Interprofessional Education

and Assessment

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Abstract

A consequence of Interprofessional Education (IPE) that is challenging to study is the improvement in the delivery of health care. The aims were to evaluate the perception and the impact of IPE on the delivery of pharmacy practice, and to develop outcome assessment methodologies capable of measuring the impact of IPE on service provision as it influences patient outcomes and change in organisational practice.

The objectives were to: i) review available IPE tools according to psychometric testing, relevance to pharmacy education and practice, and outcomes related to interprofessional collaboration, ii) assess changes in students' perception of interprofessional collaboration before and after an IPE activity, and iii) design, psychometrically evaluate and implement an innovative IPE tool to determine the impact of IPE activities in pharmacy practice.

The methodology involved: i) Literature scoping exercise of IPE activities and tools related to pharmacy education; ii) The Student Perceptions of Interprofessional Clinical Education–Revised 2 (SPICE-R2) tool was adopted to assess perception of IPE learning activities in undergraduate third year pharmacy, Master in Pharmacy (MPharm) and postgraduate Doctorate in Pharmacy (PharmD) students before (t0) and after (t1) an experiential learning activity; iii) An innovative IPE tool, which measures impact of IPE activities on patient services and change in pharmacy organisational practice, was designed, validated through a three-step Delphi process by a 15 member Delphi panel which included Maltese and international healthcare professionals, and was tested for internal consistency. The tool was disseminated to PharmD students who have undergone interprofessional experiential rotations and PharmD alumni of the University of Malta graduated in 2020.

Results: i) 128 instruments to measure IPE activities which assess different outputs, such as competency, autonomy and teamwork attitudes, were identified. Fifty-eight percent of

the tools which have direct applicability to the role of pharmacists on health care teams did not include a pharmacist or a student pharmacist in the psychometric testing; ii) The SPICE-R2 tool was completed at t0 and t1 by 61 students: 12 third year pharmacy students, 13 MPharm students and 36 PharmD students. A significant improvement between t0 and t1 was measured in the three groups of students for: 'Interprofessional Teamwork and Team-based Practice' ($p=0.035$, $p=0.005$, $p=0.010$), 'Roles/Responsibilities for Collaborative Practice' ($p=0.002$, $p=0.001$, $p=0.005$) and 'Patient Outcomes from Collaborative Practice' ($p=0.036$, $p=0.002$, $p=0.013$). The largest improvement was observed in the 'Roles/Responsibilities for Collaborative Practice' subscale in all three groups of students; iii) The developed 'Interprofessional Education on Pharmacy Competencies (IPEPC)' tool consists of ten statements divided into four core competencies: 'Values-Ethics for Interprofessional Practice', 'Roles-Responsibilities', 'Interprofessional Communication' and 'Teams and Teamwork'. The tool showed high internal consistency between the statements in each of the core competencies (Cronbach's alpha >0.7). Significant improvement in teamwork ($p=0.026$) and ethics competencies ($p=0.037$) were observed when students were clustered by year of study.

Perception of IPE appears to be very positive in pharmacy students across different years of study. The developed innovative tool, IPEPC, is a valid and reliable instrument to explore the impact of IPE learning experience on pharmacy practice. The research puts forward a signal that teamwork and ethics competencies may be positively influenced as students' progress in their pharmacy studies.

Keywords: interprofessional education, education outcomes, innovative tool, perception, pharmacy competencies

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Chapter 1:

Introduction

1.1 Overview of Interprofessional Education

Worldwide health is a shared field "requiring different professionals to address the clinical, biological and social factors that contribute to the health of communities, cities and nations" (West et al, 2016). From these circumstances, the necessity of having a team formed by different healthcare professionals who can deal with complex health conditions and social needs is becoming more and more essential (Hertweck et al, 2012; Darlow et al 2015). Aging populations and long-term, complex and comorbid conditions are aspects that cannot be approached and resolved by a single disciplinary skill set (Hertweck et al, 2012). This is where Interprofessional Education (IPE) and the involvement of a multidisciplinary team may play a crucial role in tackling these multifaceted needs (Darlow et al 2015).

IPE involves concurrent and collaborative education of students from different disciplines with the aim of improving delivery of health care (Kim et al, 2019). Interprofessional approaches to patients have been assumed "to have the potential for improving professional relationships, increasing efficiency and coordination, and ultimately enhancing patient and health outcomes" (Curren et al, 2008). IPE activities have been described by the World Health Organization as a crucial approach to increase interprofessional collaborative practice between healthcare practitioners.[1] This collaboration has led to a decrease in medical errors, improved patient care and patient

[1] Health Professions Networks Nursing & Midwifery Human Resources for Health. Framework for Action on Interprofessional Education & Collaborative Practice. [Internet]. Geneva: WHO; 2010 [cited 2021 Jun 3]. Available from: URL: https://apps.who.int/iris/bitstream/handle/10665/70185/WHO_HRH_HPN_10.3_eng.pdf;jsessio

satisfaction, and is a fundamental way to enhance population health and reduce therapy-related costs (Shrader et al, 2017; Dyess et al, 2019). Increased evidence advocates for interprofessional collaboration across different providers, organisations and sectors in the management of chronic diseases in both the community and hospital setting, particularly for older adults [2] (Trivedi et al, 2013; Bookey-Bassett et al, 2017).

Providing effective IP educational opportunities is associated with challenges (Dyess et al, 2019) and despite efforts to include the culture of teamwork and collaborative practice in different academic curricula, many barriers persist as difficult to address (Altin et al, 2014; Michalec et al, 2017). Students, especially medical and nursing students, frequently note that they are aware of stereotypes associated with their profession, and that these negative opinions are often reinforced in the school setting (Altin et al, 2014; Michalec et al, 2017). Moreover, imbalance of the participating students is a crucial and common problem for the implementation of an IPE learning activity since the delivery of a multifaceted healthcare service is only possible when all disciplines are involved (Altin et al, 2014). According to students, schedule incompatibilities and timetable difficulties between disciplines have a negative impact on the perception of IPE, which results in a low participation when these activities are carried out. On the other side, faculties complain about lack of logistical and administrative support and insufficient utilisation of standardised procedures to develop and evaluate IPE courses (Altin et al, 2014).

[2] Nasmith L, Ballem P, Baxter R, Bergman H, Colin-Thome D, Herbert C, et al.. Transforming Care for Canadians with Chronic Health Conditions: put People First, Expect the Best, Manage for Results [Internet]. Canadian Academy of Health Sciences, Ottawa, Canada; 2010 [cited 2021 Jun 3]. Available from: https://cahs-acss.ca/wp-content/uploads/2011/09/cdm-final-English.pdf

Despite these challenges, many students perceive IPE activities as a first experience of real-world patient care and learn to collaborate with different students (Michalec et al, 2017). The interprofessional approach to care aims to maintain or restore health through the shared experience and knowledge of healthcare professionals with different backgrounds (Dyess et al, 2019). The potential advantages of having different students and healthcare professionals together to learn from one another and recognise each other's roles to improve patient care and safety have been a crucial aspect in the implementation of IPE within professional curricula and practice (Shrader et al, 2017). Although members of a healthcare team, such as pharmacists, physicians, nurses and social workers, are not typically educated together, they are still required to collaborate and cooperate in the delivery of care (Groessl & Vandenhouten, 2019). The necessity for future health care providers to follow curricula which prepare them to deliver team-based care is important (Risling De Jong et al, 2016).

Interprofessional education aims to increase interprofessional interaction between future healthcare professionals to develop skills required for useful collaborative practice.[3] As part of their curricula, university programs should develop and implement IPE learning experiences for students (Iverson et al, 2018). Some programs can be delivered only during pre-qualification, while others can be included before and after qualification, however, the timing of inclusion of IPE is still not well-defined (Guraya & Barr, 2018). On one side, many scholars and researchers recommend the "formal adoption of

[3] Reeves S, Abramovich I, Rice K, Goldman J. An Environmental Scan and Literature Review on Interprofessional Collaborative Practice Settings Final Report for Health Canada. [Internet]. Toronto: Li Ka Shing Knowledge Institute of St Michael's Hospital University of Toronto; 2007 [cited 2021 Jun 3]. Available from: https://www.hhr-rhs.ca/index.php?option=com_mtree&task=att_download&link_id=6634&cf_id=68&lang=fr

interprofessional curriculum early on in professional training" (Pecukonis et al., 2008; Sloane & Haas, 2020). Incorporating IPE activities during this stage seems to have the largest impact on students, and consequently on the future healthcare professions (Patel et al, 2016). Exposure to a variety of different healthcare professions, subjects in common with students from many different disciplines, dedicated interprofessional experts and interprofessional student representation in the design of the curriculum are recommendations to achieve an appropriate learning experience at the beginning of the curriculum (Sloane & Haas, 2020).

Some health care educators fear that these early IPE activities are an oversimplification of what is needed to prepare students for the complexity of current-day medicine practice (Guraya & Barr, 2018; Sloane & Haas, 2020). Moreover, students in the early stages of their graduate education may not have a clear idea of their responsibilities and roles within the team, limiting their interest in the roles of other professions (Pecukonis et al., 2008; Fox et al, 2018). This may still occur despite the understanding of the responsibilities and tasks of all social and health care professionals undertaken at both undergraduate and postgraduate levels in different countries (Patel et al, 2016). Regardless, these activities should take place in a setting of supportive collaborative learning to improve interprofessional practice in the clinical care of patients (Fox et al, 2018; Dyess et al, 2019).

Innovative ways of teaching and new learning strategies which highlight and facilitate the understanding of each other's roles and the importance of teamwork are required by students to prepare them to become health care professionals (Guraya & Barr, 2018).

These programs must grant opportunities where students can learn from and with each other about their chosen professions, and the professions of their future colleagues (Martinez et al, 2013; Dyess et al, 2019), hence faculties play an important role in enabling IPE on both administrative and student levels (Groessl & Vandenhouten, 2019).

1.2 Interprofessional Education competencies

Currently, training programmes, educational seminars and academic activities which include terms such as "competency" and "interprofessional" are becoming the norm in many university curricula (Rouse & Meštrović, 2020).

In 2011, the IPEC Board published a report with the intent of defining competencies for interprofessional collaborative practice. Four different interprofessional competency domains were identified, each containing a set of more specific competency statements. These four domains were 'Values/Ethics for Interprofessional Practice', 'Roles/Responsibilities', 'Interprofessional Communication' and 'Teams and Teamwork'.[4]

[4] Interprofessional Education Collaborative Expert Panel. Core competencies for interprofessional collaborative practice: Report of an expert panel. [Internet]. Washington. D.C.: Interprofessional Education Collaborative; 2011 [cited 2021 Jun 3]. Available from: https://www.aacom.org/docs/default-source/insideome/ccrpt05-10-11.pdf?sfvrsn=77937f97_2

In 2016, this report was updated and the list of competencies were reorganised under a singular domain called 'Interprofessional Collaboration'. The four areas, which were initially called domains, became core competencies.[5]

Some of the interprofessional skills listed by the WHO were present in the development of numerous healthcare professions, while others are still inadequately addressed in many educational programmes (Rouse & Meštrović, 2020). Many curricula activities focus only on enhancing knowledge rather than on building practical skills, attitudes and values. All components of competence are, however, considered key elements for current pharmacy practice, and are required to be translated into meaningful changes in the delivery of care (Rouse & Meštrović, 2020).

Despite the effort to build an accepted and worldwide concept of pharmacy competency and interprofessional competencies, many obstacles are present within and outside the profession, when these concepts are translated into practice (Rouse & Meštrović, 2020). Current organisational culture of pharmacy education, lack of appropriate technology and resources, lack of leadership and fear of changes, are aspects reported to be hindering the evolution of pharmacy practice (Garcia-Cardenas et al, 2017).

[5] Interprofessional Education Collaborative Expert Panel. Core competencies for interprofessional collaborative practice: Report of an expert panel. [Internet]. Washington. D.C.: Interprofessional Education Collaborative; 2016 [cited 2021 Jun 3]. Available from: https://hsc.unm.edu/ipe/resources/ipec-2016-core-competencies.pdf

Connecting practice to education is necessary to evaluate impact of IPE on delivery of care. The need to measure the effectiveness of these activities and being able to assess outcomes of interprofessional competency from degree programs are crucial for ensuring a good pharmacy service (Rouse & Meštrović, 2020). Measurements of the improved competency of the pharmacist, enhancement in quality of services provided and better-quality patient outcomes should all be key aspects of pharmacy educational programmes (Ocampo et al, 2015).

It has been debated that these aspects are applicable only to the hospital and health-centre setting and are not essential for a community pharmacist. Evidence shows that the role of the pharmacist continues well after the medication has been dispensed since it is often the pharmacist, after discussions with the physician, who communicates with other healthcare professionals, such as the social worker, psychologist and physiotherapist at the hospital for better planning, coordinating and delivery of care to patients (Azzopardi & Serracino-Inglott, 2020).

1.3 Interprofessional Education tools in literature

In literature, different tools to assess IPE can be identified, and autonomy, attitudes and perception are examples of outputs which can be assessed using these tools (Kenaszchuk, 2013). The Kirkpatrick's Model has been widely used in literature to classify IPE tools (Shrader et al, 2017). In 1959, Kirkpatrick proposed his innovative approach to the evaluation of educational tools, which was later applied to the IPE field.

The model was extensively studied and revised during the celebration for the its semi-centennial anniversary,[6] and consists of six different levels according to the outcome assessed by the tool (Table 1.1). The Kirkpatrick classification is a well-established and recognised method, which provides a structure and is time efficient to administer (Paull et al, 2016). Although this approach is not the only way to evaluate IPE tools and has been criticised, its contribution in IPE cannot be underestimated (Cox et al, 2016). The simplicity, focus and systematic approach render Kirkpatrick's Model one of the most widely used tools for the evaluation and classification of IPE tools (Paull et al, 2016).

[6] Kirkpatrick J, Kayser-Kirkpatrick W. The Kirkpatrick four levels: A fresh look after 50 years [Internet]. Ocean City: Kirkpatrick Partners; 2009. [cited 2021 Jun 3]. Available from: URL: https://www.kirkpatrickpartners.com/Portals/0/Resources/Kirkpatrick%20Four%20Levels%20white%20paper.pdf

Level	Outcome
1. Reaction	Learners' views on the learning experience and its interprofessional nature
2a. Modification of attitudes/perceptions	Changes in reciprocal attitudes or perceptions between participant groups. Changes in perception or attitude towards the value and/or use of team approaches to caring for a specific group of patients
2b. Acquisition of knowledge/skills	Including knowledge and skills linked to interprofessional collaboration
3. Behavioural change	Identifies individuals' transfer of interprofessional learning to their practice setting and changed professional practice
4a. Change in organizational practice	Wider changes in the organization and delivery of care
4b. Benefits to patients	Improvement in health or well-being of patients

Table 1.1 Modified Kirkpatrick's Model of Educational Outcomes for Interprofessional Education

Reproduced from: Shrader S, Farland MZ, Danielson J, Sicat B, Umland EM. A Systematic Review of Assessment Tools Measuring Interprofessional Education Outcomes Relevant to Pharmacy Education. Am J Pharm Educ. 2017;81(6):119.

1.4 Rationale for research

While approaches to IPE have expanded and all of the existing tools are important contributions to IPE and to its impact, measurement in this area continues to develop, and further research is necessary. Assessment approaches for IPE are varied, and best practices have not yet been identified (Shrader et al, 2017). Thus, a standardised way to measure the specific impact of IPE in a particular profession on the delivery of care is needed (Cox et al, 2016).

