Liaison Committee for Medical Education (LCME), and the Accreditation Council for Graduate Medical Education (ACGME) have incorporated specific IPE standards into accreditation documents.[6-8] Other health professions accrediting bodies are moving towards requiring IPE throughout the curriculum as well.[9] This focus has prompted the need to not only create, but also assess IPE experiences. To meet this need, the National Center has compiled a variety of valid and reliable IPE instruments. Additional instruments have been posted by authors to the National Center's resource exchange, one of which is the Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education (SPICE) instrument.[10]

The SPICE instrument was developed and validated by Fike and colleagues to assess the impact of experiential IPE on student perceptions.[10] The development of the instrument was guided by the IPEC competency framework.[4,10] The instrument contains 10 items that are categorized into 3 factors, specifically, factor 1: interprofessional teamwork and team-based practice, factor 2: roles/responsibilities for collaborative practice, and factor 3: patient outcomes from collaborative practice. All items utilize a 5-point Likert scale for student responses, with 5 representing strongly agree and 1 representing strongly disagree. Validity and reliability were demonstrated in 179 students across five campuses within one institution; the sample was comprised of mostly third year medical and fourth year pharmacy students.[10] Subsequently, Zorek and colleagues conducted a study in the same population and found that the SPICE instrument was able to capture changes in students' perceptions following an IPE experience.[11] The SPICE instrument is unique in that it was specifically developed to align with the IPEC core competencies.[10,11] Additionally, it contains items that focus on student perceptions of the impact IPE has on patient outcomes, which aligns with the Triple Aim Initiative.[3] The SPICE instrument was later revised (SPICE-R) to remove profession-specific language, thus allowing the use of the instrument by other health professions.[12] Dominguez and colleagues found that the SPICE-R instrument exhibited better performance in terms of goodness of fit, construct validity, and reliability compared with a revised 21-item Attitudes Toward Health Care Teams (ATHCT-R) instrument.[12] They noted that further research is warranted to assess the external validity of both SPICE and SPICE-R instruments in broader health profession student populations.[11] Since conducting our study, the SPICE instrument was refined to address factor deficiencies. The refined model, referred to as SPICE 2, has demonstrated improved reliabilities and the factors are better balanced with items. Additionally, SPICE 2 was validated in a larger and broader student population.[13] We conducted this study to add to the growing body of evidence for using the SPICE instrument in a student population at the beginning of their educational curriculum. Given the longitudinal design of our interprofessional experiential course series, which is further described below, we also wanted to assess the impact of one year versus two years of exposure to IPE on student perceptions. Specifically, the primary objective was to compare student perceptions of IPE between first year and second year medical and pharmacy students. As a secondary objective we aimed to compare student perceptions of IPE between professions.

Methods

Study Design

This cross-sectional study evaluated student perceptions within an interprofessional experiential course series. The study occurred prior to a standardized objective behavioral assessment, which was designed to simulate the students' patient care responsibilities within the interprofessional student-run clinic and served as an end-of-year formative assessment. The Institutional Review Boards of both Rowan University and University of the Sciences (USciences) approved our study as exempt research.

Interprofessional Experiential Course Series

Cooper Medical School of Rowan University (CMSRU) and USciences Philadelphia College of Pharmacy created a longitudinal interprofessional practice experience which was part of a 6-semester experiential course series occurring during the first, second, and third year of education for both medical and pharmacy students. At the time of this study, the course series included 64 first year medical students (M1s), 50 second year medical students (M2s), 25 first-professional year pharmacy students (P1s), and 24 second-professional year pharmacy students (P2s), and no third year students. Students were divided into 12 teams in a ratio of approximately 2 medical students for every 1 pharmacy student. For the longitudinal practice experience, interprofessional teams alternated weekly between a student-run clinic and various satellite patient care sites. Students performed all responsibilities within the student-run clinic under the direct supervision of internal medicine medical residents, pharmacy residents, and both physician and pharmacist faculty. Additional details about the design of this course series and the standardized objective behavioral assessment were described previously.[14]

Participant Recruitment

All students enrolled in the interprofessional experiential course series were invited to participate in this study via email two weeks prior to a required standardized objective behavioral assessment, which occurred in April 2014. Signed consent for participation was collected prior to the assessment. Although students were not required to participate in the study, all students were required to participate in the standardized objective behavioral

assessment for course assessment purposes, which included evaluations of student perceptions via the SPICE instrument. Data were included only from participants who consented to the study.

