

RESEARCH ARTICLE

# Longer-term outcomes of medicine and pharmacy students at Cardiff University after undergraduate therapeutics and prescribing interprofessional education

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## Abstract

**Background:** Studies have reported students' satisfaction with and learning from undergraduate interprofessional education (IPE). However, there is insufficient research reporting on any longer-term effects of IPE. The objective is to assess the longer-term impact of learning by 3rd/4th year medical and pharmacy students 12-24 months after a therapeutics/prescribing IPE session. **Methods:** Semi-structured interview transcriptions were explored inductively using thematic analysis and deductively by using Modified Kirkpatrick's evaluation model. Exactly 34 interviews were conducted. **Results:** Inductively, six themes were identified: preparedness; students as learners and teachers; knowledge/skills development; application of learning; session value; and suggestions for change. Deductively, participants found the session enjoyable and interesting (level 1), had modified attitudes of peers (level 2a), acquired knowledge and skills (level 2b), and those in employment provided examples of behavioural change (level 3). No organisational change (level 4) or improved patient outcomes (level 5) were reported. **Conclusion:** Both medical and pharmacy participants were able to recall a therapeutic/prescribing IPE session that took place 12-24 months earlier. Participants emphasised the usefulness of interacting with peers, increasing their understanding of each others' roles, improving communication skills and applying learning within practice. Those developing IPE should consider early consistent delivery, utilise multidisciplinary faculty members and ensure an appropriate student knowledge gap.

## Introduction

Collaborative working among healthcare professionals (HCPs) enhances the delivery of high-quality patient care; reducing hospital stays and improving cost-efficiencies (Baggs *et al.*, 2004; Vazirani *et al.*, 2005; Buring *et al.*, 2009). Interprofessional education (IPE) has received extensive attention as a potential solution for encouraging collaborative practice and improving patient outcomes (Reeves *et al.*, 2013; Almoghirah *et al.*, 2021). IPE is recognised as an intervention when

two or more health and/or social care professions interactively learn together to improve interdisciplinary collaboration and delivery of care (Barr *et al.*, 2005; Freeth *et al.*, 2005).

The World Health Organisation (WHO) indicated that IPE is necessary to deliver an integrated, safe and efficient care system (World Health Organisation, 2010). The potential benefits of allowing HCPs to understand their respective roles and learning from and with each other to improve patient care have been

strong motivations to develop and implement IPE within undergraduate curricula (Gilligan *et al.*, 2014).

Barr and colleagues (2018) reported that at least two-thirds of UK universities providing health and social care programs implemented IPE in 1997-2013. Early and regular interprofessional (IP) interactions during undergraduate education may support embedding a culture of collaboration as an important aspect of professional practice (Areskog, 1988; Frenk *et al.*, 2010). Despite the evidence, IPE is not without its challenges; for example, aligning curricula, scheduling, and the need for an appropriate physical environment (Gilbert, 2005; Coster *et al.*, 2008; Odegard *et al.*, 2009).

The Kirkpatrick evaluation model is a four-stage hierarchy approach to training evaluation (Kirkpatrick, 1967). Barr and colleagues (2005) tailored this model to evaluate IPE (Table 1). A systematic review reported that, based on Barr's modified Kirkpatrick model, IPE is well received by students, providing foci on knowledge and skills required to enable collaborative working (Reeves *et al.*, 2016).

**Table 1: Modified Kirkpatrick's training evaluation model (Barr *et al.*, 2005)**

Level	Description	Explanation
1	Reaction	Participants' views on the learning experience and IP nature
2a	Modification of attitudes/perceptions	Changes in reciprocal attitudes, perceptions or value/utility of participating groups
2b	Acquisition of knowledge/skills	Knowledge or skills learnt by participants, linked to IP collaboration
3	Behavioural change	Transfer of IP learning to practice setting and changed professional practice
4a	Changes in organisational practice	Wider changes within the organisation and/or delivery of care
4b	Benefits to patient	Improvements in patient/client outcomes

Although there is international support for the widespread implementation of IPE, there is limited systematic evidence of its effectiveness (Almoghira *et al.*, 2021). Current literature reports that most studies concentrate on student attitudes and opinions of IPE rather than focusing on the preservation and application of skills gained during such sessions over time (Lapkin *et al.*, 2013). As implementation and

development of undergraduate IPE requires significant resources, optimum delivery requires evidence of effectiveness.