Some tools based on different competency frameworks and reports exist in literature, however a few instruments have been tailored for a specific health care profession. Even

though the competencies listed in the “Core competencies for interprofessional collaborative practice: Report of an expert panel” of 2016, published by the IPEC Board, should be applicable and achieved by all healthcare disciplines, it is important to detect different "shades" of these competencies (Harper, 2019). In particular, in the roles and responsibility area, the focus on more tailored competency may be useful to improve person-centred care when they are combined with those competencies held in common between all professions (Harper, 2019). Hence, the development of an innovative and profession-specific tool for measuring IPE competencies is needed.

1.5 Aims and objectives

The aims of the research were to evaluate the perception and the impact of IPE on the delivery of pharmacy practice, and to develop outcome assessment methodologies capable of measuring the impact of IPE on service provision as it influences patient outcomes and change in organisational practice.

The objectives of the research were to:

1. Review available IPE tools according to psychometric testing, relevance to pharmacy education and practice and outcomes related to interprofessional collaboration
2. Assess changes in students’ perception of interprofessional collaboration before and after an IPE activity
3. Design, psychometrically evaluate and implement an innovative tool to determine the impact of IPE activities in pharmacy practice.

Chapter 2:

Methodology

2.1 Methodology overview

The research study was divided into two parts:

1) Assessment of perception of pharmacy students on IPE using the Student Perceptions of Interprofessional Clinical Education–Revised (SPICE-R2) tool (Figure 2.1)

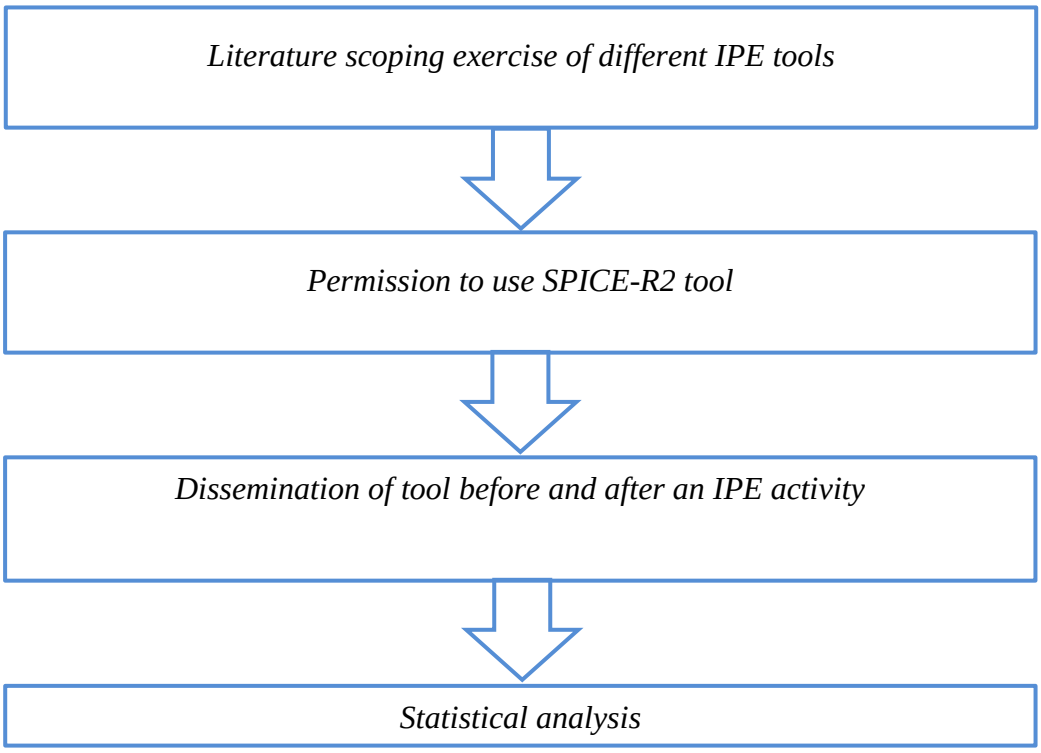

Figure 2.1 Methodology flowchart 1: Assessment of the perception of undergraduate and doctorate students on Interprofessional Education

2) Assessment of the impact of IPE activities in pharmacy practice using an innovative tool (Figure 2.2)

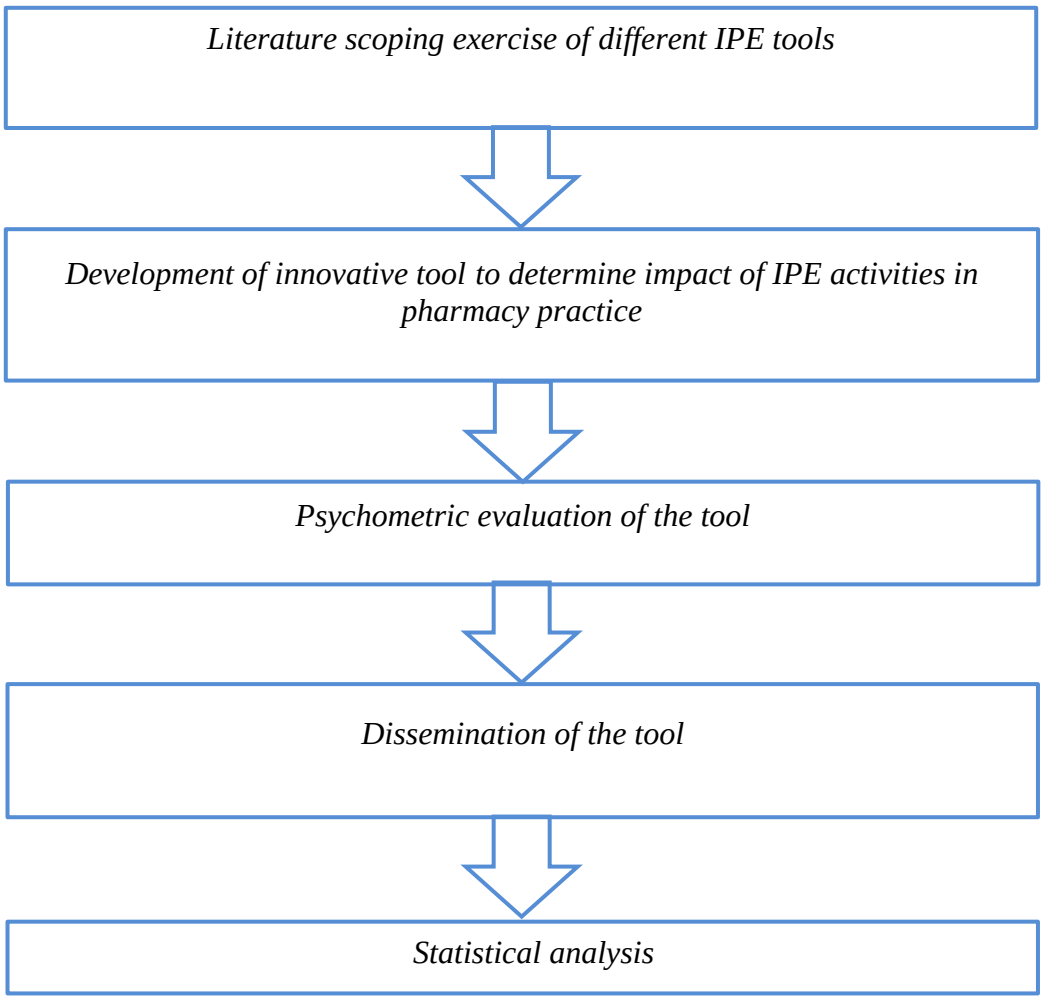

Figure 2.2 Methodology flowchart 2: Development and dissemination of new tool to assess impact of Interprofessional Education activities in pharmacy practice

2.2 Study approvals

Permission to use the SPICE-R2 tool was granted by the inventor (Appendix 1). The research study was registered with the University of Malta Faculty of Medicine and Surgery Research Ethics Committee (Appendix 2).

2.3 Literature scoping exercise

A literature scoping exercise to identify and review current IPE learning methods and tools was carried out. The review focused on outcomes such as attitudes and perception of IPE. Psychometric properties and inclusion of pharmacy students during the evaluation of the tool were investigated.

2.4 Evaluating perception of pharmacy students on Interprofessional Education

The changes in perception towards IPE were evaluated using a self-administered perception questionnaire.

2.4.1 Selection of perception questionnaire

The 'Student Perceptions of Interprofessional Clinical Education–Revised' (SPICE-R2) was selected since it can be applied to different curricula, it is concise and has demonstrated stronger psychometric properties compared to the previous version (SPICE-R) and other tools (Zorek et al, 2016). This questionnaire contains 10 items with 3 subscales highlighting topics including 'Interprofessional Teamwork and Team-Based Practice (T)', 'Roles/Responsibilities for Collaborative Practice (R)' and 'Patient Outcomes from Collaborative Practice (O)'. All Items are rated on a 5-point Likert scale (from 1= "Strongly Disagree" to 5= "Strongly Agree") (Appendix 3).

2.4.2 Dissemination of perception questionnaire

SPICE-R2 was disseminated before (t0) and after (t1) an IPE activity to undergraduate third year Pharmacy students, Master of Pharmacy (MPharm) students and doctoral

(PharmD) students. The questionnaires were disseminated between 1 March 2020 and 1 February 2021 (11 months). Dissemination of the questionnaire was done by the researcher after students were invited to join the project by an academic mentor.

2.4.3 Statistical analysis of perception questionnaire

For each group of students, mean rating scores out of 5 related to each item of the SPICE-R2 tool were calculated. The higher the mean rating score, the higher the agreement to the statement. The 'Interprofessional Teamwork and Team-based Practice' score was generated by calculating the mean of the rating scores provided to items 1, 4, 7 and 10, the 'Roles/Responsibilities for Collaborative Practice' score was generated by calculating the mean of rating scores provided to items 2, 5 and 8, and the 'Patient Outcomes from Collaborative Practice' score was generated by calculating the mean of the rating scores provided to items 3, 6 and 9. These mean scores were generated before and after the experiential activity and all range from 1 to 5 where the larger the score, the higher is the agreement with the statement. The Wilcoxon signed-rank test was used to test whether the change in mean rating scores related to each item and to each subscale before and after the experiential activity was significant. A p-value exceeding 0.05 implies no significant change in attitude towards IPE before and after the experiential activity.

2.5 Evaluation of impact of Interprofessional Education activities in pharmacy practice

The literature scoping exercise enabled the design of an innovative self-administered tool to assess the impact of IPE on patient care and pharmacy practice.

2.5.1 Development of tool to evaluate impact of Interprofessional Education

The Evaluation of the Impact of 'Interprofessional Education on Pharmacy Competencies' (IPEPC) tool was developed, highlighting topics such as ethics for interprofessional practice, roles and responsibilities within a team, interprofessional communication and teams and teamwork empowerment. The profession-specific self-assessment tool developed, focused on the outcome of IPE on patients and on change in organisational practice, particularly, on evaluating the impact of IPE on pharmacy competencies. The Interprofessional Education Collaborative (IPEC) competency was chosen as the foundation of the tool since many international communities and associations supported and worked together to build the report and since it has served as a cornerstone of many faculty development institutions since 2012. 5 The tool before validation consisted of eleven items adapted from the competencies for IPE listed and defined by the IPEC. The items were divided into the four different core competencies listed in the same 2016 report.

2.5.2 Validation of IPEPC

Three rounds of Delphi method and two different panels of experts formed the validation process. The first Delphi panel included four Maltese and nine international physicians and pharmacists with different backgrounds such as community, hospital and academia, recruited by convenience sampling (Table 2.1, Table 2.2). This part of the validation was composed of two rounds (Figure 2.3).

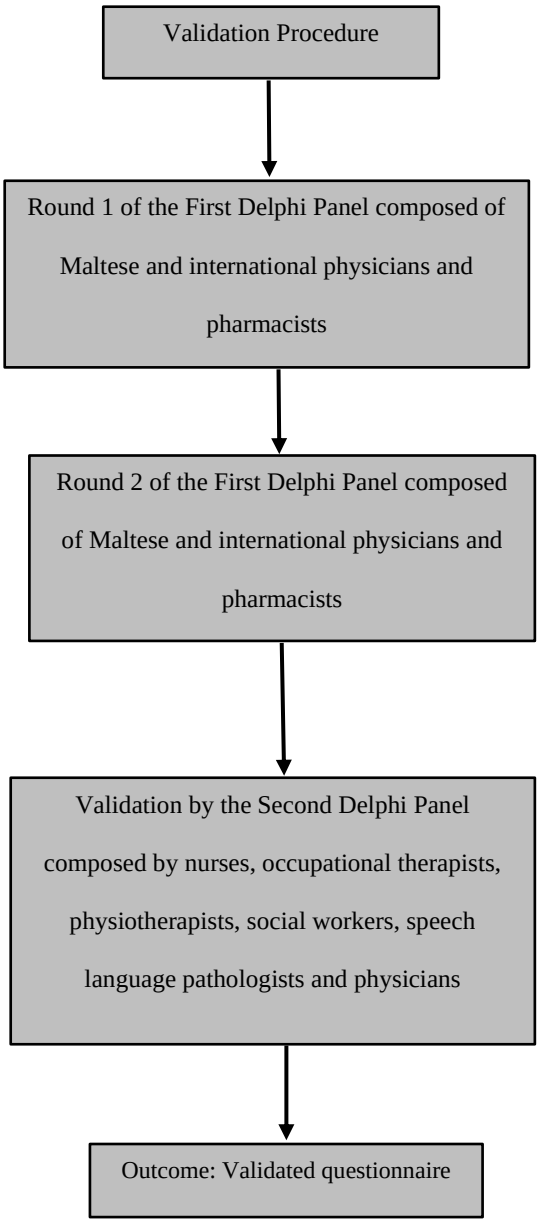

Figure 2.3 Details of the Delphi validation process for the IPEPC questionnaire

Table 2.1 Demographic characteristics of panelists:Round 1 of the Delphi process (N=13)

Gender	Male	5
	Female	8
Age (years)	21-35	2
	36-45	2
	46-55	5
	55-69	3
	70+	1
Profession	Pharmacist	12
	Physician	1
Level of education	Undergraduate	1
	Postgraduate	12
Area of practice	Community	1
	Academia	7
	Hospital	4
	Regulatory sciences	1
Years of experience	6-10 years	4
	>10 years	9

In both rounds, the panel was asked to rate clarity and relevance of each item of the questionnaire and its layout on a Likert-Scale from 1 to 5 (where 5 is the highest) using a validation tool. The validation tool was sent by email to the panel and each round lasted fourteen days. At the end of each round, a mean rating score out of 5 was calculated for each item. Items which obtained a mean rating score less than 4 were revised, optimised and submitted for a second validation by the same panel. Items which were modified as suggested by the validation panel in round 1 were revalidated for both clarity and

relevance. Consensus was reached after round 2 of validation since all items obtained a mean rating score of 4 or higher, and the questionnaire was rendered valid.

Table 2.2. Demographic characteristics of panelists: Round 2 of the Delphi process (N=10)

Gender	Male	3
	Female	7
Age (years)	21-35	2
	36-45	1
	46-55	4
	55-69	2
	70+	1
Profession	Pharmacist	10
Level of education	Undergraduate	1
	Postgraduate	9
Area of practice	Community	1
	Academia	5
	Hospital	3
	Regulatory	1
Years of experience	6-10 years	3
	>10 years	9

The questionnaire was validated by another interprofessional expert panel, which included nurses, occupational therapists, physiotherapists, social workers, speech language pathologists and physicians (Table 2.3). The panel was asked to rate clarity and relevance of each item of the questionnaire and its layout on a Likert-Scale from 1 to 5

(where 5 is the highest). The validation tool was sent by email and the round lasted fourteen days. At the end of round 1, all items obtained a mean rating score of 4 or higher and comments and suggestions were implemented resulting in a valid and effective questionnaire.

