

Implementation of a Problem Based Interprofessional Learning (PBIL) activity: A pilot study

Axel Rodríguez Rosa^{1,*}, Rosalyn Ortiz Manso¹, Isabel Rodríguez Candelario¹, Alejandro Veintidós Feliú, MPH², Ivonne Baerga Delgado, MPH², Evy Monge Ortiz, MD, MPH², Sandra Chinapen Barletta, PhD³, Yaritza D'Áz Algorri, MS, DrPH⁴

¹Fourth year medical student at San Juan Bautista School of Medicine, Caguas, PR

²Graduate from the Master's in Public Health program at San Juan Bautista School of Medicine, Caguas, PR

³Department of Bio medical Sciences, San Juan Bautista School of Medicine, Caguas, PR

⁴Associate Dean of Graduate Programs, San Juan Bautista School of Medicine, Caguas, PR

How to cite this paper: Rodríguez Rosa, A. et al. (2018) Implementation of a Problem Based Interprofessional Learning (PBIL) activity: A pilot study. *International Journal of Clinical and Experimental Medicine Research*, 2(5), 57-83.

DOI: 10.26855/ijcemr.2018.05.001

*Corresponding to: Axel Rodríguez Rosa, Fourth year medical student at San Juan Bautista School of Medicine, Caguas, PR
Email: arodriguezrosa@sanjuanbautista.edu

Abstract

Health care education is an ever changing subject, much like the science it's based upon. To ensure that students receiving this education continue to understand the roles, responsibilities, and importance of other health-related professions, a peer-based integrative model for learning is essential in the education curriculum. The development of a Problem Based Interprofessional Learning activity addresses the void in working in a multidisciplinary and team-based patient care environment that currently exists in the medical education. For development of this model, students from the medicine, public health and nursing programs were distributed in multiple multidisciplinary groups. Each group was assigned to analyze a clinical case and openly discuss and develop a patient-care plan through a team-based, multidisciplinary discussion. Before and after this session, the participants were required to complete pre- and a post-assessment. After a discussion session, an expert panel was brought to discuss adequate management of the case. Results showed that, in general, students were impacted after the activity in terms of familiarity with the aspect of working as part of an interprofessional team ($p = 0.0001$; $r = 0.47$) and in the aspect of training as part of the same team ($p < 0.0001$; $r = 0.62$) and an overall enthusiasm for the activity ($p < 0.0001$; $r = 0.52$). Students recognized the potential benefits of the activity for improved patient care. This activity provided the initial pillar to further develop a more integrative and collaborative patient care training method. Implementation of this activity to modern educational curriculum would allow students to more easily engage in and understand the impact of a multidisciplinary, team-based approach to patient care.

Keywords

interprofessional, curriculum, professional education, integrative education, medicine, public health, nursing.

1. Introduction

Health care education is an ever changing subject, just like the science it's based upon. Academic institutions need to keep up with this evolving field and provide its students with the appropriate tools and environment that will help them achieve their full potential [1]. Problem Based Learning (PBL) is a case study dynamic that has been successfully im-

plemented in health care education curriculums in recent years, but the number of staffed professors needed to implement this activity is overwhelming; and, it does not address the void in interprofessional training that exists in health care education curriculums [1]. According to the World Health Organization, interdisciplinary collaborative practice helps strengthen patient management; therefore emphasizing interprofessional activities for healthcare students provides the opportunity to have early interprofessional interactions which will help them understand the need for interprofessional skills and the role each professional plays in the clinical setting [2]. San Jua Bautista School of Medicine (SJBSOM) offers an interprofessional environment where students from all three programs participate in the community service setting. However, this pilot study attempts to incorporate interprofessional participation in a more standardized environment. This approach provides a more efficient and effective way to engage in patient management through a multidisciplinary, team-based approach at SJBSOM; with it comes the importance of exchanging knowledge among nursing, public health and medicine students in order to gather information on behalf of the patients' well-being.

Training students in a multicenter environment facilitates a clinical mindset that provides them with a more thorough understanding of the importance of social determinants and how they influence patient's management [3, 4]. Curriculum activities that promote interprofessional learning and development are needed to forge cooperative future health caregivers that are prepared to unwind in a hospital setting. Thus, the proposed hypothesis and purpose of this study is that by having students participate in a Problem Based Interprofessional Learning (PBIL) activity will improve their perception and attitude towards inter-professional communication as well as in the areas of self-efficacy and motivation during an inter-professional engagement.

2. Methodology

A PBL case study was conducted with an interprofessional team of students, composed of medical students, nursing students and public health students during a four hour activity. The strategy aimed at promoting the integration of basic and clinical science and invoking the students to interact, rely and understand each other's roles and responsibilities when evaluating a clinical case.

A. Study Design (PBIL)

The event lasted two and a half hours and had a multiple group format, all groups being experimental PBIL pilot groups, and every student completing a Pre-Assessment and Post-Assessment questionnaire. To begin, the Pre-Assessment questionnaire was completed by all participants simultaneously in a controlled setting auditorium. Following general instructions, the experimental PBIL pilot groups were created. The quantity of groups formed was determined by the number of attendees from each program, allowing for each group to have a minimum of one member of each program. Groups were formed by randomly assigning a student from each program, until all students from every program was sorted equally between groups. Next, the groups were situated in separate controlled setting study rooms, proctored by a trained mentor that explained all the guidelines for the activity.

