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Perceptions of teamwork and interprofessional education in undergraduate pharmacy students

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Abstract

Background: Interprofessional education (IPE) is a mandatory component of accredited pharmacy programs in North America, yet little is known about pharmacy students' perceptions.

Objective: To survey pharmacy students and characterise their attitudes and interest toward IPE, and identify variables associated with positive perceptions of teamwork.

Methods: 88.9% of pharmacy students (n=311) in one Canadian university completed a survey consisting of the Readiness for Interprofessional Learning Scale (RIPLS) and additional questions assessing student's skills, knowledge, and interest in collaboration in September 2015. Descriptive and univariate statistics were calculated between demographic variables and survey scores to identify associations.

Results: Reported interest in future interprofessional collaborative training was 94.2%. Mean rank total RIPLS scores were significantly higher in females(p=0.000) and inversely correlated to year of pharmacy, declining by an average of 23 RIPLS points with each year (p=0.000).

Conclusion: Pharmacy students are interested in IPE, but their interest but declines with year of study.

Keywords: *Interprofessional Education, Teamwork, Pharmacy Students, Attitudes, Females, Gender*

Introduction

Interprofessional collaboration may be defined as the development of interprofessional relationships between health practitioners and students, patients, families, and communities, with the ultimate goal of achieving improved health outcomes (CIHC, 2010). Significant benefits have been attributed to interprofessional collaboration within the health care setting, including a reduction in medical errors (Leap *et al*., 1999; Kucukarslan *et al.*, 2003), improved patient satisfaction (Berglund et al., 2015), and achieving shared goals by embracing collaborative decision making (Haggerty *et al*., 2003).

Interprofessional education (IPE), the learning process when two or more professions work collaboratively in an academic or work-place setting to improve quality of care (CAIPE, 2015), is important for helping students to attain appropriate collaborative skills (CIHC, 2010). It has therefore been recommended that students learn interprofessional collaboration and teamwork skills at educational institutions and throughout their program of study (Buring *et al*., 2009). Previous studies have shown that students involved in IPE curricula were more confident in their interactions, professional relationships, and relevant skills compared to students not exposed to IPE during their educational program (Pollard *et al*., 2008; Wilhemsson *et al*., 2011). IPE events, such as workshops dedicated to interprofessional collaboration, have also been shown to improve student attitudes towards interprofessional collaboration and foster a better understanding of professional team roles (Van Winkle *et al*., 2012).

The Accreditation Council of Pharmacy Education (Accreditation Standards, 2015) and the Canadian Council for Accreditation of Pharmacy Programs (Accreditation Standards, 2014) have integrated IPE into educational outcomes to assist in preparing pharmacy students to effectively practice in health care teams. As a result, an educational model to support collaborative learning has become an essential component of all pharmacy programmes accredited in Canada and the United States (Accreditation Standards 2014; Accreditation Standards, 2015;).

In our institution (the University of Saskatchewan) there is a desire to increase IPE in the curricula of health science students. Characterising pharmacy students' knowledge, skills and interest in various IPE activities would be helpful to guide future initiatives within our college and the university. Even though IPE is a mandatory component of pharmacy programs in Canada and the United States, little is currently known about pharmacy student perceptions and attitudes towards interprofessional collaboration in general. Other studies have examined the perceptions of health science students

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and have included pharmacy students as a subset of the population. To our knowledge, however, no study has exclusively examined the perceptions of pharmacy students at various points throughout their pharmacy program. Characterising student beliefs may also provide guidance on how and when to best incorporate IPE activities into pharmacy curriculums. The purpose of this study was to establish a baseline understanding of undergraduate pharmacy student perspectives on IPE, and identify variables associated with positive perceptions of teamwork in this population.

Methods

A quantitative survey was created to examine students' receptiveness, interest and skills related to interprofessional collaboration. The instrument consisted of a modified version of the Readiness for Interprofessional Learning Scale (RIPLS) (Blight *et al*., 1999), questions to assess collaboration knowledge and interest in interprofessional collaboration training (Baerg *et al*., 2012), and demographic questions. The instrument was finalised by the research team, reviewed by two additional faculty members and then distributed to all four years of pharmacy students at the University of Saskatchewan. The paper survey was disseminated during the first two weeks of classes in September 2015. Data was purposefully collected at the beginning of each year to minimise contamination from IPE exposure and to capture student perspectives when they were 'fresh'. Pharmacy students at the University of Saskatchewan currently have very little exposure to IPE. The only formalised IPE activities occur in the form of interprofessional problem-based learning (iBPL) activities, which occur consistently throughout the program (one topic per year, each lasting two or three sessions, with the exception of third year which has an extra topic).