Table 2.3. Demographic characteristics of panelists: Round 3 of the Delphi process (N=8)

Gender	Male	2
	Female	6
Age (years)	21-35	3
	36-45	4
	55-69	1
Profession	Nurse	1
	Occupational therapist	2
	Physiotherapist	1
	Social worker	1
	Speech language pathologist	2
	Physician	5
Level of education	Undergraduate	5
	Postgraduate	3
Area of practice	Hospital	8
Years of experience	2-5 years	1
	6-10 years	3
	>10 years	4

2.5.3 Reliability testing of IPEPC

Cronbach's Alpha was used to test the internal consistency between statements related to a particular core competency. A Cronbach's alpha value larger than 0.7 indicates acceptable internal consistency; a value between 0.5 and 0.7 indicates questionable internal consistency; and a value less than 0.5 indicates unacceptable internal consistency.

Exploratory Factor Analysis (EFA) was used to confirm the existence of a latent factor structure and to determine the number of factors (core competences). The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and the Bartlett's test of sphericity were calculated for the tool. A value of KMO higher than 0.5 generally indicates that the sampling is adequate while a value lower than 0.5 indicates that the sampling is not acceptable and adequate. A Bartlett's test lower than 0.05 implies that a factor structure exists within the items of the tool.

2.5.4 Dissemination of IPEPC

The study population consisted of students enrolled in the Doctorate in Pharmacy course (PharmD) at the University of Malta in different academic years and PharmD alumni graduated in 2020.The IPEPC tool was administered electronically, using Google Forms in January 2021. Questionnaire responses were collected online between 4 January and 31 January 2021 (3 weeks). Dissemination was done by the researcher after students were invited to join the project by an academic mentor.

2.5.5 Statistical analysis of IPEPC

The Shapiro Wilk test was used to determine whether the Core Competency score distribution was normal or skewed. All Shapiro Wilk p-values were less than the 0.05 level of significance indicating that the core score distributions were skewed and do not satisfy the normality assumption.

Since data were not normally distributed, non-parametric analyses were conducted and the Kruskal Wallis was used to compare mean core competency scores between groups of participants clustered by gender, age, year of study, years of practice and area of practice. A p-value less than 0.05 level of significance indicated that the mean core competency scores varied significantly between the groups.

Chapter 3:

Results

3.1 Literature scoping exercise of Interprofessional Education activities and tools relevant to pharmacy education

Thirty-six out of 128 tools reviewed are applicable to pharmacy education. Different outputs can be assessed using these tools: 16 tools focused on teamwork attitudes, 8 tools on competencies and team performance, 8 tools assessed perception and reaction to IPE and only 4 were able to measure quality of care delivered to patients (Appendix 4).

Regarding classification by Kirkpatrick assessment levels, out of the 36 tools, 19 assessed behaviour changes, 8 tools were able to assess reaction, 7 tools assessed modification of attitudes/perceptions, and 2 tools measured changes in organisational practice.

Seventeen tools were able to assess an individual member of a team, 16 were designed to measure the team, and 3 tools could be used to assess both an individual and a team.

The number of items or questions which composed the tools found in literature ranged from 5 to 59, with a mean of 24 items per tool. Twenty-one tools included a number of items equal or higher than 20, showing no standardisation on the length of the tools.

Despite having a direct applicability to the role of pharmacists on health care teams and could be potentially applied to pharmacy students, not every tool found in literature included a pharmacist or a pharmacy student in the validity or reliability testing. Sixteen tools included a pharmacist or a student pharmacist in the psychometric testing, and for 1 tool this aspect was not specified.

No specific tool for the evaluation of pharmacist competency was found and only 3 tools focused on assessing of IPE competency. Furthermore, these 3 tools did not go further

then level 3 of the Kirkpatrick classification, with the consequence of not exploring in a deeper way the effect of IPE competencies on the delivery of care to patients.

3.2 Analysis of Interprofessional Education perception questionnaire

In Section 3.2 results of the questionnaire assessing the students' perception of IPE is described.

3.2.1 Participant demographics

The SPICE-R2 tool was completed before and after the experiential by 61 students: 12 third year pharmacy students, 13 Master in Pharmacy (MPharm) students, 16 first year PharmD students, 10 second year PharmD students and 10 third year PharmD students. Fourteen questionnaires were collected by the researcher. Seventy-seven percent of the questionnaires were completed online. In each group, the number of female students was higher than the male students (Table 3.1).

Table 3.1 Interprofessional Education perception questionnaire - Participant demographics (N=61)

Gender / Year of Study	Male	Female
3rd Year Pharmacy (n=12)	5	7
MPharm (n=13)	4	9
1st Year PharmD (n=16)	3	13
2nd Year PharmD (n=10)	2	8
3rd Year PharmD (n=10)	4	6

3.2.2 Changes in attitude towards Interprofessional Education

For the third-year pharmacy student group, an overall improvement in the mean rating scores for all the items was observed. The improvement was statistically significant ($p=0.046$, $p=0.005$, $p=0.007$) for items 2, 5 and 8, all items related to the Roles/Responsibilities for Collaborative Practice subscale. The largest improvement was seen in item 5 *"I have an understanding of the courses taken by, and training requirements of, other health professionals"* where the mean increased from 2.84 before the IPE, to 3.75 after the experiential (Table 3.2).

Table 3.2 Wilcoxon Signed Ranks Test – 3rd year Pharmacy students mean rating scores for items (N=12)

Item			Mean	Std. Deviation
1	Working with students from different disciplines enhances my education	Before	4.000	0.748
		After	4.250	0.755
2	My role within an interprofessional team is clearly defined*	Before	3.000	0.603
		After	3.330	0.492
3	Patient/client satisfaction is improved when care is delivered by an interprofessional team	Before	4.580	0.514
		After	4.675	0.496
4	Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team	Before	4.420	0.797
		After	4.580	0.518
5	I have an understanding of the courses taken by, and training requirements of, other health professionals*	Before	2.835	0.949
		After	3.750	1.050
6	Healthcare costs are reduced when patients/clients are treated by an interprofessional team	Before	3.250	1.212
		After	3.750	0.456
7	Health professional students from different disciplines should be educated to establish collaborative relationships with one another	Before	4.670	0.494
		After	4.830	0.398
8	I understand the roles of other health professionals within an interprofessional team*	Before	3.335	0.896
		After	4.080	0.514
9	Patient/client-centeredness increases when care is delivered by an interprofessional team	Before	4.420	0.515
		After	4.505	0.522
10	During their education, health professional students should be involved in teamwork with students from different disciplines in order to understand their respective roles	Before	4.670	0.656
		After	4.750	0.457

***p<0.05**

There was a statistically significant improvement in the mean scores of all 3 subscales (p=0.035, p=0.002 and p=0.036) (Table 3.3).

Table 3.3 Wilcoxon Signed Ranks Test – 3rd year Pharmacy students mean scores for subscales/domains (N=12)

Domain		Mean	Std. Deviation
Interprofessional Teamwork and Team-based Practice*	Before	4.435	0.525
	After	4.603	0.405
Roles/Responsibilities for Collaborative Practice*	Before	3.050	0.724
	After	3.724	0.624
Patient Outcomes from Collaborative Practice*	Before	3.975	0.838
	After	4.416	0.385

***p<0.05**

For the Master in Pharmacy group, an overall improvement in the mean rating scores was observed for all items. For items 1, 2, 3, 5, and 9 the improvement was statistically significant (p=0.004, p=0.011, p=0.007, p=0.013 and p=0.024). The largest improvement was seen in item 1 "*Working with students from different disciplines enhances my education*" where the mean increased from 3.16 before the IPE to 4.62 after the experiential (Table 3.4).

Table 3.4 Wilcoxon Signed Ranks Test – Master in Pharmacy students mean rating scores (N=13)

Item			Mean	Std. Deviation
1	Working with students from different disciplines enhances my education*	Before	3.154	1.214
		After	4.615	0.506
2	My role within an interprofessional team is clearly defined*	Before	3.154	0.899
		After	4.385	0.961
3	Patient/client satisfaction is improved when care is delivered by an interprofessional team*	Before	3.615	1.121
		After	4.846	0.376
4	Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team	Before	4.462	0.660
		After	4.231	0.599
5	I have an understanding of the courses taken by, and training requirements of, other health professionals*	Before	3.308	0.630
		After	4.077	0.641
6	Healthcare costs are reduced when patients/clients are treated by an interprofessional team	Before	4.000	0.816
		After	4.077	0.862
7	Health professional students from different disciplines should be educated to establish collaborative relationships with one another	Before	4.615	0.650
		After	4.846	0.376
8	I understand the roles of other health professionals within an interprofessional team	Before	4.308	0.855
		After	4.308	0.635
9	Patient/client-centeredness increases when care is delivered by an interprofessional team*	Before	4.077	0.760
		After	4.769	0.439
10	During their education, health professional students should be involved in teamwork with students from different disciplines in order to understand their respective roles	Before	4.385	0.768
		After	4.692	0.488

***p<0.05**

There was a statistically significant improvement in the mean scores of all 3 subscales (0.005, 0.001 and 0.002) (Table 3.5).

Table 3.5 Wilcoxon Signed Ranks Test – Master in Pharmacy students mean scores for subscales/domains (N=13)

Domain		Mean	Std. Deviation
Interprofessional Teamwork and Team-based Practice*	Before	4.154	0.451
	After	4.596	0.331
Roles/Responsibilities for Collaborative Practice*	Before	3.590	0.53
	After	4.256	0.338
Patient Outcomes from Collaborative Practice*	Before	3.897	0.534
	After	4.564	0.285

***p<0.05**

In the 1st year PharmD students' group, an increase of the mean rating scores in all ten items of the SPICE-R2 tool was assessed. The p-value did not exceed the 0.05 level of significance in items 5, 9 and 10 (0.005, 0.021 and 0.010) (Table 3.6). These items belonged to the three different subscales. The largest improvement was seen in item 5 *"I have an understanding of the courses taken by, and training requirements of, other health professionals"* where the mean changed from 2.74, before the IPE, to 3.74 after the experiential.

Table 3.6 Wilcoxon Signed Ranks Test – 1st year PharmD students mean rating scores (N=16)

Item			Mean	Std. Deviation
1	Working with students from different disciplines enhances my education	Before	4.076	0.706
		After	4.335	0.826
2	My role within an interprofessional team is clearly defined	Before	3.474	0.915
		After	3.877	0.748
3	Patient/client satisfaction is improved when care is delivered by an interprofessional team	Before	4.205	1.156
		After	4.532	0.646
4	Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team	Before	4.075	0.805
		After	4.408	0.918
5	I have an understanding of the courses taken by, and training requirements of, other health professionals*****	Before	2.735	0.805
		After	3.735	0.707
6	Healthcare costs are reduced when patients/clients are treated by an interprofessional team	Before	3.479	0.835
		After	3.831	0.523
7	Health professional students from different disciplines should be educated to establish collaborative relationships with one another	Before	4.532	0.645
		After	4.805	0.564
8	I understand the roles of other health professionals within an interprofessional team	Before	3.204	1.216
		After	3.405	1.355
9	Patient/client-centeredness increases when care is delivered by an interprofessional team*****	Before	4.206	0.862
		After	4.872	0.352
10	During their education, health professional students should be involved in teamwork with students from different disciplines in order to understand their respective roles*****	Before	3.876	1.306
		After	4.871	0.526

***p<0.05**

A significant change (0.015, 0.003 and 0.049) between the beginning and the end of the experiential was measured in in this group in all three subscales. Roles/Responsibilities for Collaborative Practice is still the one with the highest increase between all (Table 3.7).

Table 3.7 Wilcoxon Signed Ranks Test – 1st year PharmD students mean scores for subscales/domains (N=16)

Domain		Mean	Std. Deviation
Interprofessional Teamwork and Team-based Practice*	Before	4.064	0.456
	After	4.606	0.364
Roles/Responsibilities for Collaborative Practice*	Before	2.934	0.514
	After	3.671	0.583
Patient Outcomes from Collaborative Practice*	Before	3.842	0.502
	After	4.163	0.352

***p<0.05**

There was an increase in the mean rating scores in all items of the 2nd year PharmD students' group. However, the increment was not significant in any of the ten items of the questionnaire since the p-values exceeded the 0.05 level of significance. The lowest improvement was seen in items 9 and 10 where both means changed from 4.75 to 4.88 (Table 3.8).

Table 3.8 Wilcoxon Signed Ranks Test – 2nd year PharmD students mean rating scores (N=10)

Item			Mean	Std. Deviation
1	Working with students from different disciplines enhances my education	Before	4.501	1.078
		After	4.884	0.351
2	My role within an interprofessional team is clearly defined	Before	4.001	0.934
		After	4.258	0.714
3	Patient/client satisfaction is improved when care is delivered by an interprofessional team	Before	4.501	0.534
		After	4.758	0.467
4	Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team	Before	4.631	0.747
		After	4.887	0.354
5	I have an understanding of the courses taken by, and training requirements of, other health professionals	Before	3.759	1.288
		After	4.131	1.134
6	Healthcare costs are reduced when patients/clients are treated by an interprofessional team	Before	4.384	0.747
		After	4.509	0.761
7	Health professional students from different disciplines should be educated to establish collaborative relationships with one another	Before	4.381	0.929
		After	4.634	0.746
8	I understand the roles of other health professionals within an interprofessional team	Before	4.386	0.521
		After	4.508	0.761
9	Patient/client-centeredness increases when care is delivered by an interprofessional team	Before	4.750	0.463
		After	4.880	0.352
10	During their education, health professional students should be involved in teamwork with students from different disciplines in order to understand their respective roles	Before	4.750	0.715
		After	4.880	0.354

$p>0.05$

In all 3 subscales there was an increase in the score but the increment was significant in two subscales out of three: Patient Outcomes from Collaborative Practice subscale (p=0.046) and Roles/Responsibilities for Collaborative Practice subscale (p=0.034), the latter with the highest improvement (Table 3.9).

Table 3.9 Wilcoxon Signed Ranks Test – 2nd year PharmD students mean scores for subscales/domains (N=10)

Domain		Mean	Std. Deviation
Interprofessional Teamwork and Team-based Practice	Before	4.722	0.474
	After	4.818	0.378
Roles/Responsibilities for Collaborative Practice*	Before	4.047	0.8249
	After	4.292	0.826
Patient Outcomes from Collaborative Practice*	Before	4.549	0.474
	After	4.712	0.495

***p<0.05**

In the 3rd year PharmD students' group, an increase of the mean rating scores in all ten items of the SPICE-R2 tool was observed. The p-value (0.038, 0.025 and 0.014) did not exceed the 0.05 level of significance in items 1, 5 and 9 (Table 3.10). These items belonged to the three different subscales. The largest improvement was seen in item 9 *"Patient/client-centeredness increases when care is delivered by an interprofessional team"* where the mean changed from 3.81 before the IPE, to 3.40, after the experiential.