All groups were presented with the same case study and required to complete specific goals of encounter. The case study selected was one that would allow engagement of all the participating programs and each student would have a pivotal role in the correct management of the case. The goals of this PBIL encounter were setting the platform for the interaction of the students by having them propose and discuss the correct management of the case study. Each group had one hour to complete the task. After every group completed their task, all groups were merged at the initial auditorium. The Post-Assessment questionnaire was then simultaneously completed by all participating students in the same controlled setting. To conclude the didactic activity an expert in the presented case study discussed the proper strategy for patient intervention. By exposing the students to this dynamic, it is understood that the students were able to identify, understand, and

develop the necessary communication, analytical and, team-oriented tools that will aid them to efficiently and accurately acquire the vital pieces of information. In conjunction, students will progressively learn to integrate themselves with each other for a more swift and precise patient management, diagnosis, treatment, and preventive strategy development.

To measure the relevant student characteristics of the PBIL, the following questionnaires from Brock et al [4] was used before and after the activity, respectively: 1) Pre-Assessment: Interprofessional Team Simulation Training and 2) Post-Assessment: Interprofessional Team Simulation Training. Permission from the author for their use in our study was obtained before the activity date. A brief description of both assessments is included in the appendix. Because these questionnaires contained items that were too specific from the original author's paper and its setting, both were modified with careful consideration on what items are relevant to our study as well as to our study design. In addition, they were translated into Spanish through a certified translator for the purposes of being inclusive for Spanish-speaking participants in the activity, which was the majority. English questionnaires were still available for those not proficient in Spanish. All these modifications were consulted with and approved by the author of the paper. A more detailed explanation of their description and subscales is included in table 1. Modified Pre-Assessment and Post-Assessment questionnaires in the English language are available in Appendix A and B, respectively.

Table 1. Description of Modified Questionnaires and Subscales

<i>Description</i>	<i>Subscales</i>
<p>Pre-Assessment: Problem Based Interprofessional Activity</p> <p>A 43-item questionnaire that uses a five-point Likert scale for the most part (the exception being the subscale Essential Practice Characteristics, which is a three-point Likert scale) in order to evaluate perception, attitudes, motivation and self-efficacy <u>prior to the start of the activity</u>. Additional variables such as sociodemographic characteristics and expectations are also collected through this questionnaire. Subscales Leadership and Situation Monitoring were eliminated due to incompatibility with the activity.</p>	<ol style="list-style-type: none"> 1. Familiarity working and training 2. Interprofessional Training 3. Benefits of Training 4. Learning and Performance 5. Learning Environments 6. Skills 7. Team Structure 8. Mutual Support 9. Communication 10. Essential Practice Characteristics
<p>Post-Assessment: Problem Based Interprofessional Activity</p> <p>A 49-item questionnaire that uses a five-point Likert scale for most part (the exceptions being the subscales Interprofessional Training Experience and Essential Practice Characteristics, which respectively use a six-point and a three point Likert scale) in order to evaluate perception, attitudes, motivation and self-efficacy <u>in the end of the activity</u>. Additional variables such as sociodemographic characteristics and expectations are also collected through this questionnaire. Subscales Leadership, Situation Monitoring, and Before and After were eliminated due to incompatibility with activity.</p>	<ol style="list-style-type: none"> 1. Familiarity working and training 2. Interprofessional Training 3. Benefits of Training 4. Learning and Performance 5. Learning Environments 6. Skills 7. Team Structure 8. Mutual Support 9. Communication 10. Essential Practice Characteristic 11. Interprofessional Training Experience

B. Study Population

The study population were students enrolled in the nursing, medicine, or public health programs at SJBSOM, Caguas, Puerto Rico. From these programs, the students who participated in the PBIL activity were by convenience sample: fourth year nursing students, second year medical students, and first and second year public health students.

C. Sample Size/Selection

The study has a sample size of 71 students in total. 51 medical students, 3 nursing students and 17 public health students. When comparing the potential sample size of students of SJBSOM with other United States (US) mainland medical schools during literature review, it yielded a significantly larger sample size on every US medical school. Thus, minimum sample size calculation was not conducted for the potential student sample size at SJBSOM.

D. Inclusion and Exclusion Criteria

As mentioned in the “Study population” section, the inclusion criteria was all fourth-year nursing students, second year medical students, and first and second year public health students of SJBSOM, who participated in the PBIL activity. All other students enrolled in SJBSOM that did not meet the previously mentioned inclusion criteria were excluded. Qualifying students were invited as volunteer participants through official SJBSOM emails.

E. Study variables

The variables of interest for this study were sociodemographic characteristics (age & sex), academia (program & level), previous healthcare work experience, perceptions, attitudes, self-efficacy, and motivation. Previous healthcare experience variable provided a perspective of how many students had previously been exposed to team-based dynamics within the work field. The perceptions and the attitudes variables provided an understanding of how much students, not only know about each other’s professional roles but also, of how involved was each profession involved in patient care. The self-efficacy variable provides an insight of how they see themselves and how important is their profession in patient care. The motivation variable provided a perception on how much were the students, in general, interested in learning not only about each other’s profession but also, to engage in team-based patient care dynamics before they enter the work field. The analysis was based on answers derived from the Pre-Assessment and Post-Assessment questionnaires that each participant completed. The sample was drawn from students enrolled in SJBSOM, Caguas, Puerto Rico, in the medicine, nursing or public health programs considering academic level or current year. Any previous healthcare work experience before or during the completion of the academic program was evaluated. Perceptions, attitudes, self-efficacy and motivation data were derived from the Pre-Assessment and Post-Assessment questionnaires that each participant completed.

F. Data Collection Method

Each student completed the questionnaires in a controlled setting auditorium, simultaneously with every student participating in the Pilot Study. Both the Pre-Assessment and Post-Assessment questionnaires were completed in the same auditorium and conditions. All quantitative data from the pre/post-activity questionnaire and sociodemographic characteristics were collected with the utmost confidentiality, integrated in Microsoft Excel and linked for statistical analysis based on codification that consisted of three alphanumeric digits of the participant’s choice. This method assured their confidentiality before and after the event, as well as with data management. All data was encrypted until data analysis was performed.