Students were provided with a brief description of the study, and it was administered during the first 15 minutes of class. Participation was optional and responses remained anonymous. Demographic variables collected included age, gender, year in pharmacy, year in university, previous degree, exposure to interprofessional collaboration in work/school, and exposure to interprofessional collaboration as patient/caregiver. The protocol for the study was reviewed by the Behavioural Research Ethics Board at the University of Saskatchewan. The study met the requirements for exemption status as per Article 2.5 of the Tri-Council Policy Statement (TCPS) (Canadian Institute of Health Research, 2010), since this study fell under the program evaluation category. Hence a full ethics board review was not deemed necessary.

The Readiness for Interprofessional Learning Scale

Receptiveness to IPE was assessed using the Readiness for Interprofessional Learning Scale (RIPLS). The original RIPLS questionnaire created by Parsell and Bligh (Blight *et al*., 1999) consists of 19-items measuring students' readiness for interprofessional education and open-mindedness to working with other professionals. The questionnaire was developed from a study of 120 students representing eight different professional groups and literature addressing social and psychological theories pertaining to adult learning for healthcare students. While the questionnaire was initially designed to evaluate interprofessional learning activities, it has since been adapted to better suit different situations, populations, and cultures (McFadyen *et al*., 2005; Reid *et al*., 2006; Van Lauffs *et al*., 2008) resulting in the availability of numerous modified versions. The RIPLS version used in this study was adapted by Latrobe Health Service and the Health & Social care Interprofessional Network (HSIN), Victoria - August 2009 (Appendix A). It is available online on the National Centre for International Practice and Education website (RIPLS, 2015), and was chosen since it matches most closely with Association of Facilities of Pharmacy of Canada (AFPC), CCAPP, and National Association of Pharmacy Regulatory Authorities (NAPRA) learning outcomes (Appendix B). The 19 items in this questionnaire are scored based on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). There are three sub-scales; team-work and collaboration, professional identity, and roles and responsibilities.

Assessment of Collaboration Knowledge and Interest in Interprofessional Collaboration Training

Additional questions were added to the survey to assess student perceptions of collaborative skills and knowledge, and to quantify student interest in specific IPE activities. These questions, which were adapted from a study by Baerg *et al*. (2012), assessed students' skills for building rapport, communicating effectively, management and leadership skills, as well as their knowledge of leaderships styles, team stages, and interprofessional collaboration models and research. Respondents rated their skill level as either 'not applicable', 'poor', 'satisfactory', 'good' or 'excellent', and their interest in future interprofessional collaboration training as either 'not interested', 'somewhat interested', or 'very interested'. Questions pertaining to interprofessional collaboration training assessed interest in learning more about interprofessional collaboration in general, and interest in more training opportunities (as one or two-day workshops, online modules, or three-credit university courses). A question to evaluate student interest in participating in small group sessions or interprofessional problem based learning (iPBL) was also added, since health science students at our institution currently are involved in this activity. Finally, an open-ended question was added to collect any additional comments regarding IPE, and the comments were reviewed to identify common themes.

Statistical Methods

Results were analysed using SPSS version 23® (IBM Corp., Armonk, NY, USA). The seven demographic

questions included in the survey were treated as independent variables (*e.g*. age, gender, year in pharmacy, year in university, previous degree, exposure to interprofessional collaboration in work/school, and exposure to interprofessional collaboration as patient/caregiver). RIPLS individual question scores, RIPLS total domain scores, self-assessment of skills, and evaluation pertaining to interest in collaboration and training were coded as a Likert-type response and treated as dependent variables. The RIPLS included three sub scales that were analyzed as separate domains; teamwork and collaboration (questions 1-9), professional identity (10-17), and roles and responsibilities (18-19). Prior to statistical analysis of the data, rescaling of questions 10-12 and 18 was required. These items were reverse coded as follows: (maximum score +1) - original score. Mean imputation (the replacement of a missing observation with the mean of the non-missing observations) was used to adjust for missing values.

The Mann Whitney-U test was used to calculate univariate relationships between the independent variables that included two ordinal groups and RIPLS scores (both at item level and domain level). Kruskal-Wallis test was used similarly for independent variables, which had more than two groups. Kendall's tau b correlation coefficient was used to calculate potential relationships between self-assessed knowledge and skills and interest in interprofessional collaboration training and participant demographics. *P*-values of less than 0.05 were considered statistically significant. Cronbach's alpha, developed to measure the internal constancy of either a statistical scale or test (Tavakol *et al*., 2011) was calculated on each of the three RIPLS domains and the overall RIPLS questionnaire.

Results

Of 350 pharmacy students in the program, 311 took part in the study resulting in a response rate of 88.9%. Two respondents failed to indicate gender, one failed to indicate year of pharmacy, and three respondents had missing values in the RIPLS and skills and interest questions. An overview of demographic information of participants in the study is presented in Table I. The response rate was highest in first year pharmacy students (n= 85, 94.4%), followed by fourth year (n= 80, 94.1%), third year (n= 81, 91.0%), and lastly second year students (n= 65, 75.6%).