Table 3.10 Wilcoxon Signed Ranks Test – 3rd year PharmD students mean rating scores (N=10)

Item			Mean	Std. Deviation
1	Working with students from different disciplines enhances my education*	Before	3.905	0.748
		After	4.708	0.485
2	My role within an interprofessional team is clearly defined	Before	3.407	0.979
		After	3.603	0.845
3	Patient/client satisfaction is improved when care is delivered by an interprofessional team	Before	4.402	0.841
		After	4.705	0.485
4	Participating in educational experiences with students from different disciplines enhances my ability to work on an interprofessional team	Before	3.804	0.929
		After	4.108	1.105
5	I have an understanding of the courses taken by, and training requirements of, other health professionals*	Before	3.105	0.746
		After	3.604	0.976
6	Healthcare costs are reduced when patients/clients are treated by an interprofessional team	Before	3.605	0.703
		After	3.902	0.993
7	Health professional students from different disciplines should be educated to establish collaborative relationships with one another	Before	4.305	0.823
		After	4.609	0.703
8	I understand the roles of other health professionals within an interprofessional team	Before	3.504	0.974
		After	3.704	1.166
9	Patient/client-centeredness increases when care is delivered by an interprofessional team*	Before	3.807	0.428
		After	4.401	0.848
10	During their education, health professional students should be involved in teamwork with students from different disciplines in order to understand their respective roles	Before	4.105	0.998
		After	4.607	0.708

***p<0.05**

There was improvement in all 3 subscales and the increment in the means cores was significant in the Interprofessional Teamwork and Team-based Practice subscale (p=0.042) and Patient Outcomes from Collaborative Practice subscale (p=0.015) since the p-value was less than 0.05 level of significance (Table 3.11).

Table 3.11 Wilcoxon Signed Ranks Test – 3rd year PharmD students mean scores for subscales/domains (N=10)

Domain		Mean	Std. Deviation
Interprofessional Teamwork and Team-based Practice*	Before	4.031	0.738
	After	4.507	0.622
Roles/Responsibilities for Collaborative Practice	Before	3.333	0.689
	After	3.635	0.914
Patient Outcomes from Collaborative Practice*	Before	3.935	0.529
	After	4.936	0.706

***p<0.05**

3.3 Interprofessional Education on Pharmacy Competencies Tool

The tool after validation consisted of 10 competencies divided into 4 different core competencies (Table 3.12): 2 items belonged to the Values-Ethics for Interprofessional Practice, 4 items to the Roles-Responsibilities, 2 items to the Interprofessional Communication and 2 to Teams and Teamwork (Appendix 5).

Table 3.12 Description of IPEPC tool after validation

Core Competencies	Number of Competencies	Description
Values-Ethics for Interprofessional Practice	2	Being able to work with other people in a climate of mutual respect
Roles-Responsibilities	4	Use the knowledge of the different roles to appropriately address the health care needs of patients
Interprofessional Communication	2	Communicate with other professionals in a responsive manner which promotes the delivery of care
Teams and Teamwork	2	Apply relationship-building values plan, deliver, and evaluate person-centered care

The development, validation and testing of the IPEPC tool was summarised in a manuscript submitted to the American Journal of Pharmaceutical Education (Appendix 6).

3.3.1 Reliability of IPEPC tool

The Cronbach's alpha values obtained exceeded the 0.7 threshold value indicating satisfactory internal consistency between the items in each of the four core competencies (Table 3.13).

Table 3.13 Cronbach's alpha statistics for core competencies

Core competencies	Number of competencies	Cronbach's alpha
Values/Ethics for Interprofessional Practice	2	0.757
Roles/Responsibilities	4	0.903
Interprofessional Communication	2	0.922
Teams and Teamwork	2	0.824

The EFA showed that the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.761) exceeded the 0.5 threshold value, while the Bartlett's test of sphericity yielded a p-value (approx. 0) which was less than the 0.05 level of significance, implying that a factor structure existed within the ten observable items.

Table 3.14 shows that all four factors have an eigenvalue larger than 1, thus confirming the existence of a four-factor structure. These four factors explained 75.14% of the total variation in the rating scores provided to the ten items.

Table 3.14 Total variance for IPEPC tool examined

Factor	Rotation Sums of Squared Loadings		
	Eigenvalue	**% Variance**	**Cumulative %**
1	2.435	24.349	24.349
2	1.972	19.720	44.069
3	1.594	15.945	60.013
4	1.513	15.126	75.140
5	0.769	7.691	82.831
6	0.678	6.779	89.610
7	0.467	4.675	94.285
8	0.277	2.770	97.055
9	0.277	2.768	99.823
10	0.018	0.177	100.000

Table 3.15 shows the factor loadings for each factor that exceed the value of 0.4. Factor 1 loads heavily on competencies 3, 4, 5 and 6, representing Roles/Responsibilities, Factor 2 loads heavily on competencies 7 and 8, representing Interprofessional Communication, Factor 3 loads heavily on competencies 1 and 2, representing Values/Ethics for Interprofessional Practice and Factor 4 loads heavily on competencies 9 and 10, representing Cooperation and Teamwork. This statistically validates the developed tool.

Table 3.15 Varimax Rotated Component Matrix

	Factor			
	1	**2**	**3**	**4**
Building a trusting relationship with other professionals who support and deliver health services			0.751	
Contributing to placing the person at the centre of healthcare delivery systems			0.895	
Using each professionals' unique skills to provide safe, timely, efficient and effective care	0.804			
Building interdependent relationships with other professionals to reinforce learning experience	0.805			
Participating in continuous inter-professional education opportunities	0.551			
Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	0.659			
Communicating with other professionals to ensure collaborative decision making		0.616		
Discussing with other professionals involved in person-centred care with confidence, clarity and respect		0.741		
Involving other professionals in shared person-centred care for therapeutic optimisation				0.543
Using advanced strategies which increase the efficiency of teamwork and team-based care				0.889

3.3.2 Participant demographics

The tool was tested in a group of 46 participants enrolled in the Doctorate in Pharmacy course (PharmD) at the University of Malta in different academic years and PharmD alumni graduated in 2020 (Figure 3.1). Thirty-eight respondents were between 21 and 35 years old and the majority were female (n=29). Years of practice of the participants was divided as follows: less than 4 years of practice (n=4), between 2 and 5 years of practice (n=27), between 6 and 10 years of practice (n=9) and more than 10 years of practice (n=6).

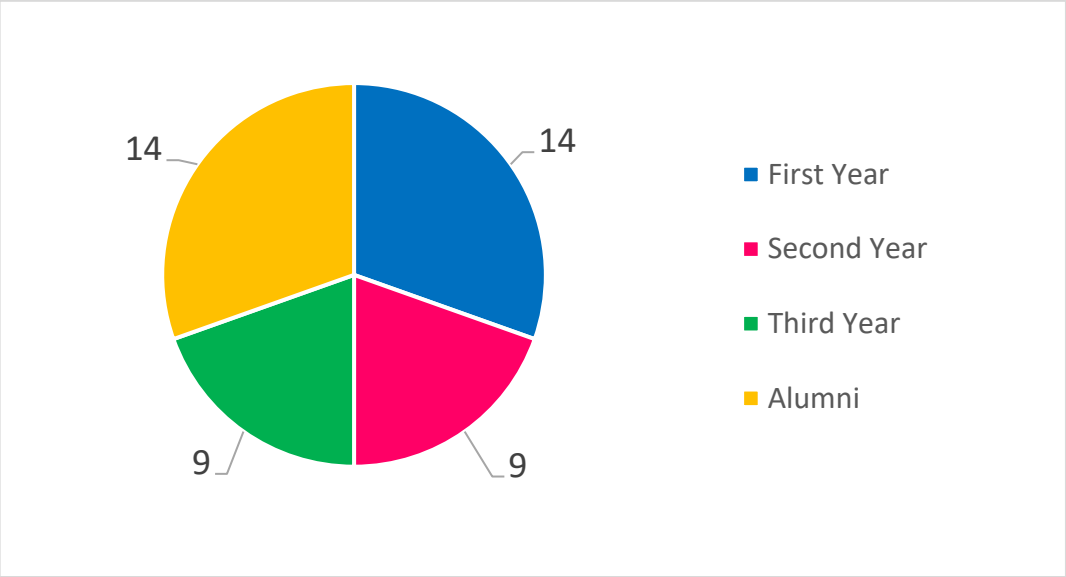

Figure 3.1. Characteristics of participants (N=46)

3.3.3 Evaluation of impact of Interprofessional Education activities on pharmacist's competencies

All the items, hence all core competencies, received a mean score higher than 4.0 indicating the importance of these IPE competencies in pharmacy practice (Table 3.16). The highest score was seen in competency 3 *"Using each professionals' unique skills to provide safe, timely, efficient and effective care"*, while the lowest in competency 10,

"Using advanced strategies which increase the efficiency of teamwork and team-based care" (Table 3.17).

Table 3.16 Mean scores across the four core competencies for all respondents (N=46)

Core competency	**Mean**
Values/Ethics for Interprofessional Practice	4.228
Roles/Responsibilities	4.326
Interprofessional Communication	4.217
Teams and Teamwork	4.196

Table 3.17 Means and standard deviations across items for all respondents (N=46)

	Competency	Mean	Std. Deviation
1	Building a trusting relationship with other professionals who support and deliver health services	4.217	1.094
2	Contributing to placing the person at the centre of healthcare delivery systems	4.239	0.923
3	Using each professionals' unique skills to provide safe, timely, efficient and effective care	4.478	0.888
4	Building interdependent relationships with other professionals to reinforce learning experience	4.261	1.144
5	Participating in continuous interprofessional education opportunities	4.152	1.192
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	4.413	1.066
7	Communicating with other professionals to ensure collaborative decision making	4.174	1.180
8	Discussing with other professionals involved in person-centred care with confidence, clarity and respect	4.261	0.880
9	Involving other professionals in shared person-centred care for therapeutic optimisation	4.283	1.026
10	Using advanced strategies which increase the efficiency of teamwork and team-based care	4.109	1.016

For the first set of analyses, the 4 scores were compared to determine whether there were differences between genders. Even though in all four core competencies, the mean scores provided by males were marginally higher than those provided by females, these differences were not significant since all p-values (0.122. 0.457, 0.333 and 0.267) exceeded the 0.05 level of significance (Table 3.18).

Table 3.18 Mean core competency scores grouped by gender

Core Competency	Gender	Sample size	Mean score	Std. Deviation
Values/Ethics for Interprofessional Practice	Male	11	4.591	0.539
	Female	35	4.114	0.924
Roles/Responsibilities	Male	11	4.636	0.409
	Female	35	4.229	1.073
Interprofessional Communication	Male	11	4.500	0.632
	Female	35	4.129	0.995
Teams and Teamwork	Male	11	4.454	0.723
	Female	35	4.114	0.932

Only for competency number 2, *"Contributing to placing the person at the centre of healthcare delivery systems"*, there was a significant difference between genders (p=0.042) (Table 3.19).

Table 3.19 Mean scores of the ten items grouped by gender

Competency		Gender	Sample size	Mean score	Std. Deviation
1	Building a trusting relationship with other professionals who support and deliver health services	Male	11		0.688
		Female	35	4.14	1.192
2	Contributing to placing the person at the centre of healthcare delivery systems*	Male	11	4.73	0.467
		Female	35	4.09	0.981
3	Using each professionals' unique skills to provide safe. timely. efficient and effective care	Male	11	4.55	0.820
		Female	35	4.46	0.919
4	Building interdependent relationships with other professionals to reinforce learning experience	Male	11	4.82	0.405
		Female	35	4.09	1.245
5	Participating in continuous interprofessional education opportunities	Male	11	4.45	0.688
		Female	35	4.06	1.305
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	Male	11	4.73	0.467
		Female	35	4.31	1.183
7	Communicating with other professionals to ensure collaborative decision making	Male	11	4.45	0.688
		Female	35	4.09	1.292
8	Discussing with other professionals involved in person-centred care with confidence. clarity and respect	Male	11	4.55	0.688
		Female	35	4.17	0.923
9	Involving other professionals in shared person-centred care for therapeutic optimisation	Male	11	4.36	0.924
		Female	35	4.26	1.067
10	Using advanced strategies which increase the efficiency of teamwork and team-based care	Male	11	4.55	0.688
		Female	35	3.97	1.071

***p<0.05**

For the second set of analyses, the participants were clustered according to age. Students between 21 and 35 years old provided the highest scores in all the items but these differences were significant only for competency number 2, *"Contributing to placing the person at the centre of healthcare delivery systems"*, and 9, *"Involving other professionals in shared person-centred care for therapeutic optimisation"* (Table 3.20).

Table 3.20 Mean scores of the ten items grouped by age

Competency		Age (years)	Sample size	Mean score	Std. Deviation
1	Building a trusting relationship with other professionals who support and deliver health services	21-35	38	4.421	0.722
		36-45	5	3.200	2.049
		46-55	3	3.333	2.082
2	Contributing to placing the person at the centre of healthcare delivery systems*	21-35	38	4.368	0.913
		36-45	5	3.600	0.894
		46-55	3	3.667	0.577
3	Using each professionals' unique skills to provide safe, timely, efficient and effective care	21-35	38	4.632	0.633
		36-45	5	3.600	1.517
		46-55	3	4.000	1.732
4	Building interdependent relationships with other professionals to reinforce learning experience	21-35	38	4.447	0.795
		36-45	5	3.200	2.049
		46-55	3	3.667	2.309
5	Participating in continuous interprofessional education opportunities	21-35	38	4.368	0.883
		36-45	5	2.800	1.789
		46-55	3	3.667	2.309
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	21-35	38	4.658	0.582
		36-45	5	3.200	2.049
		46-55	3	3.333	2.082
7	Communicating with other professionals to ensure collaborative decision making	21-35	38	4.342	0.878
		36-45	5	3.200	2.049
		46-55	3	3.667	2.309
8	Discussing with other professionals involved in person-centred care with confidence, clarity and respect	21-35	38	4.368	0.751
		36-45	5	3.600	1.140
		46-55	3	4.000	1.732
9	Involving other professionals in shared person-centred care for therapeutic optimisation	21-35	38	4.474	0.862
		36-45	5	3.200	1.304
		46-55	3	3.667	1.528
10	Using advanced strategies which increase the efficiency of teamwork and team-based care	21-35	38	4.237	0.998
		36-45	5	3.200	0.837
		46-55	3	4.000	1.000

p<0.05

A significant difference was seen in the Teams and Teamwork core competency (p= 0.026) (Table 3.21).

Table 3.21 Mean core competency scores grouped by age

Core Competency	Age (years)	Sample size	Mean score	Std. Deviation
Values/Ethics for Interprofessional Practice	21-35	38	4.395	0.669
	36-45	5	3.400	1.387
	46-55	3	3.500	1.323
Roles/Responsibilities	21-35	38	4.526	0.538
	36-45	5	3.200	1.841
	46-55	3	3.667	2.097
Interprofessional Communication	21-35	38	4.355	0.697
	36-45	5	3.400	1.432
	46-55	3	3.833	2.021
Teams and Teamwork*****	21-35	38	4.355	0.788
	36-45	5	3.200	0.975
	46-55	3	3.833	1.155

***p<0.05**

Regarding Teams and Teamwork and the Values/Ethics for Interprofessional Practice core competency, a significance difference was observed between different years of the doctorate students (p=0.026. p=0.037) with the second and third year having the highest scores (M=4.611. M=4.667) (Table 3.23).