3. Data Analysis

Descriptive statistics (including the median and the interquartile range) and frequency analysis were determined in this study. Wilcoxon on matched pairs signed rank test and the sign test were used to respectively assess whether there is a difference in the median ranks of the paired data and if there is a higher median rank in the data after the activity than before the activity. The two-sided p-value was derived from the Wilcoxon on matched pairs signed rank test, whereas the one-sided p-value was derived from the sign test. Effect size estimates were also determined from the paired data by taking into consideration the correlation r proposed by Cohen in the case of nonparametric data [6, 7] for the purposes of evaluating if the activity had a *practical* change in the answers given by the students before and after the activity and the level of impact. This was determined by using the z -value from the Wilcoxon on test and dividing it by the square root of the total sample size (N); by dividing the z -value to the function of N , it removes the effect of sample size from the resultant effect size estimate [7]. Cohen's guidelines for r are that a value of 0.5 or higher is considered a large effect, a medium effect is between 0.3 and 0.49, and a small effect is between 0.1 and 0.29 [7, 8]. The statistical significance was set at $\alpha = 0.05$. Stata V. 14 (College Station, TX, USA: StataCorp LP) was used for the analysis.

4. Results

A total of 71 students completed both pre and post-assessments. Table 2 shows the sociodemographic characteristics from the participants in all three programs who completed the assessments.

Table 3 shows both the statistical and practical significance for the answers in the questionnaire given before and after the activity. For the most part, results in this table exhibited statistical significance as well as varying effect sizes, although some exceptions were found. The students in general were largely impacted after the activity in terms of familiarity with the aspect of working as part of an interprofessional team ($p = 0.0001$; $r = 0.47$) and in the aspect of training as part of the same team ($p < 0.0001$; $r = 0.62$) in the subscale "Familiarity working and training", as well as an enthusiasm for the activity ($p < 0.0001$; $r = 0.52$) in the "Interprofessional Training" subscale. The subscales that for the most part exhibited statistical significance and a large effect size were found among the subscales "Learning and Performance" and "Learning Environment", whereas "Mutual Support" exhibited non-significance and even a small to no change in the effect size. However, in terms of the questions in the subscale "Mutual Support", a high percentage of people responded the same answer in both assessments (>50%).

Students recognized the potential benefits mentioned in the subscale "Benefits of Training", with the exception of the second question in which they were asked whether the patients would ultimately benefit by an interprofessional collaboration in problem-solving ($p = 0.2271$; $r = 0.14$) and the median rank after the activity did not significantly change from the median rank prior to it ($p = 0.1808$); 41 students (57.75% of the sample) did not change their responses in both assessments, while 12 (16.90%) had a lower median ranks in the post-assessment than the pre-assessment and only 18 (25.35%) provided higher median ranks in the post-assessment than the pre-assessment.

In the subscale "Skills", the only questions in which the differences in responses were non-significance were when asked if they are not effective at delegating responsibility for tasks ($p = 0.1927$; $r = 0.15$) and if integrating information and suggestions into a plan is something they are not very good at ($p = 0.1815$; $r = 0.16$). In addition, when asked if they do not feel that they can take on a leadership role in a team and be effective, while there was a significant difference in responses between both assessments ($p = 0.0008$; $r = 0.40$), the median rank after the activity was not higher than before ($p = 0.9999$). 36 people (50.74%) had the same responses in both assessments, while 28 (39.44%) provided a lower median rank in the post-assessment than the pre-assessment and only 7 (9.86%) provided a higher median rank in the post-assessment than the pre-assessment. As for the subscale "Team Structure", only when asked if patients are a critical

component of the care team were the responses not significantly different ($p = 0.0861$; $r = 0.20$) and the ranks were lower after the activity than before ($p = 0.0717$). In this question, only 54 students (76.06%) had the same responses on both assessments, whereas 5 (7.04%) had a lower median rank in the post-assessment than the pre-assessment and only 12 (16.90%) had a higher median rank in the post-assessment than the pre-assessment.

Among the total questions found in the “Communication” subscale, only half of the questions had statistical significance and even medium- level effect sizes. Only when asked if teams that do not communicate effectively significantly increase their risk of committing errors ($p = 0.3199$; $r = 0.12$), if poor communication is the most common cause of reported errors ($p = 0.5211$; $r = 0.076$) and if it is nearly impossible to train individuals how to be better communicators ($p = 0.1160$; $r = 0.19$) did the responses did not differ significantly. A high percentage of people responded the same answer in both assessments for all these three questions (>50%).

The content of Table 4 was divided into two sub tables, which include pre and post assessments for all three academic programs and the answers from the subscale “Essential Practice Characteristics”. All three academic programs did not differ greatly in terms of percentages in the items within this subscale. Table 5 illustrates a table in which it describes certain aspects from the subscale “Interprofessional Training Experience” that the students answered after concluding the activity. For the most part, higher percentages (> 35%) were more present in the “Frequently” answer then the other answers, except for “Team members anticipated the needs of other team members” in which the higher percentage was in the “Often” answer (39.44%).