Data Collection

Anonymous SPICE instrument responses were collected electronically using Qualtrics® (2014, Provo, UT, USA) from students who consented to participate in the study. After completing the SPICE instrument items, demographic information was collected, including age, gender, profession, year of education, highest level of education, and previous work experience.

Data Analysis

Student demographics and SPICE scores were summarized using descriptive statistics of measures of central tendency (median) and variation (interquartile range, IQR) for quantitative data and frequency distributions (n, %) for qualitative data. Factor scores were calculated as the median (IQR) of item scores within the factor: factor 1 (median of items 1,5,6,8,9,10), factor 2 (median of items 2,7), factor 3 (median of items 3,4).[11] Chi-squared tests and Cochran-Mantel-Haenszel tests for ordinal data were used to assess differences in demographic variables between year of education, as well as professions. Between-group differences in single item and factor SPICE scores were assessed using Wilcoxon Rank-Sum tests. The level of significance used was *alpha* = 0.05, with a Bonferroni correction for single item comparisons (*alpha* = 0.005). All statistical analyses were performed using SAS Version 9.4 (SAS Institute, Inc, Cary, NC).

Results

Baseline demographics are listed in Table 1. Overall, 155 (95%) students completed the survey instrument of the 163 total students enrolled in the course series. Baseline demographic information was collected for 154 (99%) participants. There was a higher prevalence of female students (n=98; 63%) in the sample. The percentage of female pharmacy students (n=35; 76%) was significantly higher than among the medical students (n=63; 58%) (one-sided p=0.018). As expected, the majority of pharmacy students (n=42; 91%) enrolled in the direct-entry, 6-year Doctor of Pharmacy program had previously earned only a high school degree and the majority of medical students (n=84; 78%) had earned a bachelor's degree prior to entry into medical school. A significant difference was observed between pharmacy students (n=38; 83%) and medical students (n=69; 64%) with respect to any type of previous working experience (p=0.020). When looking more closely at different types of working experience, a significant difference was observed between pharmacy students (n=34; 74%) and medical students (n=29; 27%) with respect to previous healthcare-related working experience (p<0.001). A significant difference was also observed between medical students (n=29; 27%) and pharmacy students (n=1; 2%) with respect to previous research-related working experience (p<0.001). No significant difference was found for previous working experience related to education or other categories, including restaurant, financial, coaching, retail, and many others. Approximately the same percentages of first and second year medical and pharmacy students were included in the study; no differences were observed between first and second year students with respect to gender, highest degree earned, or previous working experience.

Table 2 contains student responses to SPICE items 1 through 10. When examining the students by years of exposure, no significant differences were observed between first and second year students in response to any of the items. Furthermore, no significant difference was observed between first and second year students in response to any items within each distinct professional group, including medical and pharmacy (subgroup analysis results not reported). When comparing professions, significant differences were observed between pharmacy students and medical students in response to item 1: working with another discipline of students enhances my education (p=0.003), item 4: patient satisfaction is improved when patients are treated by a team of professionals from different disciplines (p=0.001), and item 5: participating in educational experiences with another discipline of students enhances my future ability to work on an interdisciplinary team (p=0.001), with pharmacy students scoring higher, indicating a higher level of agreement.

Table 3 contains student responses based on the grouping of SPICE items into factors. Similar to the single item analysis, no significant differences were observed between first and second year students for any of the factors. Significant differences were observed between pharmacy students and medical students with respect to factor 1: interprofessional teamwork and team-based practice (p=0.002) and factor 3: patient outcomes from collaborative practice (p=0.005), with pharmacy students scoring higher for both factors. No differences were observed for factor 2: roles/responsibilities for collaborative practice (p=0.488).

An analysis was conducted to investigate the effect of previous working experience on SPICE item and factor scores. The student group was considered as a whole (both pharmacy and medical) and students who had any type of previous working experience scored significantly higher than students without previous working experience in response to item 6: all health professions students should be educated to establish collaborative relationships with members from other disciplines, item 9: physicians and pharmacists should collaborate in teams, factor 1: interprofessional teamwork and team-based practice and factor 3: patient outcomes from

collaborative practice; however, when the effect of working experience was analyzed separately within each distinct professional group no significant difference was found between students with and without working experience. When examining each type of working experience individually, including healthcare, research, education, or other, no significant differences were observed within each type among students having previous working experience as compared to those without.