Table 3.22 Mean scores of the ten items grouped by year of study

Competency		Year of study	Sample size	Mean score	Std. Deviation
1	Building a trusting relationship with other professionals who support and deliver health services	First year	14	4.214	0.893
		Second year	9	4.556	0.726
		Third year	9	4.667	0.500
		Alumni	14	3.714	1.541
2	Contributing to placing the person at the centre of healthcare delivery systems	First year	14	3.929	1.207
		Second year	9	4.778	0.441
		Third year	9	4.667	0.500
		Alumni	14	3.929	0.829
3	Using each professionals' unique skills to provide safe, timely, efficient and effective care	First year	14	4.714	0.469
		Second year	9	4.556	0.882
		Third year	9	4.889	0.333
		Alumni	14	3.929	1.207
4	Building interdependent relationships with other professionals to reinforce learning experience	First year	14	4.429	0.756
		Second year	9	4.889	0.333
		Third year	9	4.444	1.014
		Alumni	14	3.571	1.555
5	Participating in continuous interprofessional education opportunities	First year	14	4.071	1.207
		Second year	9	4.556	0.527
		Third year	9	4.444	0.726
		Alumni	14	3.786	1.626
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	First year	14	4.643	0.633
		Second year	9	4.889	0.333
		Third year	9	4.667	0.500
		Alumni	14	3.714	1.590
7	Communicating with other professionals to ensure collaborative decision making	First year	14	4.286	1.069
		Second year	9	4.667	0.707
		Third year	9	4.444	0.726
		Alumni	14	3.571	1.555
8	Discussing with other professionals involved in person-centred care with confidence, clarity and respect	First year	14	4.071	0.917
		Second year	9	4.778	0.441
		Third year	9	4.444	0.527
		Alumni	14	4.000	1.109
9	Involving other professionals in shared person-centred care for therapeutic optimisation	First year	14	4.429	1.089
		Second year	9	4.556	0.527
		Third year	9	4.667	0.500
		Alumni	14	3.714	1.267
10	Using advanced strategies which increase the efficiency of teamwork and team-based care	First year	14	4.000	1.177
		Second year	9	4.667	0.500
		Third year	9	4.556	1.014
		Alumni	14	3.571	0.852

$p>0.05$

Table 3.23 Mean core competency scores grouped by year of study

Core Competency	Year of study	Sample size	Mean score	Std. Deviation
Values/Ethics for Interprofessional Practice*	First year	14	4.071	0.805
	Second year	9	4.667	0.559
	Third year	9	4.667	0.433
	Alumni	14	3.821	1.085
Roles/ Responsibilities	First year	14	4.464	0.664
	Second year	9	4.722	0.292
	Third year	9	4.611	0.486
	Alumni	14	3.750	1.438
Interprofessional Communication	First year	14	4.179	0.775
	Second year	9	4.722	0.507
	Third year	9	4.444	0.583
	Alumni	14	3.786	1.267
Teams and Teamwork*	First year	14	4.214	0.871
	Second year	9	4.611	0.486
	Third year	9	4.611	0.697
	Alumni	14	3.643	0.989

***p<0.05**

The last set of analyses, which resulted in no statistically significant findings, compared each core competency score to determine whether there were differences across years of practice (Table 3.24) and area of practice (Table 3.26).

Table 3.24 Mean scores of the ten items grouped by years of practice

Competency		Years of practice	Sample size	Mean score	Std. Deviation
1	Building a trusting relationship with other professionals who support and deliver health services	<2	4	5.000	0.000
		2-5	27	4.222	0.974
		6-10	9	4.111	1.364
		>10	6	3.833	1.472
2	Contributing to placing the person at the centre of healthcare delivery systems	<2	4	4.750	0.500
		2-5	27	4.259	0.984
		6-10	9	4.222	0.972
		>10	6	3.833	0.753
3	Using each professionals' unique skills to provide safe, timely, efficient and effective care	<2	4	5.000	0.000
		2-5	27	4.444	0.847
		6-10	9	4.444	1.014
		>10	6	4.333	1.211
4	Building interdependent relationships with other professionals to reinforce learning experience	<2	4	4.750	0.500
		2-5	27	4.296	1.068
		6-10	9	4.111	1.364
		>10	6	4.000	1.549
5	Participating in continuous interprofessional education opportunities	<2	4	5.000	0.000
		2-5	27	4.222	1.121
		6-10	9	3.889	1.364
		>10	6	3.667	1.506
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	<2	4	5.000	0.000
		2-5	27	4.556	0.847
		6-10	9	4.222	1.394
		>10	6	3.667	1.506
7	Communicating with other professionals to ensure collaborative decision making	<2	4	4.750	0.500
		2-5	27	4.074	1.141
		6-10	9	4.333	1.323
		>10	6	4.000	1.549
8	Discussing with other professionals involved in person-centred care with confidence, clarity and respect	<2	4	4.750	0.500
		2-5	27	4.185	0.921
		6-10	9	4.556	0.527
		>10	6	3.833	1.169
9	Involving other professionals in shared person-centred care for therapeutic optimisation	<2	4	5.000	0.000
		2-5	27	4.259	1.059
		6-10	9	4.444	1.014
		>10	6	3.667	1.033
10	Using advanced strategies which increase the efficiency of teamwork and team-based care	<2	4	5.000	0.000
		2-5	27	4.074	1.072
		6-10	9	4.111	0.928
		>10	6	3.667	1.033

$p>0.05$

Despite not being significant, students with less than 2 years of experience (Table 3.24) seemed to highly agree on the fact the IPE has helped them to achieve the competencies listed in the IPEPC.

On the contrary, students and alumni with more than 10 years of experience provided the lowest scores across all the four domains with mean scores lower the 4 (Table 3.25).

Table 3.25 Mean core competency scores grouped by years of practice

Core Competency	Years of practice	Sample size	Mean score	Std. Deviation
Values/Ethics for Interprofessional Practice	<2	4	4.875	0.250
	2-5	27	4.241	0.789
	6-10	9	4.167	1.090
	>10	6	3.833	1.033
Roles/Responsibilities	<2	4	4.938	0.125
	2-5	27	4.380	0.824
	6-10	9	4.167	1.225
	>10	6	3.917	1.393
Interprofessional Communication	<2	4	4.750	0.500
	2-5	27	4.130	0.916
	6-10	9	4.444	0.808
	>10	6	3.917	1.320
Teams and Teamwork	<2	4	5.000	0.564
	2-5	27	4.167	0.899
	6-10	9	4.278	0.87
	>10	6	3.667	0.931

$p>0.05$

Scores provided by students and alumni who have practiced in regulatory setting are the lowest throughout the 4 domains of the IPEPC. In particular, Teams and Teamwork received the lowest score with 3.676 (Table 3.27).

Table 3.26 Mean core competency scores grouped by area of practice

Core Competency	Area of practice	Sample size	Mean score	Std. Deviation
Values/Ethics for Interprofessional Practice	Community	39	4.179	0.921
	Hospital	2	4.231	0.904
	Academia	3	4.333	1.012
	Regulatory	2	3.824	1.045
Roles/Responsibilities	Community	39	4.263	1.032
	Hospital	2	4.288	1.084
	Academia	3	4.350	1.298
	Regulatory	2	3.735	1.291
Interprofessional Communication	Community	39	4.115	0.963
	Hospital	2	4.077	1.058
	Academia	3	4.233	1.100
	Regulatory	2	3.853	1.115
Teams and Teamwork	Community	39	4.128	0.937
	Hospital	2	4.231	0.807
	Academia	3	4.433	0.884
	Regulatory	2	3.676	0.951

$p>0.05$

Chapter 4:

Discussion

4.1 Evaluation and assessment in Interprofessional Education

Currently many methods and ways to approach IPE are available in literature and they continue to develop. Hence the need for assessment keeps expanding and more information and studies are sought.[4]

Despite the large number of specific quantitative measurement tools for assessing IPE being available in the literature and continuing to expand, literature on IPE assessment strategies that apply to pharmacy education is lacking (Shrader et al, 2017). Presently, the assessment of Level 1 and 2 of the Kirkpatrick model, reaction and attitude, is not recommended and experts suggest including higher order assessments, such as impact of IPE on behaviours and patient outcomes, in developing a new tool (Reeves et al 2015; Thistlewaite et al, 2015).

From the literature scoping exercise performed, thirty-six assessment tools were available to measure IPE that include or are applicable to pharmacists or pharmacy students. Some of these tools could be used to measure IPE in an individual and/or in a group of different people or team.

The majority of available tools found in literature assess behavioral change, the Kirkpatrick level 3. Each of the tools listed in Appendix 4 has advantages and disadvantages. Currently, there exists no single comprehensive tool to fulfill assessment needs for appropriately assessing IPE competencies (Shrader et al,2017). Despite, several tools available to measure aspects that can be mapped to fundamental aspects of IPE, different types of tools and approaches are still needed to inform the IPE evaluation field and thus contribute substantively to the need for evidence (Blue et al, 2015).

4.2 Perception of pharmacy students on Interprofessional Education

Improved healthcare outcomes can be obtained through interprofessional practice when planned and coordinated person-centred care is accessible by all patients (Brandt et al, 2014). Pharmacy is part of the primary healthcare system hence pharmacists must be able to effectively communicate with other primary care providers. Pharmacists are considered valuable members of the healthcare team, who are able to promote and coordinate overall health and well-being (Azzopardi & Serracino-Inglott, 2020).

IPE is a crucial first step towards developing future healthcare professionals who understand their own responsibilities and the responsibilities of other practitioners within the collaborative team (McGregor & Lannin, 2018).

A more effective evaluation of IPE is required to determine its impact on interprofessional collaboration and to provide a more effective basis on how to apply IPE in clinical settings (Lockerman et al, 2017). That is why, one objective of this study was to explore the perception of students who completed IPE activities to help to understand how this learning may shape future practice and the composition and timing of IPE.

Consistent with other studies, quantitative data demonstrated that students' perception about interprofessional education was generally more positive following an IPE activity (Abu-Rish et al, 2012; Blue et al, 2015; Matulewicz et al, 2020). In all groups of students, the scores for all items, and the scores for the three subscales of the SPICE-R2 instrument, increased following the experiential activity. In particular, the largest difference in mean score was observed in the Roles/Responsibilities for Collaborative Practice subscale, followed by the Interprofessional Teamwork and Team-based Practice subscale and

Patient Outcomes from Collaborative Practice subscale in the first three groups of students which were the third year undergraduate pharmacy students' group, MPharm group and first year PharmD students' group. In addition, all the improvements were statistically significant for these groups.

The results of the study largely in line with previous studies where the SPICE-R2 instrument was used, where among the three subscales, the change in student attitudes toward interprofessional roles and responsibilities was the greatest (Matulewicz et al, 2020; Muzyk et al, 2020). Despite other studies demonstrating a significant change found only in the Roles/Responsibilities for Collaborative Practice and Patient Outcomes from Collaborative Practice subscales of the instrument, in our study, significant change in students' attitudes toward interprofessional Teamwork was observed in the third-year undergraduate pharmacy, MPharm and first year PharmD students and also 3rd year PharmD students (Brock et al, 2020).

The largest improvement noted in younger students regarding the perception of their role, and the roles of other healthcare professionals, may demonstrate the importance of tackling these IPE aspects during the early years of study. With early IPE experiences, pharmacy students' professional characteristics may change from ones based on individual work in a community background to considering themselves as part of broad networks of care that include different settings and as integral members of clinical care teams (Matulewicz et al, 2020). Utilisation of IPE activities along with reliable tools can benefit early learners in discovering their future professional identities as healthcare

workers and members of an interprofessional and multidisciplinary team (McGregor et al, 2018).

In the two other groups of students, consisting of second and third year PharmD students, the increase in scores did not appear to have a specific trend, however, aspects related to patient outcomes and team-based practice seemed more highlighted in these two doctorate years. In general, statistically significant differences in all three subscales is an important outcome as it indicates a shift in three foundational IPE constructs (Blue et al, 2015).

In a longitudinal study, Curran et al demonstrated that the greatest impact of IPE can be accomplished when students are continually exposed to IPE, both in early years of their study and throughout the whole university curriculum (Curran et al, 2010). Since the third year of the bachelor course in Pharmacy offered by the University of Malta, students are involved in IPE activities in different settings, such as in community pharmacy, hospitals, pharmaceutical administrative institutions, pharmaceutical regulatory sciences and the pharmaceutical industry, demonstrating how IPE can be found in all settings and not only, as may be suggested, in the hospital setting. This early exposition to different interprofessional environments, allowed students to deal with various situations which, most of the time, could not be approached alone.

The responses obtained in the questionnaire from early learners, such as bachelor and master students, showed how IPE has helped them to face these new and complex issues. This exposition to IPE is further developed during the MPharm course and for those

students who decide to progress further with their studies, the Doctorate in Pharmacy course offers many opportunities to be involved in IPE learning experiences, granting students to be involved in a larger number of IPE activities during their academic time. Curricular changes and development, together with a better understanding of effective ways to promote collaborative proactive among various healthcare professions, could prove to beneficial for pharmacy students and, in general, to those aiming for a career in healthcare.

4.3 Effects of Interprofessional Education on pharmacy practice

The research led to the development and testing of an innovative tool, the IPEPC, to assess the impact of IPE on pharmacy competencies.

Preparing future healthcare professionals for person centred and team-based care and therefore improving patient outcomes is one of the goals of the competencies and implementation recommendations published by the IPEC. This requires shifting toward a more interactive learning method which involves students of different professions and requires new tools to measure the effect of these new set of competencies.

In the IPEPC tool, high internal consistency between the statements in each core competency was measured, confirming that the tool was valid and reliable. Based on the data collected from PharmD students and alumni, all statements of the tool received a mean score higher than 4, showing that IPE played a crucial role in helping the participants to achieve IPE competencies. The Roles/Responsibilities core competency received the highest score, demonstrating the impact of IPE on the role of pharmacists within the healthcare team. In the Teams and Teamwork core competency, the lowest

score was observed, suggesting that achieving these competencies through IPE may be more difficult. In this core competency, significant differences were observed between participants of different age groups and years of study. Participants between 21 and 35 years of age considered the role of IPE in the development of competencies related to team dynamics and teamwork as very important, while older participants demonstrated a lower level of agreement.

Although prior studies of tools for measuring interprofessional competencies have not found significant differences as students progressed through training (Dow et al, 2014), when participants were stratified according to year of doctoral studies, a significant change was seen in both Values/Ethics for Interprofessional Practice ($p=0.037$) and Teams and Teamwork ($p=0.026$) core competencies. The highest agreement resulted in second and third-year students, both with a score of 4.67 for the first core competency and 4.61 for the second core competency.

The competencies listed in the IPEC were kept flexible and general in nature to help the implementation in different institutions. This would allow IPE staff and faculty members to keep their programs and IPE activities aligned with the statements presented in the report but, at the same time, would have given enough space to the institutions to tailor those competencies for a particular context and profession.

Even though the IPEC competencies should be achieved by every healthcare professional, a profession-specific nature of the tool was sought to deeper investigate the impact of IPE on the care delivered by pharmacists (Cox et al, 2016). Being able to detect different

"shades" may lead to changes in pharmacy curricula affecting services towards person-centred care (Dash & Monaghan, 2015).

Assessment is considered one of the foundations of learning and educational activities. In literature there are numerous ways in which assessment can be performed. Regardless, all these ways have gone "from expert authority-based models to a critical model based on democratisation of university education and the principle of student responsibility for learning and, therefore, assessment" (Siles-González & Solano-Ruiz, 2016). This change became particularly significant for self-assessment tools. This type of assessment can develop in students' critical thinking, a crucial element for both their academic and future professional careers, where analysing and dealing with problems is very common.
The specific self-assessment nature of the tool was sought for all these reasons even though some authors suggest developing future tools based on external observation (Shrader et al, 2017).