Table 2. Sociodemographic characteristics from students who completed both assessments

	Medicine (n = 51)	Public Health (n = 17)	Nursing (n = 3)
Sex, n (%)			
Male	25(49.02)	8(47.06)	2(66.67)
Female	26(50.98)	9(52.94)	1(33.33)
Age (years), Median (IQR)	25(24-25)	27(25-28)	24(20-35)
Current Academic Year, n (%)			
1	0(0)	13(76.47)	0(0)
2	51(100)	4(23.53)	0(0)
3	0(0)	0(0)	2(66.67)
4	0(0)	0(0)	1(33.33)
Healthcare work experience prior to entering program, n (%)			
Yes	36(70.59)	9(52.94)	1(33.33)
No	15(29.41)	8(47.06)	2(66.67)

Table 3. Statistical significance and effect size based on answers from questions in both assessments

Subscales and questions	Pre-assessment Median (IQR)	Post-assessment Median (IQR)	Two-sided p-value	One-sided p-value	Effect Size r
Familiarity working and training					
1. How familiar are you with WORKING as part of an interprofessional team?	4 (3-4)	4 (4-5)	0.0001	0.0001	0.47
2. How familiar are you with TRAINING as part of an interprofessional team?	3 (3-4)	4 (3-5)	<0.0001	<0.0001	0.62
Interprofessional Training					
1. I'm looking forward to the Problem Based Interprofessional Activity	3 (3-4)	4 (3-5)	<0.0001	<0.0001	0.52
Benefits of Training					
1. Learning with other students helps me become a more effective member of a healthcare team.	4 (4-5)	5 (4-5)	0.0031	0.0030	0.35
2. Patients ultimately benefit if interprofessional healthcare students learn together to solve patient problems.	5 (4-5)	5 (4-5)	0.2271	0.1808	0.14
3. Shared learning with other healthcare students increases my ability to understand clinical problems.	4 (4-5)	5 (4-5)	0.0156	0.0145	0.29
4. Interprofessional healthcare team training exercises help me appreciate other professionals.	4 (4-5)	5 (4-5)	0.0011	0.0011	0.39
Learning and Performance					
1. I enjoy learning in team based healthcare activities.	4 (3-4)	4 (4-5)	<0.0001	<0.0001	0.57
2. I perform well in team based healthcare activities.	4 (3-4)	4 (4-5)	<0.0001	<0.0001	0.57
3. I enjoy learning opportunities that bring together students from other professions.	4 (3-5)	4 (4-5)	0.0037	0.0041	0.35
4. I perform well in settings that bring together students from other professions.	4 (3-5)	4 (4-5)	<0.0001	<0.0001	0.50
Learning Environments					
1. Learning in small groups is a good use of training time.	4 (3-4)	4 (4-5)	<0.0001	<0.0001	0.50
2. Learning with other healthcare students is a good use of training time.	4 (3-4)	4 (4-5)	<0.0001	<0.0001	0.61
3. Learning in this team simulated team exercise is a good use of training time.	4 (3-4)	4 (4-5)	<0.0001	<0.0001	0.68
Skills					
1. I can work effectively in teams.	4 (4-5)	4 (4-5)	0.0078	0.0053	0.32
2. I can contribute valuable insight to teams.	4 (4-5)	4 (4-5)	0.0074	0.0047	0.32
3. I can easily facilitate communication between team members.	4 (4-5)	4 (4-5)	0.0055	0.0030	0.33
4. I am not effective at delegating responsibility for tasks.	3 (2-4)	2 (1-4)	0.1927	0.9061	0.15
5. I can effectively coordinate tasks and activities of a team.	4 (4-5)	4 (4-5)	0.0088	0.0083	0.31
6. I am able to resolve conflicts between individuals effectively.	4 (3-4)	4 (3-5)	0.0346	0.0307	-0.25
7. I do not feel I can take on a leadership role in a team and be effective.	2 (2-3)	2 (1-3)	0.0008	0.9999	0.40

8. Integrating information and suggestions into a plan is something I am not very good at.	2 (1-3)	2 (1-3)	0.1815	0.9283	0.16
Team Structure					
1. It is important to ask patients and their families for feedback regarding patient care.	4 (4-5)	5 (4-5)	<0.0001	<0.0001	0.53
2. Patients are a critical component of the care team.	4 (4-5)	5 (4-5)	0.0861	0.0717	0.20
3. A team's mission is of greater value than the goals of individual team members.	4 (4-5)	5 (4-5)	0.0018	0.0017	0.39
4. Effective team members can anticipate the needs of other team members.	4 (4-5)	5 (4-5)	<0.0001	<0.0001	0.51
Mutual Support					
1. To be effective, team members should understand the work of their fellow team members.	5 (4-5)	5 (4-5)	0.3560	0.2517	0.11
2. Asking for assistance from a team member is a sign that an individual does not know how to do his/her job effectively.	2 (1-3)	1 (1-3)	0.9285	0.5722	0.011
3. Providing assistance to team members is a sign that an individual does not have enough work to do.	2 (1-3)	1 (1-2)	0.6842	0.7294	0.048
4. Offering to help a fellow team member with his/her individual work tasks is an effective tool for improving team performance.	4 (4-5)	4 (4-5)	0.0814	0.0610	0.21
5. It is appropriate to continue to assert a patient safety concern until you are certain that it has been heard.	4 (4-5)	5 (4-5)	0.1732	1.000	0.16
Communication					
1. Teams that do not communicate effectively, significantly increase their risk of committing errors.	5 (4-5)	5 (4-5)	0.3199	0.8811	0.12
2. Poor communication is the most common cause of reported errors.	5 (4-5)	5 (4-5)	0.5211	0.3388	0.076
3. Adverse events may be reduced by maintaining an information exchange with patients and their families.	4 (4-5)	5 (4-5)	0.0035	0.0030	0.35
4. I prefer to work with team members who ask questions about information I provide.	4 (3-5)	4 (4-5)	0.0007	0.0007	0.40
5. It is important to have a standardized method for sharing information when handing off patients.	4 (4-5)	5 (4-5)	0.0009	0.0008	0.39
6. It is nearly impossible to train individuals how to be better communicators.	2 (1-3)	2 (1-4)	0.1160	0.1481	0.19