Table I: Demographics of Pharmacy Student Responders

Responses	n (%)
Gender	
Male	72 (23.2%)
Female	237 (76.2%)
No response	2 (0.6%)
Age	
<19	18 (5.8%)
20 & 21	92 (29.6%)
22 & 23	103 (33.1%)
24 & 25	54 (17.4%)
>26	44 (14.1%)
Year in Pharmacy	
First	85 (27.3%)
Second	65 (20.9%)
Third	81 (26.0%)
Fourth	80 (25.7%)
Year in University	
2	20 (6.4%)
3	41 (13.2%)
4	56 (18%)
5	67 (21.5%)
6	62 (19.9%)
7	40 (12.9%)
8+	24 (7.7%)
Previous Degree	
Yes	86 (27.7%)
No	225 (72.3%)
Area of Degree (if yes to previous degree) (n=86)	
Biology[1]	41(47.7%)
General Science	5 (5.8%)
Kinesiology	3 (3.5%)
Physiology/Pharmacology	16 (18.6%)
Psychology	6 (7.0%)
Other[2]	15 (17.4%)
Previous extent of exposure to interprofessional collaboration through work/school	
Not at all	20 (6.4%)
Very little	72 (23.2%)
Somewhat	177 (56.9%)
To a great extent	42 (13.5%)
Previous extent of exposure to interprofessional collaboration as patient/caregiver	
Not at all	49 (15.8%)
Very little	139 (44.7%)
Somewhat	97 (31.2%)
To a great extent	26 (8.3%)

[1]Biology includes: General Biology, Biochemistry, Biopsychology, Anatomy/Cell Biology
[2]Other includes: Chemistry, Education, Microbiology

RIPLS Questionnaire

When assessing the internal consistency of a given instrument, acceptable values of Cronbach's alpha score range from 0.70-0.95, with higher scores indicating increased inter-relatedness (Bland *et al*., 1997; Tavakol *et al.*, 2011). Teamwork and collaboration (domain 1) reported the highest Cronbach's alpha score of 0.858, while professional identity (domain 2) and roles and responsibilities (domain 3) showed Cronbach's alpha values of 0.583 and -0.381, respectively. A low Cronbach's alpha indicates that the scale does not have adequate internal consistency that results from this domain may not be reliable. The alpha value of domain 2 significantly improved to 0.826 when removing question 13. The overall RIPLS questionnaire reported high internal consistency with an alpha value of 0.722, improving to 0.868 when item 13 was removed. Since

eliminating question 13 improved the internal consistency considerably, the analysis was performed with and without the exclusion of item 13. Including or removing this item, however, did not significantly impact the results.

The overall mean rank RIPLS score was significantly higher for females (164.52) compared to males (121.06) (p<0.005). Gender was also significantly associated with mean rank scores in domains 1 (p<0.005) and 2 (p=0.014), with females indicating more positive perceptions in the categories of teamwork and collaboration, and roles and responsibilities, respectively. Year of pharmacy was significantly associated with overall RIPLS score (p<0.005), domain 1 (p<0.005) and domain 2 (p=0.014), with total mean rank RIPLS scores of 191.76, 170.53, 139.10, and 121.92 for first through fourth year, respectively. Table II summaries the results of the RIPLS score according to gender and year of pharmacy at both domain and item level. Of the 19 items, 10 showed statistical significance with respect to gender (p<0.005 to p=0.027), while 16 were significant with respect to year in pharmacy (p<0.005 to p=0.025). Figure 1 illustrates the inverse relationship between the overall RIPLS mean rank score and year of pharmacy. All other demographic variables (age, year in university, previous degree, exposure to interprofessional collaboration in work/school, and exposure to interprofessional collaboration as a patient/caregiver) were not significant in the analysis.

Assessment of Collaboration Knowledge and Skills, and Interest in Interprofessional Collaboration Training

For self-assessment of knowledge and skills, students rated their skills (for building rapport, communicating effectively, leadership and managing conflict), slightly higher than their knowledge (of leadership styles, team stages, and interprofessional collaboration models and research). Students rated their knowledge of interprofessional collaboration models lowest (mean 2.96±0.80), and skills for communicating effectively the highest (3.86±0.68). Table 3 shows the seven items relating to student's' self-assessment of their knowledge and skills regarding collaboration.