Despite the possibility of being argued that a self-assessment tool may not be the most objective way to measure IPE competencies, it must be noted that being able to assess one's own skills is a skill in itself; it requires objectivity, self-motivation, experience and good understanding of the competencies involved, all elements that every healthcare professional should have or should achieved during his/her career.

Furthermore, a self-assessment tool like the IPEPC, offers a quick and simple administration. It does not require additional resources such as academic staff or new equipment and this may allow for saving of funding and valuable time for the researcher (Jung et al, 2015).

Lastly, this type of assessment tool may also be used with new and innovative learning methodologies. The past year has been an excellent and crucial example of how critical the use of a self-assessment tool may be. Due to the COVID-19 pandemic many faculties and universities shifted their courses towards e-learning approaches. This sometimes resulted in organisational and logistic obstacles, in particular for experientials, internships, practical lessons, point of care testing courses and many others. In these more complex situations, where an evaluation from an external preceptor may not be used or may be more difficult to achieve, the use of a method where the student evaluated him/herself is optimal to overcome these obstacles.

4.4 Limitations

Limitations related to the study design should be considered. A convenience sample at a single site was used and it may limit generalisability of the findings. Although a high response rate was observed in both parts of the study, a larger sample size may be used to increase the power of the study. It should be noted that the p-value depends on the sample size and it is very unlikely to get statistical significance when the sample size is small (less than 30) unless the difference in the mean rating scores are large.

Regarding the SPICE-R2 tool, although its psychometric properties have been revised and established, and crucial measurements of early learners' attitudes of IPE have been produced, it remains unclear whether mean scores obtained from students are correlated with consequent acquisition of interprofessional collaborative skills.

Despite these potential limitations, the findings demonstrate that students overall reported having significantly more positive perceptions about IPE after completing the experiential activity, and that the impact of IPE is crucial to develop pharmacist competencies.

4.5 Recommendations for further studies

The positive result obtained from the SPICE-R2, could serve as a stimulus for further studies by disseminating the instrument to students from different healthcare profession courses, such as nurses and medical doctors, to further investigate the perception of IPE among Maltese students. Moreover, it can also be explored whether a particular setting for the experiential may influence and impact on students' perception towards IPE.

Future research should involve dissemination of the IPEPC tool to other schools of pharmacy, to refine the instrument and to further establish the applicability and usability of this innovative assessment tool for the impact of IPE on pharmacy practice. Finally, new specific professions tools might be sought to further explore and establish the role of the interprofessional competencies in different professions.

4.6 Conclusion

Perception of IPE appears to be very positive in pharmacy students across different years of study. This has led to a change in three foundational IPE constructs, demonstrating the important outcome of this study.

An innovative instrument to assess pharmacy competencies, the IPEPC, was developed and demonstrated elevated psychometric properties. The tool was deemed reliable and

accepted. The research puts forward a signal that teamwork and ethics competencies may be positively influenced as students' progress in their pharmacy studies.

This study has provided an understanding of students and alumni perspectives on IPE and how it can impact practice. Through this understanding proposals for opportunities to elaborate IPE activities in pharmacy education can be identified.

References

Abu-Rish E, Kim S, Choe L, Varpio L, Malik E, White AA et al. Current trends in interprofessional education of health sciences students: a literature review. J Interprof Care. 2012;26(6):444-451.

Altin SV, Tebest R, Kautz-Freimuth S, Redaelli M, Stock S. Barriers in the implementation of interprofessional continuing education programs – a qualitative study from Germany. BMC Medical Education. 2014; 14:227.

Azzopardi LM, Serracino-Inglott A. Clinical pharmacy education and practice evolvement in Malta. J Am Coll Clin Pharm. 2020:1–7.

Blue AV, Chesluk BJ, Conforti LN, Holmboe ES. Assessment and evaluation in interprofessional education: exploring the field. J Allied Health. 2015;44(2):73-82.

Bookey-Bassett S, Markle-Reid M, Mckey CA, Akhtar-Danesh N. Understanding interprofessional collaboration in the context of chronic disease management for older adults living in communities: a concept analysis. J Adv Nurs. 2017; 73(1): 71–84.

Brandt B, Lutfiyya MN, King JA, Chioreso CA. Scoping review of interprofessional collaborative practice and education using the lens of the triple aim. J Interprof Care. 2014; 28(5):393–9.

Brock T, Vu T, Kadirvelu A, Lee CY, Kent F. Implementing a collaborative medicine and pharmacy educational activity in two countries. Med Educ Online. 2020;25(1):1780697.

Cox M, Cuff P, Brandt B, Reeves S, Zierler B. Measuring the impact of interprofessional education on collaborative practice and patient outcomes. J Interprof Care. 2016; 30(1): 1–3.

Curran VR, Sharpe D, Flynn K, Button P. A longitudinal study of the effect of an interprofessional education curriculum on student satisfaction and attitudes towards interprofessional teamwork and education. J Interprof Care. 2010;24(1):41–52.

Curren VR, Sharpe D, Forristal J, Flynn K. Attitudes of health science students towards interprofessional teamwork and education. Learn Health Soc Care. 2008; 7:146-156.

Darlow B, Coleman K, McKinlay E, Donovan S, Beckingsale L, Gray B et al. The positive impact of interprofessional education: a controlled trial to evaluate a programme for health professional students. BMC Medical Education. 2015; 15:98.

Dow AW, Diaz Granados D, Mazmanian PE, Retchin SM. An exploratory study of an assessment tool derived from the competencies of the interprofessional education collaborative. J Interprof Care. 2014; 28(4): 299–304.

Dyess AL, Brown JS, Brown ND, Flautt KM, Barnes LJ. Impact of interprofessional education on students of the health professions: a systematic review. J Educ Eval Health Prof. 2019; 16:33.

Fox L, Onders R, Hermansen-Kobulnicky CJ, Nguyen TN, Myran L, Linn B, et al. Teaching interprofessional teamwork skills to health professional students: A scoping review. J Interprof Care. 2018; 32:127-135.

Garcia-Cardenas V, Benrimoj SI, Ocampo CC, Goyenechea E, Martinez-Martinez F, Gastelurrutia MA. Evaluation of the implementation process and outcomes of a professional pharmacy service in a community pharmacy setting. A case report. Res Soc Adm Pharm. 2017; 13:614–627.

Groessl JM, Vandenhouten CL. Examining Students' Attitudes and Readiness for Interprofessional Education and Practice. Educ Res Int. 2019; 2019.

Guraya SY, Barr H. The effectiveness of interprofessional education in healthcare: A systematic review and meta-analysis. Kaohsiung J Med Sci. 2018; 34:160-165.

Harper JC. IPEC's core competency 2 roles and responsibilities: What more do we need to implement these? J Nurs Educ Pract. 2019; 9(7): 46–55.

Hertweck ML, Hawkins SR, Bednarek ML, Goreczny AJ, Schreiber JL, Sterrett SE. Attitudes toward interprofessional education: comparing physician assistant and other health care professions students. J Physician Assist Educ. 2012; 23(2):8-15.

Iverson L, Bredenkamp N, Carrico C, Connelly S, Hawkins K, Monaghan MS et al. Development and Assessment of an Interprofessional Education Simulation to Promote Collaborative Learning and Practice. J Nurs Educ. 2018 1;57(7):426-429.

Jung S, Wollmer MA, Kruger TH. The Hamburg-Hannover Agitation Scale (H2A): Development and validation of a self-assessment tool for symptoms of agitation. J Psychiatr Res. 2015; 69:158-165.

Kenaszchuk C. An inventory of quantitative tools measuring interprofessional education and collaborative practice outcomes. J Interprof Care. 2013; 27:101-103.

Kim J, Lee H, Kim IS, Lee TW, Kim GS, Cho E et al. Interprofessional global health competencies of South Korean health professional students: educational needs and strategies. BMC Med Educ. 2019; 19:429.

Lockeman KS, Dow AW, Diaz Granados D, McNeilly DP, Nickol D, Koehn ML et al. Refinement of the IPEC Competency Self-Assessment survey: Results from a multi-institutional study. J Interprof Care. 2016; 30 (6): 726-731.

Lockeman KS, Dow AW, Randell AL. Validity evidence and use of the IPEC Competency Self-Assessment, Version 3. J Interprof Care. 2020; 35(1):107-113.

Lockeman, KS, Lanning SK, Dow AW, Zorek JA, DiazGranados D, Ivey CK et al. Outcomes of Introducing Early Learners to Interprofessional Competencies in a Classroom Setting. Teach Learn Med. 2017; 29(4): 433–443.

Martinez IL, Pfeifle AL, Ballard JA. Framing Competency-based Assessment for Interprofessional Education. Med Sci Educ. 2013; 23(3S):562-565.

Matulewicz AT, Lanning SK, Lockeman K, Frankart LM, Peron EP, Powers K, et al. Using a Mixed Methods Approach to Explore Perceptions of Early Learners in Classroom-Based Interprofessional Education Experiences. Am J Pharm Educ. 2020;84(5):7693.

McGregor MR, Lanning SK, Lockeman KS. Dental and Dental Hygiene Student Perceptions of Interprofessional Education. J Dent Oral Hyg. 2018;92(6):6-15.

Michalec B, Giordano C, Pugh B, Arenson C, Speakman E. Health Professions Students' Perceptions of Their IPE Program: Potential Barriers to Student Engagement with IPE Goals. J Allied Health. 2017; 46(1):10-20.

Muzyk A, Mullan P, Andolsek K, Derouin A, Smothers Z, Sanders C, et al. A Pilot Interprofessional Course on Substance Use Disorders to Improve Students' Empathy and Counseling Skills. Am J Pharm Educ. 2020;84(4):7415.

Ocampo CC, Garcia-Cardenas V, Martinez-Martinez F, Benrimoj SI, Amariles P, Gastelurrutia, MA. Implementation of medication review with follow-up in a Spanish community pharmacy and its achieved outcomes. Int J Clin Pharm. 2015; 37: 931–940.

Paull M, Whitsed C, Girardi A. Applying the Kirkpatrick model: Evaluating an Interaction for Learning Framework curriculum intervention. IIER. 2016; 26 (3): 490-507.

Patel N, Begum S, Kayyali R. Interprofessional Education (IPE) and Pharmacy in the UK. A Study on IPE Activities across Different Schools of Pharmacy. Pharmacy. 2016; 4(4): 28.

Pecukonis E, Doyle O, Bliss DL. Reducing barriers to interprofessional training: Interprofessional cultural competence. J. Interprof. Care. 2008; 22(4): 417–428.

Reeves S, Boet S, Kitto S. Interprofessional education and practice guide no. 3: evaluating interprofessional education. J Interprof Care. 2015;29(4):305-12.

Risling-de Jong R, Styron Jr RA, Styron JL. Designing Effective Interprofessional Education and Collaborative Practice Experiences. JSCI. 2016; 14 (6):22-27.

Rouse MJ, Meštrović A. Learn Today–Apply Tomorrow: The SMART Pharmacist Program. Pharmacy 2020; 8(3):139.

Rowthorn V, Olsen J. All together now: developing a team skills competency domain for global health education. J Law Med Ethics. 2014; 42(4):550–63.

Shrader S, Farland MZ, Danielson J, Sicat B, Umland EM. A Systematic Review of Assessment Tools Measuring Interprofessional Education Outcomes Relevant to Pharmacy Education. Am J Pharm Educ. 2017;81(6):119.

Siles-González J, Solano-Ruiz C. Self-assessment, reflection on practice and critical thinking in nursing students. Nurse Educ Today. 2016; 45:132-137.

Sloane H, Haas K. Interprofessional pedagogy in community settings: An autoethnographic study. Qual Soc Work. 2020; 19(5–6): 810–826.

Thistlewaite J, Kumar K, Moran M, Saunders R, Carr S. Exploratory review of pre-qualification interprofessional education evaluations. J Interprof Care. 2015;29(4):292-297.

Trivedi D, Goodman C, Gage H, Baron N, Scheibl F, Iliffe S et al. The effectiveness of inter-professional working for older people living in the community: a systematic review. Health Soc. Care Community. 2013; 21(2): 113–128.

West C, Graham L, Palmer RT, Miller MF, Thayer EK, Stuber ML et al. Implementation of interprofessional education (IPE) in 16 U.S. medical schools: Common practices, barriers and facilitators. J Interprof Educ Pract. 2016; 4:41-49.

Zorek JA, Fike DS, Eickhoff JC, Engle JA, MacLaughlin EJ, Dominguez DG et al. Refinement and validation of the student perceptions of physician-pharmacist interprofessional clinical education instrument. Am J Pharm Educ. 2016;80(3):47.

Appendices

Appendix 1: Permission to use the SPICE-R2 tool

L-Università ta' Malta

Alessandro Zaccomer <alessandro.zaccomer.18@um.edu.mt>

Info SPICE-R fee

Zorek, Joseph A <zorek@uthscsa.edu> 13 February 2020 at 12:21
To: Alessandro Zaccomer <alessandro.zaccomer.18@um.edu.mt>

Hello Alessandro,

The only condition is to include attribution in your work through the normal citation/referencing process. The tool is open for all to use and there is no fee. Good luck!

Joe

Get Outlook for iOS

From: Alessandro Zaccomer <alessandro.zaccomer.18@um.edu.mt>
Sent: Thursday, February 13, 2020 1:23:26 AM
To: Zorek, Joseph A <zorek@uthscsa.edu>
Subject: Info SPICE-R fee

[Quoted text hidden]

Appendix 2: Ethics Approval

L-Università ta' Malta

Alessandro Zaccomer <alessandro.zaccomer.18@um.edu.mt>

FRECMDS_1920_157 - FOR RECORDS

3 messages

FACULTY RESEARCH ETHICS COMMITTEE <research-ethics.ms@um.edu.mt> 17 July 2020 at 09:54
To: Alessandro Zaccomer <alessandro.zaccomer.18@um.edu.mt>
Cc: "Lilian M. Azzopardi" <lilian.m.azzopardi@um.edu.mt>, Francesca Wirth <francesca.wirth@um.edu.mt>

Dear Alessandro Zaccomer,

Document received with thanks.

L-Università ta' Malta

Ruth Stivala | Secretary
B.A.(Hons)(Melit.),M.A.(Melit.)

Faculty Research Ethics Committee
Faculty of Medicine and Surgery
Medical School, Mater Dei Hospital
+356 2340 1214

https://www.um.edu.mt/ms/students/researchethics

On Mon, 13 Jul 2020 at 17:24, Alessandro Zaccomer <alessandro.zaccomer.18@um.edu.mt> wrote:

> Dear Ms. Stivala,
>
> I hope this email finds you well.
>
> Kindly find attached the last document which completes my application for the ethics approval.
>
> Thank you again for the help.
>
> Best regards,
> Alessandro Zaccomer
>
> On Fri, 20 Mar 2020 at 10:40, FACULTY RESEARCH ETHICS COMMITTEE <research-ethics.ms@um.edu.mt> wrote:
>
> > Dear Alessandro Zaccomer,
> >
> > Documentation received with thanks.
> >
> > Since your application is self-assessed, FREC will keep your application for filing and it will not review your application.
> >
> > You may proceed with your study.
> >
> > Any ethical and legal issues including data protection issues are your responsibility and that of the supervisor.
> >
> > Ms Ruth Stivala
> > Secretary
> > Faculty Research Ethics Committee
> >
> > L-Università ta' Malta

Appendix 3: SPICE-R2 tool

SPICE-R2 Instrument

Dear Student:
In this survey you are being asked about your attitudes toward interprofessional teams and the team approach to care. By ***interprofessional team***, we mean two or more health professionals (e.g., nurse, occupational therapist, pharmacist, physical therapist, physician, social worker, veterinarian, etc.) who work together to plan, coordinate, and/or deliver care to patients/clients.