Table 4. a) Pre-Assessment and b) Post-Assessment of the subscale Essential Practice Characteristics

a) Pre-Assessment	Medicine (n = 51)	Public Health (n = 17)	Nursing (n = 3)	Total, n (%)
Collaboration, n (%)				
Essential	50 (98.04)	17 (100)	3 (100)	70 (98.59)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)
Working Together to Solve Patient's Problem, n (%)				
Essential	48 (94.12)	17 (100)	3 (100)	68 (95.77)
Non-Essential	2 (3.92)	0 (0)	0 (0)	2 (2.82)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)
Reducing Errors, n (%)				
Essential	48 (94.12)	17 (100)	3 (100)	68 (95.77)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	3 (5.88)	0 (0)	0 (0)	3 (4.23)
Improving Quality of Care, n (%)				
Essential	50 (98.04)	17 (100)	3 (100)	70 (98.59)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)
Anticipating the needs of other team members, n (%)				
Essential	44 (86.28)	16 (94.12)	1 (33.33)	62 (87.32)
Non-Essential	5 (9.80)	0 (0)	2 (66.67)	7 (9.86)
Don't Know	2 (3.92)	1 (5.88)	0 (0)	2 (2.82)
Asking for assistance when needed, n (%)				

Essential	48 (94.12)	16 (94.12)	1 (33.33)	65 (91.54)
Non-Essential	1 (1.96)	0 (0)	2 (66.67)	3 (4.23)
Don't Know	2 (3.92)	1 (5.88)	0 (0)	3 (4.23)

b) Post-Assessment	Medicine (n = 51)	Public Health (n = 17)	Nursing (n = 3)	Total, n (%)
---------------------------	--------------------------	-------------------------------	------------------------	---------------------

Collaboration, n (%)

Essential	50 (98.04)	17 (100)	3 (100)	70 (98.59)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)

Working Together to Solve Patient's Problem, n (%)

Essential	50 (98.04)	17 (100)	3 (100)	70 (98.59)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)

Reducing Errors, n (%)

Essential	50 (98.04)	17 (100)	3 (100)	70 (98.59)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)

Improving Quality of Care, n (%)

Essential	50 (98.04)	17 (100)	3 (100)	70 (98.59)
Non-Essential	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)

Anticipating the needs of other team members, n (%)

Essential	47 (92.16)	16 (94.12)	3(100)	66 (92.96)
Non-Essential	3 (5.88)	1 (5.88)	0 (0)	4 (5.63)
Don't Know	1 (1.96)	0(0)	0 (0)	1 (1.41)

Asking for assistance when needed, n (%)

Essential	49 (96.08)	17(100)	3(100)	69 (97.18)
Non-Essential	1 (1.96)	0 (0)	0 (0)	1 (1.41)
Don't Know	1 (1.96)	0 (0)	0 (0)	1 (1.41)

Table 5. Post-Assessment of the subscale Interprofessional Training Experience

Interprofessional Training Experience	Medicine (n = 51)	Public Health (n = 17)	Nursing (n = 3)	Total, n (%)
Team members anticipated the needs of other team members.				
Never	0 (0)	0 (0)	0 (0)	0 (0)
Rarely	2 (3.92)	0 (0)	0 (0)	2 (2.82)
Occasionally	9 (17.65)	3 (17.65)	0 (0)	12 (16.90)
Often	19 (37.25)	9 (52.94)	0 (0)	28 (39.44)
Frequently	18 (35.29)	4 (23.53)	2 (66.67)	24 (33.80)
N/A	3 (5.88)	1 (5.88)	1 (33.33)	5 (7.04)
Leaders shared information with team members				
Never	1 (1.96)	0 (0)	0 (0)	1 (1.41)
Rarely	0 (0)	0 (0)	0 (0)	0 (0)
Occasionally	3 (5.88)	2 (11.76)	0 (0)	5 (7.04)
Often	12 (23.53)	9 (52.94)	1 (33.33)	22 (30.99)
Frequently	33 (64.71)	6 (35.29)	2 (66.67)	41 (57.74)
N/A	2 (3.92)	0 (0)	0 (0)	2 (2.82)
Leaders created opportunities for team members to share information (e.g., huddles, briefs).				
Never	0 (0)	0 (0)	0 (0)	0 (0)
Rarely	0 (0)	0 (0)	0 (0)	0 (0)
Occasionally	4 (7.84)	2 (11.76)	0 (0)	6 (8.45)
Often	17 (33.33)	8 (47.06)	1 (33.33)	26 (36.62)
Frequently	28 (54.90)	7 (41.18)	2 (66.67)	37 (52.11)
N/A	2 (3.92)	0 (0)	0 (0)	2 (2.82)
Team members offered help to another team member who appeared tired or stressed.				
Never	0 (0)	0 (0)	0 (0)	0 (0)

Rarely	2 (3.92)	0 (0)	0 (0)	2 (2.82)
Occasionally	3 (5.88)	2 (11.76)	0 (0)	5 (7.04)
Often	14 (27.45)	9 (52.94)	1 (33.33)	24 (33.80)
Frequently	28 (54.90)	6 (35.29)	2 (66.67)	36 (50.70)
N/A	4 (7.84)	0 (0)	0 (0)	4 (5.63)
Team members were consulted for their experience.				
Never	1 (1.96)	0 (0)	0 (0)	1 (1.41)
Rarely	0 (0)	0 (0)	0 (0)	0 (0)
Occasionally	3 (5.88)	1 (5.88)	0 (0)	4 (5.63)
Often	12 (23.53)	8 (47.06)	1 (33.33)	21 (29.58)
Frequently	33 (64.71)	8 (47.06)	2 (66.67)	43 (60.56)
N/A	2 (3.92)	0 (0)	0 (0)	2 (2.82)
Team members asked for assistance.				
Never	3 (5.88)	0 (0)	0 (0)	3 (4.22)
Rarely	0 (0)	0 (0)	0 (0)	0 (0)
Occasionally	1 (1.96)	2 (11.76)	0 (0)	3 (4.22)
Often	11 (21.57)	7 (41.17)	0 (0)	18 (25.35)
Frequently	34 (66.67)	8 (47.06)	3 (100)	45 (63.38)
N/A	2 (3.92)	0 (0)	0 (0)	2 (2.82)