### **Therapeutics and prescribing**

In the UK, the medical regulatory body, the General Medical Council (GMC), requires newly qualified doctors to be able to safely prescribe medication (General Medical Council, 2020). The management of therapeutics and prescribing is specifically enhanced when doctors and pharmacists work collaboratively (McKinnon & Jorgenson, 2009). The pharmacy regulatory body, the General Pharmaceutical Council (GPhC), is aligned with the GMC's educational standards and expectations relating to medication safety (General Pharmaceutical Council, 2021). In a significant move to support and encourage such educational focus, both regulatory bodies have advised universities that medical and pharmacy students should participate in IPE with other HCPs (General Medical Council, 2015; General Pharmaceutical Council, 2021).

### **IPE at Cardiff University**

Typically, Cardiff medical students graduate after a five-year MBBCh degree followed by 12 months of working as doctors with provisional GMC registration. The pharmacy M.Pharm. is four years long and followed by a 12-month foundation, formerly pre-registration, and a training period before being eligible to register as a pharmacist with the GPhC.

An IPE session, focusing on therapeutics/prescribing, was conducted with medical and pharmacy students. When this session was first delivered, it was the first formal IPE between the third year medical and fourth (final) year pharmacy students with 40 students per workshop, working in small interprofessional groups. The two-hour workshops were cases-based, and supported by medical and pharmacy professionals.

When sessions were run, medical students had exposure to several clinical environments in primary and secondary care. This experience demonstrated interprofessional practices within various environments in the National Health Service (NHS). Pharmacy students had more limited opportunities for exposure to patients, pharmacy practice and other HCPs at that time.

Students were expected to utilise the British National Formulary (BNF); a widely used resource for UK HCPs (Joint Formulary Committee, n.d.). The objectives of the workshop were to 1) Establish an accurate drug history, covering both prescribed and other medications; 2) Provide appropriate information to the

user about medicines; 3) Detect and document for reporting adverse drug reactions; and 4) Write an appropriate prescription. Given the lack of evidence for participants' longer-term views of, and experiences following, undergraduate therapeutics/prescribing IPE, the study aimed primarily to explore the experiences and reflections of Cardiff University medical students and pharmacy graduates. The modified Kirkpatrick model was applied to evaluate the IPE session. An additional aim was to capture suggestions for change.

## Methods

### Design

Participants' views were explored using one-to-one, semi-structured interviews with those who had one to two years- post-IPE session (Britten, 1995; Cohen & Crabtree, 2006). The time interval was selected to provide students with adequate opportunities to reflect on session values and provide sufficient time to apply any learning during subsequent clinical placements or post-graduate pharmacy practice.

### Sampling

Medical students and pharmacy graduates were recruited using non-probability sampling techniques, that is, purposive, snowball and convenience, to ensure diversity of subjects and attempt to reduce potential recruitment bias where possible (Acharya et al., 2013).

### Data collection

Interviews were undertaken by an intercalating medical student (CR) who had not taken part in IPE and was therefore unfamiliar with the session to limit bias. Interviews were conducted face-to-face or via telephone or Skype. An interview guide was developed following a review of the intended learning outcomes, analyses of the literature and discussions within the research team. Interviews were audiotaped and, once anonymised, transcribed *ad verbatim*.

### Analysis

Inductive thematic analysis using the six-step process outlined by Braun & Clarke (2006) was applied, involving accuracy verification and familiarisation of anonymised transcripts followed by formal coding to identify meaningful words and phrases, undertaken by an independent researcher who was a former pharmacist and current qualified medical doctor (DM) who had not taken part in the IPE session. Coded data were reviewed with themes subsequently identified.

Deductive analysis using the modified Kirkpatrick evaluation model was also undertaken (Barr et al., 2005). All final codes and themes were agreed upon by consensus by all members of the research team.

### Ethical considerations

Ethics approval was granted by the Cardiff University School of Pharmacy and Pharmaceutical Sciences (201302-2019). All participants provided informed written consent.

## Results

Thirty-four interviews were conducted with 20 medical students and 14 pharmacy graduates; 22 participants were female. Medical students undertook IPE in their third year of study and were interviewed during their fourth or fifth year. Pharmacy participants undertook IPE in their fourth year and were interviewed during either their pre-registration training year (n=8) or first year as a pharmacist. Participants were working in a hospital (n=9), community (n=4), or a joint pharmaceutical industry-hospital post (n=1).

### Inductive analysis

Thematic analysis of interview transcriptions identified six themes (Table II).