PLEASE NOTE: The following scale progresses from "Strongly Disagree (1)" à "Strongly Agree (5)"

INSTRUCTIONS: **Please be candid as you indicate the extent of your disagreement/agreement with each of the following statements related to interprofessional teams and the team approach to care.**		***Strongly Disagree (1)***	***Disagree (2)***	***Neutral (3)***	***Agree (4)***	***Strongly Agree (5)***
1.	Working with students from different disciplines enhances my education	1	2	3	4	5
2.	My role within an interprofessional team is clearly defined	1	2	3	4	5
3.	Patient/client satisfaction is improved when care is delivered by an interprofessional team	1	2	3	4	5
4.	Participating in educational experiences with students from different disciplines enhances	1	2	3	4	5

	my ability to work on an interprofessional team					
5.	I have an understanding of the courses taken by, and training requirements of, other health Professionals	1	2	3	4	5
6.	Healthcare costs are reduced when patients/clients are treated by an interprofessional team	1	2	3	4	5
7.	Health professional students from different disciplines should be educated to establish collaborative relationships with one another	1	2	3	4	5
8.	I understand the roles of other health professionals within an interprofessional team	1	2	3	4	5
9.	Patient/client-centeredness increases when care is delivered by an interprofessional team	1	2	3	4	5
10.	During their education, health professional students should be involved in teamwork with students from different disciplines in order to understand their respective roles	1	2	3	4	5

Appendix 4: Tools to assess Interprofessional Education applicable for pharmacy education

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual / Team	Reliability / Validity	Pharmacy inclusion in evaluation
1	Reaction Modification of attitudes/ perceptions	Collaborative Healthcare Interdisciplinary Planning Scale (CHIRP)	Self-assessment of attitudes about health care teamwork	14	Teamwork attitudes; need for recognition; expertise acknowledgement; communication	I	Y	Y
2	Reaction Modification of attitudes/ perceptions	Interdisciplinary Education Perception Scale (IEPS)	The 18-item scale assesses effects of interprofessional experiences on students; 17-item scale assesses students' perceptions of interprofessional experiences; 12-item scale assesses effects of interprofessional experiences on undergraduate students	12-17-18	Competency and autonomy; perceived need for cooperation; perception of actual cooperation; understanding others' values (18-item scale). Perceptions of other health professions (17-item scale). Interdisciplinary education perceptions (12-item scale)	I	N	Y (12- and 17-item scales)
3	Reaction	Interprofessional Attitudes Scale (IPAS	Assesses attitudes. Compared to other attitudes scales, better reflects current thinking about the interprofessional competencies	27	Teamwork, roles, and responsibilities; patient centeredness; interprofessional biases; diversity & ethics; community centeredness	I	Y	Y

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual / Team	Reliability / Validity	Pharmacy inclusion in evaluation
4	Reaction Modification of attitudes/ perceptions	Perception of Interprofessional Collaboration Model Questionnaire (PINCOM-Q)	Assesses perception of interprofessional collaboration. new Evaluate new ways to enhance dialogue and investigate changes in perception of collaboration over	48	Motivation; role expectations; personality style; professional power; group leadership; communication; coping; social support; organizational aims	I	Y	N
5	Reaction	Readiness for Interprofessional Learning Scale (RIPLS)	Evaluates readiness of health professions students for interprofessional education.	15-19	Teamwork and collaboration; roles and responsibilities (19-item scale); One combined scale on benefits of interprofessional learning (15-item scale)	I	Y	Y (15-item scale only)
6	Reaction Acquisition of knowledge and/or skills (when used as part of TeamSTEPPS training)	TeamSTEPPS Teamwork Attitudes Questionnaire (T-TAQ)	Assesses impact of interprofessional education on health professionals' attitudes, knowledge, team skills	30	Team structure; leadership; situation management; mutual support; communication	T	Y	N

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual / Team	Reliability / Validity	Pharmacy inclusion in evaluation
7	Reaction	TeamSTEPPS Teamwork Perceptions Questionnaire (T-TPQ)	Assesses health professionals' perceptions of interprofessional teamwork	35	Team structure; leadership; situation management; mutual support; communication	T	Y	N
8	Reaction	We Learn Interprofessional Program Assessment Scale	Assesses learners' reactions to interprofessional education program	30	Structure; content; service; outcomes	I	Y	N
9	Modification of attitudes/ perceptions	Attitudes to Health Professional Questionnaire (AHPQ)	Determines health professionals' attitudes toward other health professions on scales of caring	20	Caring; subservience	I	Y	Y
10	Modification of attitudes/ perceptions	Attitudes Toward Health Care Teams Scale (ATHCT)	Measures team members' perceptions of quality of care delivered by healthcare teams and quality of care needed to achieve this	14-20	Quality of care/ process; physician centrality (20-item scale only); cost of care	I/T	Y	Yes (student pharmacist 14-item scale; practicing pharmacists 20-item scale)
11	Modification of attitudes/ perceptions	Entry Level Interprofessional Questionnaire (ELIQ)	Assesses students' attitudes toward interprofessional education	27	Communication and teamwork; perceptions of relationships with colleagues	I	Y	N

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual/ Team	Reliability / Validity	Pharmacy inclusion in evaluation
12	Modification of attitudes/ perceptions	General Role Perception Questionnaire (GRPQ)	Assesses views of other professions' roles. Can be Used to measure change in role perception over time	20	Roles of other professions	I	Y	N
13	Modification of attitudes/ perceptions Behavioural change	Medication Use Processes Matrix (MUPM)	Assesses health care providers' perceptions of roles in the medication use process in primary care	22	Prescribing, monitoring, education, medication review	I	Y	Y
14	Modification of attitudes/ perceptions	Scale of Attitudes Towards Physician-Pharmacist Collaboration (SATP2C)	Assess pharmacy and medical students' attitudes toward interprofessional collaboration	16	Responsibility and accountability; shared authority; interdisciplinary education	I	Y	Y
15	Modification of attitudes/ perceptions	Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education Revised 2 (SPICE-R2)	Assesses health care profession students' attitudes toward IPE	10	Interprofessional teamwork and team-based practice; roles and responsibilities for collaborative practice; patient outcomes from collaborative practice	I	Y	Y
16	Behavioural change	Assessment of Interprofessional Team Collaboration Scale (AITCS)	Self-assessment to measure interprofessional collaboration within teams, incorporating patients as team members	37	Partnership; cooperation; coordination	T	Y	N

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual/ Team	Reliability / Validity	Pharmacy inclusion in evaluation
17	Behavioural change	Collaborative Practice Assessment Tool (CPAT)	Assesses views of team members in a collaborative care team on respect, trust, shared decision making, partnerships	56	Goals; team leadership; general responsibilities, autonomy; information exchange; coordination of care	T	Y	N
18	Behavioural change	Collaboration and Satisfaction about Care Decisions (CSACD)	Self-assesses the quality of team interactions when making patient care decisions	9	Collaboration, satisfaction	T	Y	N
19	Behavioural change	Individual Teamwork Observation and Feedback Tool (iTOFT)	Used by external observers to Assess individual' s team performance in a wide array of clinical settings. There are two versions for basic and advanced learners	11 (Basic) and 10 (Advanced)	Shared decision making (Basic); Shared decision making, leadership, patient safety (Advanced)	I	Y	Y
20	Behavioural change	Interprofessional Collaborator Assessment Rubric (ICAR)	External Reviewer. Observational tool that evaluates learners' achievement of interprofessional competency domains	31	Communication; collaboration; roles collaborative patient/client family centred approach; team functioning, conflict management	I	Y	Y
21	Behavioural change	Interprofessional Collaborative Competency Attainment Survey (ICCAS)	Self-assessment of achievement of the Canadian IPE competencies of designed as a pre/post assessment	20	None	I	Y	Y

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual/ Team	Reliability/ Validity	Pharmacy inclusion in evaluation
22	Behavioural change	Interprofessional Collaboration Scale (IPC Scale)	Measures interprofessional collaboration. Unique in its administration for use in multiple group	13	Communication; accommodation; isolation	T (specific discipline)	Y	N
23	Behavioural change	IPEC Competency Survey Instrument	Self-assessment of achievement of competencies defined by Interprofessional Education Collaborative expert panel	42	Values and ethics, roles and responsibilities, interprofessional communication, teams and teamwork	I	Y	Unknown
24	Behavioural change	Interprofessional Model of Patient Care (IPMPC)	Self-assessment of interprofessional relationships and patient safety climate in the practice setting using a combination of different tools	35	Perception of collaboration, conflict, respect (Effort-Reward Imbalance Questionnaire), patient safety (Safety Attitudes Questionnaire)	T	Y	Y
25	Behavioural change	Interdisciplinary Team Performance Scale (ITPS)	Self-assesses interdisciplinary team performance in long-term care	59	Leadership, communication, coordination, conflict management, team cohesion, perceived unit effectiveness	T	Y	N
26	Behavioural change	Observed Interprofessional Collaboration (OIPC)	External Reviewer. Observational tool which evaluates interprofessional behaviors during an interprofessional team meeting	20	Purpose of meeting; person centred practice; communication; respectful attitude; mediation; shared decision-making; common action plan	T	Y	N

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual/ Team	Reliability / Validity	Pharmacy inclusion in evaluation
27	Behavioural change	Performance Assessment for Communication and Teamwork Tool Set (PACT - Novice)	External observer. To assess teams during a live simulated scenario	5	Team structure, leadership, situation monitoring, mutual support, communication	T	Y	Y
28	Behavioural change	Performance Assessment for Communication and Teamwork Tool Set (PACT - Expert)	External observer. To assess teams during a live simulated scenario	13	Team structure, leadership, situation monitoring, mutual support, communication	T	Y	Y
29	Behavioural change	Relational Coordination Scale (RCS)	Assesses the quality of teamwork and interprofessional interaction	7	Communication, relationships	T	Y	N
30	Behavioural change	Safety Organizing Scale (SOS)	Assesses the culture of safety among people working together.	9	None	T	Y	N
31	Behavioural change	Team Climate Inventory (TCI)	Assesses climate for innovation of teams and team function	38	Vision, participation safety, task orientation, support for innovation	T	Y	N

	Level of evaluation	Tool name	Brief description	N. items	Domains/ Subscales	Individual / Team	Reliability/ Validity	Pharmacy inclusion in evaluation
32	Behavioural change	Team Decision Making Questionnaire (TDMQ)	Self-assesses the perceptions of an individual on the quality of the team decisionmaking process	19	Decision-making, team support, learning, developing quality services	T	Y	N
33	Behavioural change	Team Skills Scale (TSS)	Self-assesses skills required to work effectively on an interprofessional geriatric patient care team	17	Interpersonal skills, discipline-specific skills, geriatric care skills, team skills	I	Y	Y
34	Behavioural change	Index for Interdisciplinary Collaboration (IIC)	Assesses aspects and levels of interprofessional collaboration within an organization	42	Interdependence and flexibility; collective ownership of goal; reflection on process	I/T	Y	N
35	Change in organizational practice	Interprofessional Socialization and Valuing Scale (ISVS)	Tool used to evaluate the shift toward collaborative care within an organization	24	Ability to work with others; value in working with others; comfort in working with others	I/T	Y	N
36	Change in organizational practice	Healthcare Team Vitality Instrument (HTVI)	Assesses healthcare team functioning	10	Support structures; patient care transitions; team communication	T	Y	N

Appendix 5: IPEPC tool

Evaluation of the impact of Interprofessional Education on Pharmacy Competencies (IPEPC) Tool

Cores/subscales:

Red: Values/Ethics for Interprofessional Practice

Blue: Roles/Responsibilities = Tasks

Green: Interprofessional Communication

Orange: Teams and Teamwork = Cooperation and Teamwork

In this questionnaire you are being asked about the impact of Interprofessional Education (IPE) activities in your area of practice. IPE is defined as the process when two or more health care professionals work together to enable collaboration and improve delivery of patient-care.

All responses measured on a 5-point Likert-type scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree or Disagree, 4 = Agree, 5 = Strongly Agree).

Indicate the extent to which Interprofessional Education is helping, or has helped you, achieving the following competencies:		1= Strongly Disagree	2= Disagree	3= Neither Agree or Disagree	4= Agree	5= Strongly Agree
1)	Building a trusting relationship with other professionals who support and deliver health services	1	2	3	4	5
2)	Contributing to placing the person at the centre of healthcare delivery systems	1	2	3	4	5
3)	Using each professionals' unique skills to provide safe, timely, efficient and effective care	1	2	3	4	5

4)	Building interdependent relationships with other professionals to reinforce learning experience	1	2	3	4	5
5)	Participating in continuous interprofessional education opportunities	1	2	3	4	5
6)	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	1	2	3	4	5
7)	Communicating with other professionals to ensure collaborative decision making	1	2	3	4	5
8)	Discussing with other professionals involved in person-centred care with confidence, clarity and respect	1	2	3	4	5
9)	Involving other professionals in shared person-centred care for therapeutic optimisation	1	2	3	4	5
10)	Using advanced strategies which increase the efficiency of teamwork and team-based care	1	2	3	4	5

Appendix 6: Dissemination of study findings

Manuscript submitted to the American Journal of Pharmaceutical Education

American Journal of Pharmaceutical Education

Development of an innovative tool to evaluate impact of interprofessional education on pharmacy competencies

--Manuscript Draft--

Manuscript Number:	ajpe8725
Full Title:	Development of an innovative tool to evaluate impact of interprofessional education on pharmacy competencies
Article Type:	Research Article
Keywords:	education outcomes; innovative tool; pharmacy competencies; interprofessional education
Corresponding Author:	Alessandro Zaccomer, Master degree in Pharmacy University of Malta Msida, Msida MALTA
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	Liberato Camilleri, B.Ed.(Hons),M.Sc.,Ph.D.(Lanc.),
	Lilian M Azzopardi, Ph.D.,M.R.Pharm.S.,F.F.I.P.,F.E.S.C.P.
Order of Authors Secondary Information:	
Manuscript Region of Origin:	MALTA
Abstract:	Introduction : A consequence of interprofessional education (IPE) that is challenging to study is the improvement in the delivery of health care. Objective : To design, psychometrically evaluate and implement a tool to determine impact of IPE activities on pharmacy practice. Methods: An innovative IPE tool which measures impact of IPE activities on patient services and change in pharmacy organisational practice was designed, validated through a three-step Delphi technique, tested for internal consistency and implemented. Results: The developed 'Interprofessional Education on Pharmacy Competencies (IPEPC)' tool consists of ten statements divided into four competency cores. The tool shows high internal consistency between the statements in each of the core competencies. Significant changes in both teamwork and ethics competencies were observed. Conclusion: An innovative tool to assess pharmacy competencies was developed and demonstrated elevated psychometric properties. High scores received by all statements of the IPEPC tool showed the crucial role of IPE on pharmacy practice. Impact of the 'Roles/Responsibilities' core competency on the role of pharmacists was established. The profession-specific nature of the tool is useful to detect different "shades" of IPE competencies and improvement of person-centred care.

Development of an innovative tool to evaluate impact of interprofessional education on pharmacy competencies

Authors

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Keywords: *education outcomes, innovative tool, pharmacy competencies, interprofessional education*

Number of words: 2476

Number of tables: 5

Number of figures: 0

Number of appendices: 1

Abstract

Introduction: A consequence of interprofessional education (IPE) that is challenging to study is the improvement in the delivery of health care.