5. Discussion

Patient health care is a constantly growing and ever-changing field that involves the physical, biological, social, and spiritual aspects of an individual. Hence, effective patient care is achieved through an integrated interdisciplinary and patient-centered approach. To facilitate the transition towards a comprehensive patient-centered care, the development and implementation of interprofessional activities within medical and healthcare-related educational curriculum is needed [2]. Thus, providing the future generations of healthcare providers with the ability to facilitate and coordinate multi-disciplinary care for the patient is an essential skill in the management of chronic diseases [10]. The development of this pilot PBIL model intended to take advantage of the SJBSOM multiprofessional education programs and integrate the interprofessional approach of care to its educational curriculum. This allowed implementing an essential, peer-driven,

PBL activity in which students from medicine, nursing, and public health could be involved in a multidisciplinary approach to patient care, similar to that in professional practice.

Upon analysis, the PBIL pilot activity was successful in measuring the level of impact this dynamic had on the students on the matter of interprofessional communication, as well as some of the perceptions and attitudes that were intertwined with this topic. Similarly, Tan et al., (2014) reported that shared learning experiences influence students' perceptions of and attitudes to Interprofessional Learning (IPL) and help them prepare for future collaborative practice [10]. Morison et al., (2004) reported that medical students enjoyed and recognized the importance of shared learning sessions when learning about interprofessional engagement and the role of other healthcare professionals [11]. Our results demonstrated a similar trend since there was a general interest on the matter of interprofessional collaboration and an interest to become further familiar with this experience. According to the results, there were improvements in the answers given in questions after concluding the event. As for the questions that demonstrated non-statistical significance and even small to no change in effect size, when revised in detail, it turns out that it is not necessarily due to a fault in the activity, but rather because most students in the sample gave similar answers in both assessments. It is possible that responses in the post-assessments may have been attributed from other aspects in their ongoing professional training. Regardless, for the most part, while there appear to be improvements on the various subscales and even in the motivation, there are also certain aspects that can be improved upon in future activities of a similar nature, including any teamwork and self-efficacy aspects.

When comparing our interprofessional activity regarding methodology, implementation, longevity, sample size, analysis and other factors, there was a significant difference with other interprofessional education activities. Thus, proving difficult a generalized analysis and comparison of the developed methodology and results. For this reason, the focus of the interprofessional activity was directed to the particular population and necessities SJBSOM has. Furthermore, our results seek to support that interprofessional education demonstrates added value over uniprofessional learning [9].

6. Conclusions

In conclusion, educational methods and practices that evolve concurrently with the dynamic nature of patient care is essential for optimal integration of skills and communication among health professionals in training when transitioning to the work field. Thus, early understanding of the roles and responsibilities among health professionals in an interdisciplinary team will potentially provide a more holistic and efficient approach in patient care. The implementation of a PBIL pilot model has provided the initial basis for early interdisciplinary interaction and experience for students to unmask the compartmentalization of their traditional education and integrate their knowledge and skills with other health professionals in training. Furthermore, it provided a first glance to each individual's strengths and weaknesses in regards to the ability of communicating ideas for efficient patient care. This project highlighted the necessity of further development of a more dynamic and engaging curriculum where students are able to engage in peer-assisted learning practices. In addition, it confirmed the interest of students to exchange ideas and understand and develop the required team-based communication skills to further become more proficient in their role within the healthcare field.

7. Strengths and limitations

This study has some important limitations to consider. Due to sample size constraints, it was not possible to do further data analysis on how statistically significant were the differences in responses in each of the academic programs. Another limitation is that some of the subscales in the original questionnaires, including "Leadership" and "Situation Monitoring", were not used in this study because of irrelevance on what we intended to measure. Further review of the model suggested limitations in continuity of multidisciplinary interactions due to activity time constraints. Also, a limitation of

health-related professions involved in the activity may have played a role in further peer-to-peer engagement. In contrast, this study has several important assets to recognize. Firstly, introduction of this concept and model has established grounds for the implementation of improved and more engaging models in SJBSOM health care education. Another strength is that it was developed utilizing a peer-assisted learning (PAL) approach to provide a more engaging and empowering method for students to apply and understand theoretical concepts. This model also provided a first and novel approach to initiate the development of communication skills and interaction within an interdisciplinary team. An asset that was also highlighted by the participants was that they not only began to understand the roles and responsibilities of their peers but also, felt profound respect for other health professions. Lastly, there are several recommendations and future directions that are being developed for this project. This activity could emulate other models and provide a more extensive set of tasks to be performed through a period of months to ensure the continuity of learning and interaction of the interdisciplinary team. In addition, partnerships with other institutions could be developed to broaden the diversity of health-related professions. Finally, along with faculty members, this model could be structured to provide quantifiable results through impact to underserved communities.

Acknowledgements

The authors of this paper wish to express their sincere gratitude and appreciation to all the fellow educators, scientists, and students whose work has been cited here. Also, we would like to express our appreciation to SJBSOM for providing us with the unconditional support and providing the facilities for the development and execution of the project. Further, we would like to extend our gratitude to Dr. Álvaro Perez, Dr. Kiebelle González, Dr. Yaritza Dáz Algorri, Dr. Sandra Chinapen Barletta, Dr. Alexis Vera, Dr. Elizabeth Padilla, and Kamille Camacho, MPH for their continued support throughout. Only their effort made this publication possible.