In the analysis of the effect of demographics on SPICE item and factor scores, no significant differences in responses were observed based on gender. With regards to highest degree earned, a significant difference was observed for item 1: working with another discipline of students enhances my education (median scores: high school degree = 4, Bachelor's degree = 4, Master's degree = 4, Professional degree = 5; p=0.004).

Discussion

Our findings indicate a high level of agreement within our student population regarding the value of interprofessional collaboration in education, patient care, and development of future health care professionals, as evidenced by the fact that the median scores were ≥4 (4=Agree, 5=Strongly Agree) for all SPICE items and factors. These positive findings are well supported in the literature. Previous studies have observed positive attitudes toward and perceptions of IPE involving various combinations of health professional students utilizing a variety of educational designs.[11,14,15-22] A majority of these investigators have evaluated changes in student attitudes and/or perceptions after completing an interprofessional activity, course, or practice experience.[11,16-18,22-24]

Different instruments have been utilized to collect attitudes and perceptions; the most frequently reported tools in the aforementioned studies include the Readiness for Interprofessional Learning Scale (RIPLS), Interdisciplinary Education Perception Scale (IEPS), and Attitudes Toward Health Care Teams (ATHCT) scale.[15-19,21,22] A recent review evaluated the psychometric strengths of these commonly used instruments and suggested that the measurement of between-group differences and within-group changes have been problematic with RIPLS and IEPS.[25] Specifically, there have been variations in item scoring with RIPLS and IEPS making it difficult to compare findings across studies. Additionally, the reviewers' critical appraisal of RIPLS and IEPS indicated that there was insufficient evidence for validity and reliability to support the use of these instruments, in addition to the others evaluated. This implies that although RIPLS and IEPS are commonly used, broader use warrants appropriate consideration. Of note, this review did not evaluate ATCHT, SPICE, SPICE-R, SPICE 2, or SPICE-R 2.[25] Given the limitations of these commonly published instruments, we decided to utilize the SPICE instrument to collect student perceptions, which was prior to the publication of the refined model, SPICE 2. At the time of this study, additional benefits of utilizing the SPICE instrument over others included: (1) its ease of administration (only 10 items), (2) its items and factors are linked with the core competencies of IPE, and (3) its ability to be used longitudinally to evaluate changes.[11] SPICE 2 offers similar benefits noted above with better external validity, improved reliability, better balance of items within factors, and improvements in specific items. These strengths suggest that SPICE 2 may be a preferred instrument in future IPE assessments.[13]

We compared perceptions of IPE between first and second year students and found no differences for any SPICE item or factor. With both groups reporting a high level of agreement, finding no difference between first and second year students is encouraging and provides evidence that we are able to maintain positive student perceptions within our longitudinal interprofessional experiential course series. These findings are similar to those of Pittenger and colleagues, who also did not observe increases in scores over time. In fact, they indicated that this finding was a measure of success for the course because scores were maintained and did not decline.[22] It is also important to explore the implications that exist with observing agreement in an earlier student population, as with our first and second year students. This notion has also been suggested in other studies, including one conducted by Seif and colleagues, who observed high pretest scores at the start of an IPE program and suggested the difficulty this presents in identifying changes or differences over time.[17] Moreover, they stated that early exposure to IPE activities can lead to overall high scores for IEPS and RIPLS, which may limit the ability for these instruments to detect a difference, if indeed it exists, in student populations similar to ours that are exposed to IPE early in the curriculum. Over time, these results may trend in two ways: either no change occurs, indicating positive scores are maintained, or a change occurs, indicating a decline. Coster and colleagues observed the latter, reporting that the attitudes of medicine, pharmacy, occupational, and physical therapy students, as assessed by the RIPLS instrument, became more negative over a three-year time period.[26] It must be noted that our study did not directly compare changes in perceptions over time for individual students, which is important when interpreting our results. Instead we evaluated the impact the duration of exposure to IPE has on a group of individuals enrolled in the same curriculum. We are encouraged that this cross sectional evaluation demonstrated high perceptions of IPE amongst both first and second year students, despite the different durations of exposure within our interprofessional experiential course series.