Objective: To design, psychometrically evaluate and implement a tool to determine impact of IPE activities on pharmacy practice.

Methods: An innovative IPE tool which measures impact of IPE activities on patient services and change in pharmacy organisational practice was designed, validated through a three-step Delphi technique, tested for internal consistency and implemented.

Results: The developed 'Interprofessional Education on Pharmacy Competencies (IPEPC)' tool consists of ten statements divided into four competency cores. The tool shows high internal consistency between the statements in each of the core competencies. Significant changes in both teamwork and ethics competencies were observed.

Conclusion: An innovative tool to assess pharmacy competencies was developed and demonstrated elevated psychometric properties. High scores received by all statements of the IPEPC tool showed the crucial role of IPE on pharmacy practice. Impact of the 'Roles/Responsibilities' core competency on the role of pharmacists was established. The profession-specific nature of the tool is useful to detect different "shades" of IPE competencies and improvement of person-centred care.

Introduction

Aging populations and long-term, complex conditions are aspects that cannot be resolved by a single disciplinary skill set,[1] hence the necessity of a multidisciplinary team who can deal with complex health conditions gains particular relevance.[2,3] Interprofessional approaches to patient care improves professional relationships, increases efficiency and enhances health outcomes.[4] Establishing the concept of interprofessional education (IPE) and practice rely on aspects of collaborative education of students from different disciplines with the aim of improving delivery of care.[3,5]

In 2016, the Interprofessional Education Collaborative (IPEC) Board published an update of the report of 2011 to define competencies for interprofessional collaborative practice. One domain and four core competencies were identified. Each core competency included a set of specific competency statements applicable to different healthcare professions.[6,7]

The significance of including interprofessional competencies in pharmacy education has been recognised by the Accreditation Council for Pharmacy Education (ACPE) standards for pharmacy education, where IPE was included in the most recent revision.[8]

To what extent do we need to express IPE in pharmacy education curricula to achieve the competency outcomes desired? In literature, different tools to assess IPE can be identified.[9] Best practices have not yet been identified,[10] thus a standardised approach to measure the impact of IPE in a particular profession is needed.[11] Some tools based on different competency frameworks already exist, but only a few instruments have been tailored for a specific healthcare profession.[12]

Even though the competencies listed in the 2016 IPEC report should be applicable to all healthcare disciplines, it is important to detect different "shades" of them.[13] In the roles and responsibility area, the focus on more tailored competencies may be useful to improve person-centred care.[14]

The aims were to develop and psychometrically evaluate an innovative and profession-specific tool for measuring IPE competencies and to evaluate the impact of these competencies on pharmacy practice.

Methods

An extensive literature review, highlighting topics including ethics for practice and teamwork communication and responsibilities, was carried out to develop the new tool. Focus was on the evaluation of the impact of IPE on pharmacy competencies. The IPEC report was chosen as the foundation of the tool since many international associations supported and worked to develop it. Three rounds of the Delphi method were undertaken by two panels of experts to validate the Tool (Table 1).

In each round, the panel rated clarity and relevance of each statement on a Likert-scale from 1 to 5. At the end of each round, a mean score was calculated for each statement. Statements which obtained a mean score less than 4 after the Delphi Panel were optimised and submitted for a second validation by the same panel.

Cronbach's Alpha was used to test internal consistency between statements in a particular core competency. The Kruskal Wallis test was used to compare mean core competency scores between groups of participants clustered by gender, age, year of study, years and area of practice. Exploratory Factor Analysis (EFA) was used to confirm the existence of a latent factor structure and determine the number of factors (core competencies). The output was obtained using Varimax rotation and Principal Component extraction method.

After psychometric evaluation, the Interprofessional Education on Pharmacy Competencies (IPEPC) Tool, as a self-administered questionnaire based on a Likert scale (1-5, 1 being weakest), was evaluated. To evaluate the tool, it was disseminated to postgraduate Doctorate in Pharmacy

(PharmD) students who have undergone doctoral level interprofessional experiential rotations and PharmD alumni graduated in 2020 of the University of Malta.

Following ethics approval, the IPEPC tool was administered using Google Forms. Dissemination was undertaken by the researcher after students were invited to join the project by an academic mentor. Responses were collected over a 3-week period.

Results

The IPEPC tool after validation consists of 10 statements divided into four core competencies (Appendix 1: IPEPC tool).

For the four core competencies, the Cronbach's Alpha values exceeded the 0.7 threshold value indicating satisfactory internal consistency between the statements in each core competency (Table 2).

In the Exploratory Factor Analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.761) exceeded the 0.5 threshold value, while the Bartlett's test of sphericity yielded a p-value (approx. 0) which was less than the 0.05 level of significance, implying that a factor structure existed within the ten observable items.

Table 3 showed that four factors have an eigenvalue larger than 1, thus confirming the existence of a four-factor structure. These four factors explained 75.14% of the total variation in the rating scores provided to the ten items.

Table 4 displays the factor loadings for each factor exceeding the value 0.4. Factor 1 loads heavily on items 3, 4, 5 and 6, representing Roles/Responsibilities. Factor 2 loads heavily on items 7 and 8, representing Interprofessional Communication. Factor 3 loads heavily on items 1 and 2, representing Values/Ethics for Interprofessional Practice. Factor 4 loads heavily on items 9 and 10, representing Cooperation and Teamwork. This validates the tool statistically.

The tool was tested in a group of 51 participants. Forty-six participants (response rate 90.2%), completed the tool: 14 first year PharmD students, 9 students from second and third year each and 14 PharmD alumni. Thirty-eight of the respondents were aged between 21 and 35 years old and 35 were female.

All statements received a mean score higher than 4 out of 5. The lowest mean score (4.109) was seen in statement 10, *"Using advanced strategies which increase the efficiency of teamwork and team-based care",* while the highest mean (4.478) in statement 3 *"Using each professionals' unique skills to provide safe, timely, efficient and effective care"* (Table 5).

When analysed according to age, students between 21 and 35 years old provided the highest scores in all statements and a significant difference was seen in the 'Teams and Teamwork' core competency (p=0.026). In 'Teams and Teamwork' and 'Values/Ethics for Interprofessional Practice' core competencies, a significance difference was found between years of the PharmD course (p=0.026, p=0.037), with second and third year showing the highest agreement (M=4.611, M=4.667).

Discussion

This research led to development and evaluation of an innovative tool, IPEPC, to assess the impact of IPE on pharmacy competencies. In the IPEPC tool, high internal consistency between the statements in each core competency was measured, confirming tool validity and reliability.

All statements in the tool received a mean score higher than 4, showing that IPE played a crucial role in helping to achieve IPE competencies. The 'Roles/Responsibilities' core competency received the highest score, demonstrating the impact of IPE on the role of pharmacists within the team. In the 'Teams and Teamwork' core competency, the lowest score was observed, suggesting that achieving these competencies through IPE may be more difficult. In this core competency, significant differences were observed between students of different age groups. Participants between 21 and 35 years old considered the role of IPE in the development of competencies

related to team dynamics and teamwork as very important, while older students demonstrated a lower level of agreement.

Although prior studies of tools for measuring interprofessional competencies have not found significant differences as students progressed through training,[15] when participants were stratified according to year of doctoral studies, a significant change was seen in both 'Values/Ethics for Interprofessional Practice' ($p=0.037$) and 'Teams and Teamwork' ($p=0.026$) core competencies. The highest agreement resulted in second and third-year students, both with a score of 4.667 for the first core competency and 4.611 for the second core competency.

Even though the IPEC competencies should be achieved by every healthcare professional, the profession-specific nature of the tool was sought to deeper investigate the impact of IPE on the care delivered by pharmacists.[11] Being able to detect different "shades" may lead to changes in pharmacy curricula affecting services towards person-centred care.[16] Despite having a high response rate (90.2%), the low number of participants is considered a study limitation. Another limitation is that the tool was applied to pharmacists who had varied practice experience when they joined the post-graduate professional doctorate programme. This cohort was chosen since the students are exposed to interprofessional rotations with an objective to reflect on practice.

Conclusion

An innovative instrument to assess pharmacy competencies, the IPEPC, was developed and demonstrated elevated psychometric properties. The findings indicate a possible effect of extent of exposure to interprofessional rotations in teamwork and ethics competencies since these competency achievements were influenced by years of study of participants.

References

1 Hertweck ML, Hawkins SR, Bednarek ML, Goreczny AJ, Schreiber JL, Sterrett SE. Attitudes toward interprofessional education: comparing physician assistant and other health care professions students. J Physician Assist Educ. 2012; 23(2):8-15.

2 West C, Graham L, Palmer R T, Miller MF, et al. Implementation of interprofessional education (IPE) in 16 U.S. medical schools: Common practices, barriers and facilitators. JIEP. 2016; *4*, 41–49.

3 Kim J, Lee H, Kim IS, Lee TW, Kim GS, Cho E et al. Interprofessional global health competencies of South Korean health professional students: educational needs and strategies. BMC Med Educ. 2019; 19:429.

4 Curran VR, Sharpe D, Flynn K, Button P. A longitudinal study of the effect of an interprofessional education curriculum on student satisfaction and attitudes towards interprofessional teamwork and education. J Interprof Care. 2010 Jan;24(1):41–52.

5 Darlow B, Coleman K, McKinlay E, Donovan S, Beckingsale L, Gray1 B, Neser H, Perry M, Stanley J, Pullon S. The positive impact of interprofessional education: a controlled trial to evaluate a programme for health professional students. BMC Medical Education. 2015; 15:98.

6 Interprofessional Education Collaborative Expert Panel. Core competencies for interprofessional collaborative practice: Report of an expert panel, Washington D.C: Interprofessional Education Collaborative; 2011. https://www.aacom.org/docs/default-source/insideome/ccrpt05-10-11.pdf?sfvrsn=77937f97_2. Accessed October 15, 2020.

7 Interprofessional Education Collaborative Expert Panel. Core competencies for interprofessional collaborative practice: Report of an expert panel, Washington D.C: Interprofessional Education Collaborative; 2016. https://hsc.unm.edu/ipe/resources/ipec-2016-core-competencies.pdf. Accessed October 15, 2020.

8 Accreditation Council for Pharmacy Education (ACPE). Accreditation standards and key elements for the professional program in pharmacy leading to the Doctor of Pharmacy degree - 'Standards 2016', Chicago, Illinois: ACPE; 2015. https://www.acpe-accredit.org/pdf/Standards2016FINAL.pdf . Accessed March 29, 2021.

9 Kenaszchuk C. An inventory of quantitative tools measuring interprofessional education and collaborative practice outcomes. J Interprof Care. 2013; 27:101-103.

10 Shrader S, Farland MZ, Danielson J, Sicat B, Umland EM. A Systematic Review of Assessment Tools Measuring Interprofessional Education Outcomes Relevant to Pharmacy Education. Am J Pharm Educ. 2017;81(6):119.

11 Cox M, Cuff P, Brandt B, Reeves S, Zierler B. Measuring the impact of interprofessional education on collaborative practice and patient outcomes. J Interprof Care. 2016; 30(1), 1–3.

12 Salvati L.A., Meny L.M., de Voest M.C., Bright D.R., Vavra-Janes K.L., Young M.A., et al (2020). Assessing the Validity and Reliability of the Pharmacist Interprofessional Competencies Tool. American journal of pharmaceutical education, 84(7).

13 Rouse MJ, Meštrović A. Learn Today–Apply Tomorrow: The SMART Pharmacist Program. Pharmacy 2020; 8(3):139.

14 Harper JC. IPEC's core competency 2 roles and responsibilities: What more do we need to implement these?, J Nurs Educ Pract. 2019; 9(7), 46–55.

15 Dow AW, Diaz Granados D, Mazmanian PE, Retchin SM. An exploratory study of an assessment tool derived from the competencies of the interprofessional education collaborative. J Interprof Care. 2014; 28(4): 299–304.

16 Dash AK & Monaghan MS. (2015). Importance of interprofessional education, practice and research in the pharmacy curriculum in the era of globalization. EJS. 2015; 11(10).

Tables

Table 1. Characteristics of panels of the Delphi process

Participants		Round 1 (N=13)	Round 2 (N=10)	Round 3 (N=8)
Gender	Male	5	3	2
	Female	8	7	6
Age	21-35	2	2	3
	36-45	2	1	4
	46-55	5	4	-
	55-69	3	2	1
	70+	1	1	-
Profession	Pharmacist	12	10	-
	Physician	1	-	1
	Nurse	-	-	1
	Occupational therapist	-	-	2
	Physiotherapist	-	-	1
	Social worker	-	-	1
	Speech language pathologist	-	-	2
Graduate level	Undergraduate	1	1	5
	Postgraduate	12	9	3
Area of practice	Community	1	1	-
	Academia	7	5	-
	Hospital	4	3	8
	Other	1	1	-
Years of experience	2-5	-	-	1
	6-10	4	1	3
	>10	9	9	4

Table 2. Mean score and Cronbach's alpha statistics across four core competencies

Core competencies	Number of statements	Mean	Cronbach's alpha
Values/Ethics for Interprofessional Practice	2	4.228	0.757
Roles/Responsibilities	4	4.326	0.903
Interprofessional Communication	2	4.217	0.922
Teams and Teamwork	2	4.196	0.824

Table 3. Total variance explained

Factor	Rotation Sums of Squared Loadings		
	Eigenvalue	% of Variance	Cumulative %
1	2.435	24.349	24.349
2	1.972	19.720	44.069
3	1.594	15.945	60.013
4	1.513	15.126	75.140
5	0.769	7.691	82.831
6	0.678	6.779	89.610
7	0.467	4.675	94.285
8	0.277	2.770	97.055
9	0.277	2.768	99.823
10	0.018	0.177	100.000

Table 4 Varimax Rotated Component Matrix

		Factor			
Items		1	2	3	4
1	Building a trusting relationship with other professionals who support and deliver health services			0.751	
2	Contributing to placing the person at the centre of healthcare delivery systems			0.895	
3	Using each professionals' unique skills to provide safe, timely, efficient and effective care	0.804			
4	Building interdependent relationships with other professionals to reinforce learning experience	0.805			
5	Participating in continuous inter-professional education opportunities	0.551			
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	0.659			
7	Communicating with other professionals to ensure collaborative decision making		0.616		
8	Discussing with other professionals involved in person-centred care with confidence, clarity and respect		0.741		
9	Involving other professionals in shared person-centred care for therapeutic optimisation				0.543
10	Using advanced strategies which increase the efficiency of teamwork and team-based care				0.889

Table 5. Means and standard deviations across statements

	Item	Mean ± SD
1	Building a trusting relationship with other professionals who support and deliver health services	4.217±1.094
2	Contributing to placing the person at the centre of healthcare delivery systems	4.239±0.923
3	Using each professionals' unique skills to provide safe, timely, efficient and effective care	4.478±0.888
4	Building interdependent relationships with other professionals to reinforce learning experience	4.261±1.144
5	Participating in continuous interprofessional education opportunities	4.152±1.192
6	Understanding how the different roles of other professionals complement each other in the delivery of person-centred care	4.413±1.066
7	Communicating with other professionals to ensure collaborative decision making	4.174±1.180
8	Discussing with other professionals involved in person-centred care with confidence, clarity and respect	4.261±0.880
9	Involving other professionals in shared person-centred care for therapeutic optimisation	4.283±1.026
10	Using advanced strategies which increase the efficiency of teamwork and team-based care	4.109±1.016