Ethical Considerations

As investigators, we conform to the laws and regulations imposed by the Institutional Review Board at SJBSOM. All investigators have proper certification for data management and subject privacy standards. In addition, this investigation was approved by the SJBSOM Ethics committee. An informed consent form was provided to participants prior to the activity with relevant information of the study, all while complying with IRB guidelines with the IRB number of EMSJB- 11-2016.

References

- [1] Burgess, A., Ayton, T., & Mellis, C. (2016). Implementation of team-based learning in year 1 of a PBL based medical program: a pilot study. *BMC Medical Education*, 16(1). <http://dx.doi.org/10.1186/s12909-016-0550-3>
- [2] Maharajan, M. K; Rajiah, K; Phalik Khoo, S; Chellappan, D. K; De Alwis, R; Cing Chui, R; Lee Tan, L; Ning Tan, Y; and Yee Lau, S. (2017) Attitudes and Readiness of Students of Healthcare Professions towards Interprofessional Learning. *PLOS one*. 1-12
- [3] Bell, S. K., Krupat, E., Fazio, S. B., Roberts, D. H., & Schwartzstein, R. M. (2008). Longitudinal pedagogy: a successful response to the fragmentation of the third-year medical student clerkship experience. *Academic Medicine*, 83(5): 467–475. <http://doi.org/10.1097/ACM.0b013e31816bdad5>
- [4] Gaufberg, E. H., Batalden, M., Sands, R., & Bell, S. K. (2010). The Hidden Curriculum: What Can We Learn From Third-Year Medical Student Narrative Reflections? *Academic Medicine*, 85(11): 1709– 1716. <http://doi.org/10.1097/ACM.0b013e3181f57899>
- [5] Brock, D., Abu-Rish, E., Chiu, C., Hammer, D., Wilson, S., Vorvick, L...Blondon, K. (2013). Interprofessional education in team communication: working together to improve patient safety. *BMJ Quality & Safety*, 22(5): 414-423. <http://dx.doi.org/10.1136/bmjqs-2012-000952>

- [6] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- [7] Fritz, C., Morris, P., & Richler, J. (2012). Effect size estimates: Current use, calculations, and interpretation. *Journal Of Experimental Psychology: General*, 141(1): 2-18. <http://dx.doi.org/10.1037/a0024338>
- [8] Coolican, H. (2009). *Research methods and statistics in psychology*. London, United Kingdom: Hodder.
- [9] Thistlethwaite, J. (2012), Interprofessional education: a review of context, learning and the research agenda. *Medical Education*, 46: 58–70. doi:10.1111/j.1365-2923.2011.04143.x
- [10] Tan, Chai-Eng et al. “Comprehensive Healthcare Module: Medical and Pharmacy Students’ Shared Learning Experiences.” *Medical Education Online* 19 (2014): 10.3402/meo.v19.25605. PMC. Web. 31 Jan. 2018.
- [11] Developing pre-qualification inter-professional education for nursing and medical students: sampling student attitudes to guide development Morison, Sue et al. *Nurse Education in Practice* , Volume 4 , Issue 1 , 20 - 29

Appendix A:

Pre-Assessment: Problem Based Interprofessional Activity

Before you begin to answer the following items, please select **three** alphanumeric digits (any mixture of numbers and letters) as your identifier and write in the provided space below. **It is important that you write it down somewhere hidden, as you will be using it again in the Post-Assessment.**

_____ - _____ - _____

1. Demographics

Sex: Male ___ Female ___

Age: ___

Academic Program: Public Health (M.P.H.) ___ Medicine (M.D.) ___ Nursing (B.S.N.) ___

Current Academic Year: 1st___2nd___3rd___4th___

Did you have healthcare work experience prior to entering your program (e.g., as a volunteer or researcher):

Yes ___ No ___

2. Familiarity working and training with teams

	Very Un-familiar	Unfamiliar	Neutral	Familiar	Very Familiar
How familiar are you with WORKING as part of an interprofessional team?					
How familiar are you with TRAINING as part of an interprofessional team?					

3. Interprofessional Training

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I'm looking forward to the Problem Based Interprofessional Activity.					

4. Benefits of Training

Students experience varying benefits from working with students from other professions. Please answer each of the following with regard to how would you from working with other healthcare students.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning with other students helps me become a more effective member of a healthcare team.					
Patients ultimately benefit if interprofessional healthcare students learn together to solve patient problems.					
Shared learning with other healthcare students increases my ability to understand clinical problems.					
Interprofessional healthcare team training exercises help me appreciate other professionals.					

5. Learning and Performance

Sometimes we learn more quickly or perform better doing tasks we enjoy, while at other times we may enjoy something that we don't easily learn or necessarily perform well at. For each of the following questions answer with regard to both how much would you something and with regard to how well you tend to learn and perform.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I enjoy learning in team based healthcare activities.					
I perform well in team based healthcare activities.					
I enjoy learning opportunities that bring together students from other professions.					
I perform well in settings that bring together students from other professions.					

6. Learning Environments

Learning can take place in many environments. Some are more suited to your learning style than are others. Please answer each of the following with regard to what works best for you.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning in small groups is a good use of training time.					
Learning with other healthcare students is a good use of training time.					
Learning in this team simulated team exercise is a good use of training time.					