Interest in interprofessional collaboration was high, with 94.2% of students expressing interest (either somewhat or

Table II: Univariate Associations Between the Variables Gender and Year of Pharmacy and Items in RIPLS

	Gender			**Year of pharmacy**				
	Female (n=237)	Male (n=72)		Year 1	Year 2	Year 3	Year 4	
	Mean rank	Mean rank	*p*	Mean Rank	Mean Rank	Mean rank	Mean rank	*p*
Teamwork and Collaboration	165.41	118.10	**0.000**	186.18	174.47	142.23	121.30	**0.000**
Q1	161.79	130.18	**0.003**	199.04	165.85	137.60	119.49	**0.001**
Q2	160.13	135.72	**0.013**	169.23	176.20	142.28	137.65	**0.001**
Q3	159.01	139.44	0.066	183.64	162.47	147.28	128.47	**0.000**
Q4	157.61	144.13	0.209	167.38	175.16	144.91	137.78	**0.011**
Q5	161.65	130.62	**0.002**	165.67	168.85	149.96	139.58	0.053
Q6	160.92	133.08	**0.011**	175.67	157.53	152.97	135.23	**0.018**
Q7	165.16	118.92	**0.000**	178.95	170.43	142.86	131.55	**0.000**
Q8	161.49	131.72	**0.005**	170.26	169.05	150.77	133.79	**0.012**
Q9	161.96	129.61	**0.001**	158.66	159.97	148.61	155.53	0.776
Professional Identity	161.31	131.75	**0.014**	194.43	166.79	137.65	123.51	**0.014**
Q10	159.91	136.43	**0.027**	182.10	170.78	142.33	128.49	**0.000**
Q11	158.60	140.82	0.096	171.89	164.80	149.40	136.91	**0.025**
Q12	158.75	140.32	0.083	169.57	172.27	150.20	132.47	**0.005**
Q13	161.46	131.27	**0.005**	179.53	159.59	144.97	137.61	**0.004**
Q14	158.24	142.03	0.147	195.73	157.98	134.26	132.75	**0.000**
Q15	159.30	138.46	0.055	173.88	163.58	146.30	138.96	**0.024**
Q16	157.99	142.85	0.159	177.92	167.43	147.45	130.42	**0.001**
Q17	161.25	131.98	**0.006**	188.23	169.57	133.09	132.39	**0.000**
Roles and Responsibilities	154.01	156.13	0.854	148.60	151.28	160.90	160.71	0.854
Q18	156.07	149.25	0.528	142.32	140.65	154.91	182.01	**0.004**
Q19	152.03	162.73	0.344	163.53	158.66	163.81	136.08	0.117

Statistically significant p-values (p<0.05) are bolded.

very interested) in future interprofessional collaboration training. Students were most interested in a one-day workshop (88.8% somewhat or very interested) and least interested in an online module (63.3% somewhat or very interested). Table III displays the distribution of student responses to six questions regarding interest in interprofessional collaboration training.

Table III: Self-assessment of Collaboration Knowledge and Skills

Personal rating	N	Mean rating
Skills level for building rapport	306	3.67
Skill levels for communicating effectively	310	3.86
Skills level for leadership skills	310	3.57
Skill level for managing conflict	310	3.6
Knowledge of leadership styles	310	3.45
Knowledge of team stages	301	3.03
Knowledge of interprofessional collaboration models and research	306	2.96

The above items had the following options for response: poor (2), satisfactory (3), good (4), and excellent (5). Students who selected not applicable were excluded from analysis.

Kendall's tau-b coefficients were calculated to explore the relationship of student self-assessed knowledge, skills, and interest in IPE and future training to student demographics. No correlation was noted between any demographic variables to knowledge and skill. With respect to interest in interprofessional collaboration training, a negative association was noted between year of pharmacy and most activities, including learning more about IPE, a one-day or two-day workshop and working in small group sessions or iPBLs. Kendall's tau-b coefficients ranged from -0.12 to -0.17 ($p<0.05$). A positive association, however, was noted between year of pharmacy and interest in a training opportunity such as a web-based (online) module on interprofessional collaboration (Kendall's tau-b coefficient = 0.12, $p=0.02$). Figure 2 illustrates the trends in interest in the specific activities according to year of pharmacy.

Additional Comments

The option for additional comments was provided at the end of the survey; 36 students (11.6%) provided additional comments about IPE and the survey itself. A common theme among respondents was the recognition of the importance and value of interprofessional collaboration and IPE. Most students, however, expressed concern about how IPE is currently implemented. Criticisms included the lack of time in the current pharmacy schedule, the challenges which occur when students at various levels of training are placed within the same interprofessional training group, and disrespect displayed by students towards students from other disciplines.