We also compared perceptions between professions (pharmacy versus medical) and identified significant differences for SPICE items 1, 4, and 5, as well as factors 1 and 3. Of note, the differences identified for factor 1: interprofessional teamwork and team-based practice (which includes items 1 and 5) and factor 3: patient outcomes from collaborative practice (which includes item 4) are likely influenced by the differences identified for items 1, 4, and 5, since these items are components of these factors. Differences in attitudes and perceptions between professions have frequently been reported in the literature for RILPS, IEPS, ATHCT, SPICE, and other instruments.[11,15,16,21,24,27-31] Interestingly, these differences have been observed in students, as well as post-graduate practicing professionals. In a majority of these observations, medical students and physicians had lower ratings for each respective instrument (i.e. lower readiness for, perceptions about, and attitudes towards interprofessional learning), compared to the other health professions. Van Winkle and colleagues provide a theory for these observed differences called the *principle of least interest*.[27] This principle was originally proposed in the context of family relations by Waller and Hill.[32] Van Winkle and colleagues explain that traditionally physicians hold more powerful positions and therefore are less likely to express eagerness for collaborative relationships with those with less power (e.g. pharmacists, nurses, etc.).[27] Zorek and colleagues also found differences between professions for certain SPICE items (8 and 10), proposing similar rationales for these observations. Specifically, they suggested that, although pharmacists and other health professionals can independently impact patient care, healthcare outcomes are optimized with effective team collaboration, in order to reach the broadest scope of practice.[11] The motivation to collaborate may be higher for those professions whose roles have continued to evolve, such as pharmacy, resulting in an increasing responsibility to contribute to the optimization of patient care outcomes. These theories may hold true for our study as well, especially for the items that differed between professions. Specifically, pharmacy students indicated a higher level of agreement compared to medical students on the following statements: their education is enhanced when working with another discipline (item 1), their ability to work on an interprofessional team is enhanced from participating in interprofessional educational experiences (item 5), and patient satisfaction is improved with interprofessional collaborative practice (item 4). The implications of these statistical differences in perceptions require further investigation.

Our study adds to the growing body of evidence for using the SPICE instrument to evaluate student perceptions of IPE. We achieved a sample size similar to the population targeted in the original study conducted by Fike and colleagues;[10] however, our population is unique because we included first and second year students. Our study also includes an interprofessional experiential course series and demonstrates that students enrolled within the course series have a positive perception of IPE. We collected student perceptions after our students had spent a substantial amount of time getting to know their team members, establishing relationships, and strengthening teamwork skills. The second year students had spent approximately two years with their original team, and the first year students had spent all of Fall semester and most of Spring semester together with their team. Any level of agreement or disagreement to the SPICE items is likely influenced by each student's longitudinal exposure to this interprofessional practice experience. Evaluating changes in perceptions using pre- and post-exposure data has already been established by Zorek and colleagues.[11] Evaluating student perceptions at specific points in time (i.e. at the end of year 1, 2, etc.), rather than conducting pre- and post-assessments for each year, offers another method to assess student perceptions while reducing the survey burden on and resultant fatigue of students. Our study is also unique because we have combined students from two separate academic institutions, which is different from that of the original study population in which the SPICE instrument was developed and validated. Although we have not conducted analyses to determine validity or reliability in this student population, our data provides some evidence for using this tool in first and second year students during their professional curricula.

There are a few notable limitations to our study. Since our pharmacy students were enrolled in a direct-entry, six-year program, our results may not be applicable to institutions with different Doctor of Pharmacy programs. Moreover, our results may not be applicable to institutions with different IPE curricula and different health professions; however, this is inherent to most studies evaluating IPE. Additionally, psychometric testing was not conducted to determine validity or reliability of the instrument in our first and second year student population. Finally, after this study was conducted, Zorek and colleagues refined the SPICE instrument, to SPICE 2, and demonstrated validity and reliability in a broader population of pharmacy and medical students. These authors now recommend using SPICE 2 for IPE assessments moving forward.[13]

Conclusion

In this study, no differences were identified in perceptions between students with one and two years of exposure to IPE. Although one may expect that students with an additional year of exposure to IPE may have higher perception scores, it is important to recognize that oftentimes baseline scores are high when IPE is introduced early into curricula. Maintaining the same level of agreement longitudinally may be a more appropriate goal in these situations rather than identifying

increases. Additionally, our results aligned with other literature suggesting that there are differences in perceptions among professions. Although differences between pharmacy and medical students were observed, the impact of these differences remains unclear at this time and requires further research and application of the SPICE instrument in other settings with other student populations.