7. Skills

We all have skills we're great at and other skills where we could use some assistance. For the following questions answer with regard to your level of confidence.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can work effectively in teams.					
I can contribute valuable insight to teams.					
I can easily facilitate communication between team members.					
I am not effective at delegating responsibility for tasks.					
I can effectively coordinate tasks and activities of a team.					
I am able to resolve conflicts between individuals effectively.					
I do not feel I can take on a leadership role in a team and be effective.					
Integrating information and suggestions into a plan is something I am not very good at.					

8. Team Structure

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is important to ask patients and their families for feedback regarding patient care.					

Patients are a critical component of the care team.					
A team's mission is of greater value than the goals of individual team members.					
Effective team members can anticipate the needs of other team members.					

9. Mutual Support

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
To be effective, team members should understand the work of their fellow team members.					
Asking for assistance from a team member is a sign that an individual does not know how to do his/her job effectively.					
Providing assistance to team members is a sign that an individual does not have enough work to do.					
Offering to help a fellow team member with his/her individual work tasks is an effective tool for improving team performance.					
It is appropriate to continue to assert a patient safety concern until you are certain that it has been heard.					

10. Communication

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Teams that do not communicate effectively, significantly increase their risk of committing errors.					
Poor communication is the most common cause of reported errors.					
Adverse events may be reduced by maintaining an information exchange with patients and their families.					
I prefer to work with team members who ask questions about information I provide.					
It is important to have a standardized method for sharing information when handing off patients.					
It is nearly impossible to train individuals how to be better communicators.					

11. Essential Practice Characteristics

For each of the following please state whether the issue is essential to interprofessional practice or is not essential to interprofessional practice.

	Essential	Not Essential	Don't Know
Collaboration			
Working together to solve patients' problems			
Reducing errors			
Improving quality of care			
Anticipating the needs of other team members			
Asking for assistance when needed			

Thank you for your participation!

Appendix B:

Post-Assessment: Problem Based Interprofessional Activity

Before you begin to answer the following items, please write down the **three** alphanumeric digits that you used as an identifier for the Pre-Assessment in the provided space below.

____-____-____

1. Familiarity working and training with teams

	Very Un-familiar	Unfamiliar	Neutral	Familiar	Very Familiar
How familiar are you with WORKING as part of an interprofessional team?					
How familiar are you with TRAINING as part of an interprofessional team?					

2. Interprofessional Training

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I'm looking forward to the Problem Based Interprofessional Activity.					

3. Benefits of Training

Students experience varying benefits from working with students from other professions. Please answer each of the following with regard to how you benefited from working with other healthcare students.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Learning with other students helps me become a more effective member of a healthcare team.					
Patients ultimately benefit if interprofessional healthcare students learn together to solve patient problems.					
Shared learning with other healthcare students increases my ability to understand clinical problems.					
Interprofessional healthcare team training exercises help me appreciate other professionals.					

4. Learning and Performance

Sometimes we learn more quickly or perform better doing tasks we enjoy, while at other times we may enjoy something that we don't easily learn or necessarily perform well at. For each of the following questions answer with regard to both how much you enjoyed something and with regard to how well you tend to learn and perform.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I enjoy learning in team based healthcare activities.					
I perform well in team based healthcare activities.					
I enjoy learning opportunities that bring together students from other professions.					
I perform well in settings that bring together students from other professions.					

5. Learning Environments

Learning can take place in many environments. Some are more suited to your learning style than are others. Please answer each of the following with regard to what works best for you.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning in small groups is a good use of training time.					
Learning with other healthcare students is a good use of training time.					
Learning in this team simulated team exercise is a good use of training time.					

6. Skills

We all have skills we're great at and other skills where we could use some assistance. For the following questions answer with regard to your level of confidence.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can work effectively in teams.					
I can contribute valuable insight to teams.					
I can easily facilitate communication between team members.					
I am not effective at delegating responsibility for tasks.					
I can effectively coordinate tasks and activities of a team.					
I am able to resolve conflicts between individuals effectively.					
I do not feel I can take on a leadership role in a team and be effective.					
Integrating information and suggestions into a plan is something I am not very good at.					

7. Team Structure

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is important to ask patients and their families for feedback regarding patient care.					
Patients are a critical component of the care team.					
A team's mission is of greater value than the goals of individual team members.					
Effective team members can anticipate the needs of other team members.					

8. Mutual Support

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
To be effective, team members should understand the work of their fellow team members.					
Asking for assistance from a team member is a sign that an individual does not know how to do his/her job effectively.					
Providing assistance to team members is a sign that an individual does not have enough work to do.					
Offering to help a fellow team member with his/her individual work tasks is an effective tool for improving team performance.					
It is appropriate to continue to assert a patient safety concern until you are certain that it has been heard.					

9. Communication

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Teams that do not communicate effectively, significantly increase their risk of committing errors.					
Poor communication is the most common cause of reported errors.					
Adverse events may be reduced by maintaining an information exchange with patients and their families.					
I prefer to work with team members who ask questions about information I provide.					
It is important to have a standardized method for sharing information when handing off patients.					
It is nearly impossible to train individuals how to be better communicators.					

10. Essential Practice Characteristics

For each of the following please state whether the issue is essential to interprofessional practice or is not essential to interprofessional practice.

	Essential	Not Essential	Don't Know
Collaboration			
Working together to solve patients' problems			
Reducing errors			
Improving quality of care			
Anticipating the needs of other team members			
Asking for assistance when needed			

11. Interprofessional Training Experience

	Never	Rarely	Occasionally	Often	Frequently	N/A
Team members anticipated the needs of other team members.						
Leaders shared information with team members.						
Leaders created opportunities for team members to share information (e.g., huddles, briefs).						
Team members offered help to another team member who appeared tired or stressed.						
Team members were consulted for their experience.						
Team members asked for assistance.						

12. Expectations

What is the most important learning experience you took away from the interprofessional training?

Thank you for your participation!