Figure 1: Mean Ranks for RIPLS overall total score, and for domains 1 and 2, based on student responses

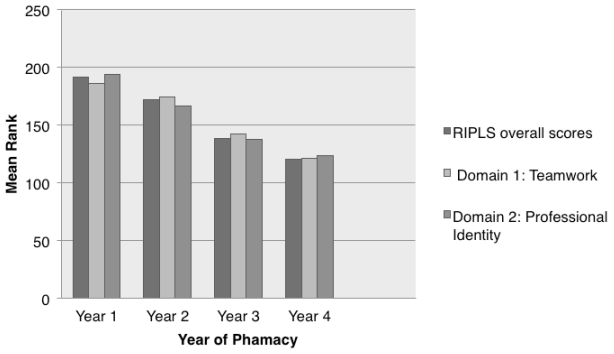
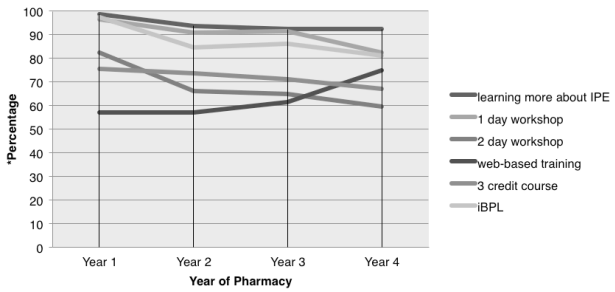


Table IV: Interest in interprofessional collaboration training

Personal interest in interprofessional collaboration training	Not interested (%)	Somewhat interested (%)	Very interested (%)
Learning more about interprofessional collaboration (n=310)	18 (5.8%)	187 (60.3%)	105 (33.9%)
A training opportunity such as a 1-day workshop on interprofessional collaboration (n=310)	32 (10.3%)	167 (53.9%)	110 (35.5%)
A training opportunity such as a 2-day workshop on interprofessional collaboration (n=310)	102 (32.9%)	153 (49.4%)	55 (17.7%)
A training opportunity such as Web-based (online) module on interprofessional collaboration (n=308)	113 (36.7%)	131 (42.5%)	64 (20.8%)
A training opportunity such as 3 credit (1 semester) university course in interprofessional collaboration (n=310)	87 (28.1%)	156 (50.3%)	67 (21.6%)
Working in small group sessions or participating in iPBL (n=308)	39 (12.7%)	188 (61.0%)	81 (26.3%)

The above items had the following options for responses: not interested (0), somewhat interested (1), and very interested (2). iPBL= interprofessional problem based learning; the totals vary due to missing data (n=the number of students who responded to the question)

Figure 2: Illustrates the percentage of students in each respective year that were 'interested' or 'very interested' in each IPE-based activity.



Discussion

The purpose of the study was to characterise pharmacy students' attitudes towards IPE and to identify variables associated with positive perceptions of teamwork. Overall, the survey results were very positive, with pharmacy students expressing interest in IPE activities and exhibiting positive attitudes towards teamwork. Previous research has also noted favourable attitudes towards IPE in health science students (Reynolds, 2003; Tunstall-Pedoe *et al*., 2003; Curran *et al*., 2008). In a study by Curran and colleagues (Curran *et al*., 2008) pharmacy, nursing and social work students all expressed overall positive responses, with pharmacy and social work students showing an increased positivity compared to medical and nursing students.

While student attitudes were overall positive, some significant differences were noted between the subgroups of gender and year of pharmacy. With respect to gender, overall mean rank RIPLS scores, as well as mean rank scores in domains 1 and 2 were higher in females compared to their male counterparts. In a Swedish study by Wilhelmsson, the RIPLS was used to investigate attitudes towards teamwork in nursing and health science students (n=670). After multivariate analysis, females (p=0.001), nursing students (p<0.001), as well as students earlier in their program (0.026) expressed more positive attitudes to teamwork (Wilhemsson *et al*., 2011). The authors speculate that healthcare has historically been a hierarchal system dominated by males where females were given little authority and influence on their working conditions. With practices transitioning to a larger focus on patient-centred care and teamwork, women appear to be more willing to adapt (Wilhemsson *et al*., 2011).

Another study of nursing and medicine students of two universities (n=261) investigated student perceptions using the Jefferson Scale of Attitudes toward Physician-Nurse Collaboration. This study identified a small but statistically significant difference in attitudes towards collaboration, with median scores of 51 for females, and 49 for the male students (p=0.0017) (Hansson *et al*., 2010). In contrast to our results, however, final year students expressed slightly more positive attitudes toward collaboration than students in their first year. A qualitative study comparing male and female opinions of iPBL found that women had more trust in the quality of information presented by other students, and reported more pleasant experiences when working with other students from another professional program (Reynolds, 2003). Both trust and enjoyment are key elements of effective teamwork, which perhaps may contribute to positive perceptions of IPE in females.

Perhaps the most significant finding of this study is that the student's appreciation for teamwork declined fairly consistently over the four years of pharmacy school. The RIPLS mean rank scores were highest in the first year and subsequently decreased by an average of 23 points each year. To our knowledge this is the first study that has examined baseline attitudes across the various years of study in a pharmacy program. The finding that interest in IPE activities waned over time is of value. It addresses the continued debate regarding when is the most appropriate time to implement interprofessional initiatives, and it highlights the need for future study in this area. Our results would suggest that it would be prudent to implement IPE early on in the curriculum, as pharmacy students are more receptive to team-based work at the beginning of their professional degree.