References

1. Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. Health Aff (Millwood). 2008 May-Jun 2008;27(3):759-769.
2. National Center for Interprofessional Practice and Education: About the National Center. https://nexusipe.org/informing/about-national-center. Accessed September 30, 2016.
3. The Institute for Healthcare Improvement: Institute for Healthcare Improvement triple aim initiative. http://www.ihi.org/engage/initiatives/tripleaim/pages/default.aspx. Accessed September 30, 2016.
4. Interprofessional Education Collaborative Expert Panel: Core competencies for interprofessional collaborative practice: report of an expert panel. http://www.aacn.nche.edu/education-resources/ipecreport.pdf.
5. Canadian Interpforessional Health Collaborative. A national interprofessional competency framework. http://www.Cihc.Ca/files/cihc_ipcompetencies_feb1210.Pdf.
6. Accreditation Council for Pharmacy Education: Accreditation standards and key elements for the professional program in pharmacy leading to the doctor of pharmacy degree ("standards 2016"). https://www.acpe-accredit.org/pdf/Standards2016FINAL.pdf.
7. Liaison Committee for Medical Education: Functions and structure of a medical school. Standards for accreditation of medical education programs. http://lcme.org/publications/#Standards. Accessed September 30, 2016.
8. Nasca TJ, Philibert I, Brigham T, Flynn TC. The next GME accreditation system--rationale and benefits. N Engl J Med. Mar 2012;366(11):1051-1056.
9. Zorek J, Raehl C. Interprofessional education accreditation standards in the USA: a comparative analysis. J Interprof Care. 2013;27(2):123-130.
10. Fike DS, Zorek JA, MacLaughlin AA, Samiuddin M, Young RB, MacLaughlin EJ. Development and validation of the student perceptions of physician-pharmacist interprofessional clinical education (SPICE) instrument. Am J Pharm Educ. 2013 Nov 12;77(9):Article 190.
11. Zorek JA, MacLaughlin EJ, Fike DS, MacLaughlin AA, Samiuddin M, Young RB. Measuring changes in perception using the Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education (SPICE) instrument. BMC Med Educ. 2014;14:101.
12. Dominguez DG, Fike DS, MacLaughlin EJ, Zorek JA. A comparison of the validity of two instruments assessing health professional student perceptions of interprofessional education and practice. J Interprof Care. 2015;29(2):144-9.
13. Zorek JA, Fike DS, Eickhoff JC, Engle JA, MacLaughlin EJ, Dominguez DG, Seibert CS. Refinement and Validation of the Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education Instrument. Am J Pharm Educ. 2016; 80(3):Article 47.
14. Rotz ME, Dueñas GG, Zanoni A, Grover AB. Designing and evaluating an interprofessional experiential course series involving medical and pharmacy students. Am J Pharm Educ. 2016;80(5):Article 85.
15. Horsburgh M, Lamdin R, Williamson E. Multiprofessional learning: the attitudes of medical, nursing and pharmacy students to shared learning. Med Educ. Sep 2001;35(9):876-883.
16. Curran VR, Sharpe D, Flynn K, Button P. A longitudinal study of the effect of an interprofessional education curriculum on student satisfaction and attitudes towards interprofessional teamwork and education. J Interprof Care. 2010;24(1):41-52.
17. Seif G, Coker-Bolt P, Kraft S, Gonsalves W, Simpson K, Johnson E. The development of clinical reasoning and interprofessional behaviors: service-learning at a student-run free clinic. J Interprof Care. 2014;28(6):559-564.
18. Gunaldo TP, Andrieu SC, Garbee D, et al. Student perceptions about interprofessional education after an elective course. J Interprof Care. 2015;29(4):370-1.
19. Shrader S, Kern D, Zoller J, Blue A. Interprofessional teamwork skills as predictors of clinical outcomes in a simulated healthcare setting. J Allied Health. 2013;42(1):e1-6.
20. Rotz ME, Dueñas GG, Grover AB, Headly A, Parvanta CF. Exploring first-year pharmacy and medical students' experiences during a longitudinal interprofessional education program. Curr Pharm Teach Learn. 2015;7(3):302-311.
21. Hawk C, Buckwalter K, Byrd L, Cigelman S, Dorfman L, Ferguson K. Health professions students' perceptions of interprofessional relationships. Acad Med. 2002;77(4):354-357.