Consistent with our findings, other research has shown that attitudes towards IPE are highest in the first year, but wane over time (Pollard *et al*., 2004; Curran *et al*., 2008; Williams *et al*., 2015). Pollard and colleagues examined attitudes towards IPE in a variety of health related programs, including nursing, midwifery, physiotherapy, occupational therapy and social work students (n=581) (Pollard *et al*., 2004). In this three-year longitudinal study attitudes were most positive in the first year, but student responses over time indicated that they lost confidence in their communication and teamwork skills in their second year, but regained it as they neared qualification. Similarly in an Australian cohort of nursing and paramedic students (n=1264), mean RIPLS scores were higher in first year students compared to students in years two or three of the program (Williams *et al*., 2015).

Interestingly, in the present study no significant differences were noted between the students perceived skills and knowledge with respect to gender and year of pharmacy. In fact, in some cases first year students perceived their skills to be higher compared to 4th year students, although this was not significant in the analysis. Hence, we can rule out the possibility that students in higher years of study become less interested in IPE activities as they perceive their knowledge and skills to improve.

Interest in all IPE activities significantly declined with year of study, with the exception of an online module, which significantly increased with year of pharmacy. This leads us to hypothesise that lack of time and other course commitments may affect pharmacy student's interest and perceptions of IPE. As the program becomes progressively more challenging and course load becomes heavier, perhaps interest diminishes since students feel they do not have adequate time to prepare or contribute.

An online module may seem less appealing to an enthusiastic first year student, but more appealing to a busy fourth year student - particularly since a specific grade is not currently awarded for student involvement in IPE in our college. Corroborating this hypothesis were several student comments that expressed interest in IPE but also concern about lack of time and lack of academic credit for participation.

The rest of the open-ended student feedback from the questionnaire also followed a similar theme. Students communicated support for IPE, but highlighted flaws with the current process. Some suggested working with real patients for cases to develop collaborative skills, rather than the paper cases currently used. Very few pharmacy students commented on the lack of benefit however. Moving forward, we suggest that student feedback should be used to adapt training formats to improve student engagement. It should also be noted that only 11% of the cohort provided additional comments. A more in depth qualitative analysis would be helpful to guide future IPE initiatives.

A number of study limitations deserve consideration. First, it should be noted that using an assessment tool such as the RIPLS to measure perceptions of teamwork is subjective and does not measure objective outcomes, such behaviour or improved interprofessional collaboration. Further, additional confounding factors could influence a student's attitudes and beliefs toward teamwork, such as personality, religious background, and cultural beliefs, which were not measured in this study. The tool used to assess perceptions of teamwork in this study was chosen because it best aligned with our curriculum's educational outcomes. The original version of the RIPLS was inappropriate for our pharmacy students due to the wording of some questions (For instance, question 19 stated 'the function of nurses and therapists is mainly to provide support for doctors'.) Hence, we opted to use a modified version of RIPLS that has not been validated. To characterise the internal consistency of the modified RIPLS, we calculated Cronbach's alpha and discovered poor consistency within domain 3. Inconsistent results have been generated from factor analysis of the RIPLS, particularly with the last domain, which is one reason why previous researchers have attempted to modify the scale (McFadyen *et al*., 2005).

IPE exposure within the curriculum may influence student perceptions, and will inevitably vary between institutions, limiting the generalisability of these findings. Fortunately the formalised IPE activities in this institution were minimal and consistent throughout the program making this an ideal site to perform a baseline analysis on pharmacy student perspectives. An additional data collection time was considered at the end of the forth year, immediately prior to licensure. Students in the final year of the program, however, spend a large proportion of their time on Structured Practice Experiential Program (SPEP) placements. Currently no formalised process exists for incorporating IPE into these placements, and exposure to team collaboration varies immensely between students. Since we could not control for the impact of IPE exposure during this time, for the purpose of this baseline analysis, data collection was performed at the beginning of the year for all students. Future studies should examine the potential impact of IPE exposure during SPEPs on pharmacy student perspectives, as well as whether or not place of employment or further education can impact attitudes. This study showed that student's appreciation for teamwork declined during the pharmacy program. While caution should be taken when extrapolating the results from a single centre study, we are encouraged that studies in other institutions (and countries) have noted a similar trend in health science students.

With respect to demographics, there was an uneven gender distribution among the respondents, with fewer male respondents compared to females (nearly 1:4). Enrolment in the pharmacy program at the University of Saskatchewan is predominately female, however, which is reflective of the actual ratio of health care and social assistance employees in Canada, where it is one male for every five females (Government of Canada, 2015), and more specifically, as of 2011, over half (59.7%) of pharmacists in Canada were female (CIHI, 2001).

Despite the limitations, the strengths of this study include the large representation of students in all years in the same professional program. The study achieved a high response rate with nearly 90% of participants completing the questionnaire, and the students had minimal and consistent exposure to IPE throughout the study. The finding that interest in IPE activities declined with year of study is significant, and may be of value for pharmacy programs striving to increase IPE in student-receptive ways.

Conclusion

The benefits of interprofessional collaboration have been widely established, hence, it is encouraging that pharmacy students have positive perceptions towards IPE and are interested in further training in this area. Student attitudes towards interprofessional teamwork are most positive early on in the pharmacy program, supporting early implementation of IPE activities. The development of new IPE initiatives should be tailored to student feedback with the aim of maintaining engagement in IPE throughout all years of study. Future program evaluation should be undertaken to evaluate the effectiveness of IPE activities and to determine whether student attitudes towards IPE change over time.

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Appendices

Appendix A: The 19 Items and Three Factors on the Readiness for Interprofessional Learning Scale (RIPLS)[1]

Domain 1: Teamwork and Collaboration

Q1. Learning with other students/professionals will help me become a more effective member of a health and social care team.

Q2. Patients would ultimately benefit if health and social care students/professionals worked together.

Q3. Shared learning with other health and social care students will increase my ability to understand clinical problems.

Q4. Communication skills should be learned with other health and social care students/professionals.

Q5. Team-working skills are vital for all health and social care students/professionals to learn.

Q6. Shared learning will help me to understand my own professional limitations.

Q7. Learning between health and social care students before qualification and for professionals after qualification would improve working relationships after qualification/collaboration practice.

Q8. Shared learning will help me think positively about other health and social care professionals.

Q9. For small-group learning to work, students/professionals need to respect and trust each other.

Domain 2: Professional Identity

Q10. I don't want to waste time learning with other health and social care students/professionals.

Q11. It is not necessary for undergraduate/postgraduate health and social care students/professionals to learn together.

Q12. Clinical problem solving can only be learnt effectively with students/professionals from my own school/organisation.

Q13. Shared learning with other health and social care professionals will help me to communicate better with patients and other professionals.

Q14. I would welcome the opportunity to work on small group project with other health and social care students/professionals.

Q15. I would welcome the opportunity to share some generic lectures, tutorials, or workshops with other health and social care students/professionals.

Q16. Shared learning and practice will help me clarify the nature of patients' or clients' problems.

Q17. Shared learning before and after qualification will help me become a better team worker.

Domain 3: Role and Responsibilities

Q18. I am not sure what my professional role will be/is.

Q19. I have to acquire much more knowledge and skill than other students/professionals in my own faculty/organisation.

[1] The RIPLS version used in this study was adapted by Latrobe Health Service and the Health & Socialcare Interprofessional Network (HSIN)

Appendix B: Interprofessional Education Survey Competency Map

AFPC	RIPL Survey	CIHC (AIHPE)	CCAP	NAPRA
Communicator As Communicators pharmacy graduates communicate with diverse audiences, using a variety of strategies that take into account the situation, intended outcomes of the communication and the target audience.				
2.1. Communicate non-verbally and verbally with others. *2.1.1. use active listening skills and respond appropriately;* *2.1.2. exhibit empathy, tact and respect in their dealings with others;* *2.1.3. demonstrate sensitivity, respect and empathy in intercultural and inter-professional situations;* *2.1.4. when speaking, use organized processes and appropriate, precise expressions and vocabulary;* *2.1.5. tailor the content of their communication to specific contexts and audiences, and:* *2.1.6 adapt their communication techniques to facilitate efficient and effective clinical encounters.*	4	Interprofessional Communication		2.18, 2.19, 2.20, 4.1, 4.5
Collaborator As Collaborators pharmacy graduates work collaboratively with teams to provide effective, quality health care and to fulfill their professional obligations to the community and society at large.				
3.1. Function as members of teams. *3.1.1 accept leadership roles where appropriate;* *3.1.2 actively make their expertise available to others and willingly agree to share relevant information, using language that can be understood by all;* *3.1.3 clarify roles, responsibilities and expertise of team members, identifying overlaps and gaps;* *3.1.4 recognize and respect the roles, responsibilities and competence of other professionals;* *3.1.5 make their points of view known, listen to and respect the opinions of others, defend points of view if necessary;* *3.1.6 contribute to planning, organizing and performing of work to be done, and integrating evidence while evaluating the results;* *3.1.7 respect the rules established by the group;* *3.1.8 help maintain a healthy work environment and assist with conflict management, and:* *3.1.9 support continued efforts of the group by providing positive feedback, including evidence of progress and impact.*	*1, 5, 17, 18*	Team Functioning Interprofessional Conflict Resolution	E. 32:1-3	2.1, 2.3, 2.5, 2.8, 2.9, 2.18, 2.19, 4.1,
3.2 Support team-based care in a community setting with geographically distinct centres of care. *3.2.1 develop and maintain collaborative relationships with a network of local health care professionals and care providers;* *3.2.2 clarify pharmacist's roles and responsibilities that are acceptable / appropriate;* *3.2.3 fulfill commitments for provision and follow-up of care;* *3.2.4 adapt their roles in teams and networks of care to the circumstances and requirements, and;* *3.2.5 participate in local health initiatives as requested and appropriate.*	*13, 14, 15, 17, 18*	Role clarification	E. 32:1-3	
3.3 Work collaboratively with the patient and his/her health care professionals to provide care and services that facilitate management of the patient's health needs. *3.3.1 negotiate the care and services that the pharmacist and other members of the health care team will provide as consistent with laws / regulations relevant to collaborative care;* *3.3.2 ensure attainment and maintenance of training / certification / credentials required to provide collaborative care or to fulfill medical directives / delegation;* *3.3.3 ensure legality of collaborative practice agreements / medical directives / delegation agreements;* *3.3.4 plan the provision of care in a coordinated fashion;* *3.3.5 provide agreed upon care and services;* *3.3.6 document the provision of care and services, and:* *3.3.7 communicate and review the care / services provided and patient status / outcome.*	*3, 4, 7, 13, 16*	Interprofessional Communciation	E. 32:1-3	2.18, 2.19, 2.20, 2.21, 4.4, 4.11
Advocate As Advocates pharmacy graduates use their expertise and influence to advance the health and wellbeing of individual patients, communities, and populations, and to support pharmacist's professional roles.				