22. Pittenger AL, Westberg S, Rowan M, Schweiss S. An interprofessional diabetes experience to improve pharmacy and nursing students' competency in collaborative practice. Am J Pharm Educ;77(9):Article 197.
23. Vaughn LM, Cross B, Bossaer L, Flores EK, Moore J, Click I. Analysis of an interprofessional home visit assignment: student perceptions of team-based care, home visits, and medication-related problems. Fam Med. 2014;46(7):522-526.
24. Dow AW, DiazGranados D, Mazmanian PE, Retchin SM. An exploratory study of an assessment tool derived from the competencies of the interprofessional education collaborative. J Interprof Care. 2014;28(4):299-304.
25. Oates M, Davidson M. A critical appraisal of instruments to measure outcomes of interprofessional education. Med Educ.2015;49(4):386-398.
26. Coster S, Norman I, Murrells T, et al. Interprofessional attitudes amongst undergraduate students in the health professions: a longitudinal questionnaire survey. Int J Nurs Stud. 2008;45(11):1667-1681.
27. Van Winkle LJ, Fjortoft N, Hojat M. Validation of an instrument to measure pharmacy and medical students' attitudes toward physician-pharmacist collaboration. Am J Pharm Educ. 2011;75(9):Article 178.
28. Leipzig RM, Hyer K, Ek K, et al. Attitudes toward working on interdisciplinary healthcare teams: a comparison by discipline. J Am Geriatr Soc. 2002;50(6):1141-1148.
29. Fulmer T, Hyer K, Flaherty E, et al. Geriatric interdisciplinary team training program: evaluation results. J Aging Health. 2005;17(4):443-470.
30. Curran VR, Heath O, Kearney A, Button P. Evaluation of an interprofessional collaboration workshop for post-graduate residents, nursing and allied health professionals. J Interprof Care. 2010;24(3):315-318.
31. Braithwaite J, Westbrook M, Nugus P, et al. Continuing differences between health professions' attitudes: the saga of accomplishing systems-wide interprofessionalism. Int J Qual Health Care. 2013;25(1):8-15.
32. Waller W, Hill R. The family: a dynamic interpretation. New York, NY: Dryden Press. 1951.

Table 1. Student Demographics and Working Experience

	Overall	Professional Students		p-value[Ŧ]	Professional Year		p-value[Ŧ]
		Medical (N = 108)	Pharmacy (N = 46)		First (N = 85)	Second (N = 69)	
Gender							
Male	56 (36%)	45 (42%)	11 (24%)	***0.036***[*]	34 (40%)	22 (32%)	0.297[*]
Female	98 (64%)	63 (58%)	35 (76%)		51 (60%)	47 (68%)	
Highest Degree Earned							
High School	42 (27%)	0 (0%)	42 (91%)	***<0.001***[$]	24 (28%)	18 (26%)	0.448[$]
Bachelor's	87 (56%)	84 (78%)	3 (7%)		48 (57%)	39 (57%)	
Master's	22 (14%)	22 (20%)	0 (0%)		13 (15%)	9 (13%)	
Professional Degree (JD, MD)	3 (2%)	2 (2%)	1 (2%)		0 (0%)	3 (4%)	
Working experience							
Any working experience	107 (69%)	69 (64%)	38 (83%)	***0.020***[*]	63 (74%)	44 (64%)	0.165[*]
Healthcare experience	63 (41%)	29 (27%)	34 (74%)	***<0.001***[*]	38 (45%)	25 (36%)	0.287[*]
Research experience	30 (19%)	29 (27%)	1 (2%)	***<0.001***[*]	13 (15%)	17 (25%)	0.145[*]
Education experience	19 (12%)	16 (15%)	3 (7%)	0.152[*]	12 (14%)	7 (10%)	0.456[*]
Other experience	41 (27%)	31 (29%)	10 (22%)	0.370[*]	24 (28%)	17 (25%)	0.615[*]

[Ŧ] Statistically significant results (i.e. $p \leq 0.05$) appear in bold and italicized font.