5.2 Promote the health of individual patients, communities, and populations *5.2.1 facilitate patient's interaction with the health care system through advice, education and/or guidance;* *5.2.2 support patient's access to required health services by representing or speaking on behalf of patients ;* *5.2.3 represent patient's interests through participation in policy and procedure development within health systems;* *5.2.4 participate in health promotion activities, public health campaigns and patient safety initiatives that are directed at disease prevention, risk factor reduction and/or harm minimization;* *5.2.5 undertake relevant public health screening processes for early disease detection, and; 5.2.6 plan and implement public health promotion education and awareness raising campaigns with other health professionals.*	*2, 18, 19*	Patient Centred Care		2.6, 4.7, 4.8, 4.9, 4.10
Professionals As Professionals pharmacy graduates honour their roles as self-regulated professionals through both individual patient care and fulfillment of their professional obligations to the profession, the community and society at large.				
7.3 Maintain their competence to practice through life-long learning. *7.3.1 adhere to regulatory requirements for maintenance of competence as consistent with the self-regulating status of a health professional;* *7.3.2 evaluate their practice to identify areas for continuing professional development;* *7.3.3 acknowledge and reflect on errors, omissions and close calls to identify limitations in competence / performance;* *7.3.4 seek and accept feedback to identify limitations or strengths in competence / performance;* *7.3.5 recognize their limits of competence and seek assistance;* *7.3.6 plan and undertake learning activities to support maintenance of competence and professional development;* *7.3.7 incorporate learning into their practice;* *7.3.8 assess the impact of learning on competence and practice performance, and:* *7.3.9 document their maintenance of competence.*	*1, 7, 9, 13, 14, 15,*			2.1, 2.7, 2.8,
7.4 Practice in manner demonstrating professional accountability. *7.4.1 comply with the legal and regulatory requirements of practice;* *7.4.2 respect and fulfill professional standards of practice;* *7.4.3 be accessible to patients and other health care professionals;* *7.4.4 fulfill their professional tasks and commitments to patients in a diligent, timely, reliable, respectful manner;* *7.4.5 accept responsibility for their decisions and recommendations with patients and colleagues;* *7.4.6 use health care resources appropriately, including human and financial resources;* *7.4.7 maintain a professional image, using appropriate language and demeanour;* *7.4.8 maintain their professional composure even in difficult situations, and:* *7.4.9 maintain appropriate professional boundaries.* *7.5 Display a sense of pride in and commitment to the profession and its evolving role in the health care system.* *7.5.1 participate in peer review and quality assurance processes;* *7.5.2 participate in education of future pharmacists by making practice-based learning opportunities available as a mentor / preceptor;* *7.5.3 adapt their practice to provide all professional services required according to pharmacist's scope of practice;* *7.5.4 support the professional organizations in their efforts to advance the professional role of pharmacists, and:* *7.5.5 contribute to the planning for implementation of change including strategies to identify and overcome barriers, and to capitalize on facilitators.*	*2, 6, 18,*	*Interprofessional Communication*		2.4, 4.2, 4.3, 4.6,