[*] P-value calculated using Chi-square test. [$] P-value calculated using Cochran-Mantel-Haenszel test.

Table 2. Comparison of SPICE Item Scores[§]

No.	Survey item	Overall	Professional Students		p-value[₮]	Professional Year		p-value[₮]
			Medical (N = 109)	Pharmacy (N = 46)		First (N = 85)	Second (N = 70)	
1	Working with another discipline of students enhances my education	4 (4-5)	4 (4-4)	4 (4-5)	***0.003***	4 (4-5)	4 (3-5)	0.078
2	My role within the interdisciplinary team is clearly defined	4 (3-4)	4 (3-4)	3.5 (3-4)	0.681	4 (3-4)	4 (3-4)	0.827
3	Health outcomes are improved when patients are treated by a team of professionals from different disciplines	5 (4-5)	4 (4-5)	5 (4-5)	0.254	5 (4-5)	4 (4-5)	0.361
4	Patient satisfaction is improved when patients are treated by a team of professionals from different disciplines	4 (3-5)	4 (3-4)	4 (4-5)	***0.001***	4 (3-5)	4 (3-5)	0.969
5	Participating in educational experiences with another discipline of students enhances my future ability to work on an interdisciplinary team	4 (4-5)	4 (4-5)	5 (4-5)	***0.001***	5 (4-5)	4 (4-5)	0.035
6	All health professions students should be educated to establish collaborative relationships with members from other disciplines	4 (4-5)	4 (4-5)	5 (4-5)	0.089	5 (4-5)	4 (4-5)	0.135
7	I understand the roles of other professionals within the interdisciplinary team	4 (3-4)	4 (3-4)	4 (4-5)	0.034	4 (3-4)	4 (3-4)	0.966
8	Clinical practice experiences are the ideal place within their respective curricula for medical and pharmacy students to interact	4 (4-5)	4 (3-4)	4 (4-5)	0.053	4 (3-5)	4 (4-4)	0.981
9	Physicians and pharmacists should collaborate in teams	4 (4-5)	4 (4-5)	5 (4-5)	0.008	4 (4-5)	4 (4-5)	0.510
10	During their education, medical and pharmacy students should be involved in teamwork in order to understand their respective roles	4 (4-5)	4 (4-5)	5 (4-5)	0.015	4 (4-5)	4 (4-5)	0.181

SPICE = Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education

[§] Based on a 5-point Likert-type scale: 5=Strongly agree, 4=Agree, 3=Neutral, 2=Disagree and 1=Strongly disagree. Results are reported as Median (Interquartile Range).

[₮] P-values calculated using Wilcoxon rank sum test. A Bonferroni correction for multiple tests was performed and statistically significant results (i.e. $p \leq 0.005$) appear in bold and italicized font.

Table 3. Comparison of SPICE Factor Scores by Profession and Year in Program[§]

No.	SPICE factor (items included)	Overall	Professional Students		p-value[ŧ]	Professional Year		p-value[ŧ]
			Medical (N = 109)	Pharmacy (N = 46)		First (N = 85)	Second (N = 70)	
1	Interprofessional teamwork and team-based practice (1,5,6,8,9,10)	4.17 (3.83-4.83)	4 (3.83-4.67)	4.58 (4.00-4.83)	***0.001***	4.33 (4-4.67)	4 (3.67-4.83)	0.087
2	Roles/responsibilities for collaborative practice (2,7)	4 (3-4)	4 (3-4)	3.5 (3-4.5)	0.488	4 (3-4)	3.75 (3-4)	0.844
3	Patient outcomes from collaborative practice (3,4)	4 (3.5-4.5)	4 (3.5-4.5)	4.5 (4-5)	***0.005***	4 (3.5-4.5)	4 (3.5-4.5)	0.756

SPICE = Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education

[§] Based on a 5-point Likert-type scale: 5=Strongly agree, 4=Agree, 3=Neutral, 2=Disagree and 1=Strongly disagree. Results are reported as Median (Interquartile Range).

[ŧ] P-values calculated using Wilcoxon rank sum test. Statistically significant results (i.e. $p \leq 0.05$) appear in bold and italicized font.