**Table II: Identified themes**

Section	Theme
Before session	1. Preparedness for session
	2. Students as learners and teachers
During session	3. Development of knowledge and skills
	4. Application of knowledge and skills
After session	5. Usefulness of the session
	6. Suggestions for change and improvement

#### Theme one: Preparedness for session

Medical students (M) reported that they had not used the BNF. Pharmacy participants (P) recognised that medical students were not familiar with the BNF:

*It was the first time I'd sat down and had to use the BNF. (M017)*

*It was quite apparent... that they (medics) hadn't used the BNF before. (P013)*

**Theme two: The role of student learners and teachers**

Both groups felt as though it was the role of the pharmacy students to act as teachers:

*They were there to try and help us to get familiar with the BNF. (M017)*

*I just felt we were being used as the teachers for them. (P003)*

Medical students felt that the content and format of the session was such that there was little opportunity to teach their pharmacy counterparts:

*If the session had been run differently, we could have taught them something. (M019)*

Pharmacy participants enjoyed receiving feedback from the medical faculty:

*We got feedback from the medical lecturers... they sort of teach from a different perspective to pharmacists. So that was quite good. (P010)*

**Theme three: Development of knowledge and skills**

Medical students reported increased awareness of the structure and contents of the BNF:

*I learnt much more about how to use the BNF... it was really good learning about the appendix section. (M001)*

Pharmacy participants reported an improved ability to communicate with medical peers:

*The skill that I learned in terms of obviously speaking to a medic and the information that they want. (P012)*

**Theme four: Application of knowledge and skills**

Hospital pharmacy graduates indicated that they had applied communication skills developed in the session:

*Interviewer: Have you been able to use any skills since the session?*

*It was beneficial to me to be able to communicate with the junior doctors because that's who we communicate with the majority of the time. (P014)*

**Theme five: Usefulness of the session**

In terms of therapeutics/prescribing, both groups felt that the session was more beneficial for medical students:

*I think the medics probably got a lot more out of it than the pharmacy students. (M019)*

*It was probably more beneficial for medics. I remember showing them how to use the BNF. (P011)*

**Theme six: Suggestions for change**

Medical students reported that the session was delivered too early within the curriculum:

*I think the third year was too early to introduce it from a medical point of view. (M018)*

Overall, both groups of participants believed that more sessions should be offered consistently throughout the curriculum:

*Being more of a continuous thing rather than just one time in the third year might be slightly better. (M016)*

*I came out thinking that we need more... a series of sessions. (P009)*

**Deductive analysis**

The modified Kirkpatrick evaluation model (Table I) (Barr et al., 2005) was used to appraise the session.

**Level 1: Reaction**

Both groups enjoyed meeting and interacting with allied HCP students:

*It's nice just to be with a different group of people who have a different perspectives. (M003)*

*It was just nice to start establishing a relationship with another healthcare professional that you knew you were going to have to work with in the future. (P013)*

**Level 2a: Modification of attitudes/perceptions**

Medical students recognised the pharmacy students' knowledge in therapeutics/prescribing:

*That session taught me that the pharmacists were a lot more knowledgeable about their drugs for the stage they were at in their training compared to us. (M009)*

Pharmacy students appreciated that they had gained some understanding of medical student knowledge:

*I definitely changed my attitude towards working with doctors, because I just assumed that they knew it all. (P010)*

### Level 2b: Acquisition of knowledge/skills

Medical students gained an understanding of the role of pharmacists:

*I'm more aware of what pharmacists do because of this session. (M001)*

Following the session, pharmacy participants felt more confident to approach medical colleagues and felt it had removed barriers in communication:

*It definitely made me more confident to approach them (medics). (P003)*

### Level 3: Behavioural change

Pharmacy graduates illustrated that they had implemented their learning within the practice:

*I think the session is more influential now that I'm starting work... you're more confident and people can appreciate your role. (P004)*

### Level 4a: Changes in organisational practice

Neither medical students nor pharmacy graduates demonstrated any evidence of wider changes within the organisational delivery of care.

### Level 4b: Benefits to the patient

Although both groups could not provide evidence that the IPE session had benefited patients; it was acknowledged that regular IPE may help to understand how HCPs develop working relationships, which may indirectly improve patient outcomes:

*IPE is essential in the holistic treatment of the patient. (M014)*

*If you're able to communicate better and work better as a team, then you're going to reach your goals and get better outcomes. (P013)*

## Discussion

All 34 participants were able to recall the therapeutics/prescribing IPE one to two years post-session, a finding also reported elsewhere (Shelvey et al., 2016).

Others analysed an IPE session for fourth-year pharmacy students to teach second-year medical students basic prescription writing (Allen et al., 2020). This study also found that post-session, medical students were more confident in their prescription writing abilities,

demonstrating that pharmacy students can act as effective IP educators, a finding also observed in this study.

The level of pre-existing therapeutic knowledge, and prior use of prescribing resources, differed between medical and pharmacy participants. Medical students reported they had limited experience using the BNF before the session. The disparity in knowledge among students can inspire learning by divulging educational expectations and stimulating learners to close the gap. However, differences in knowledge of therapeutics/prescribing may act as a barrier to learning and demotivate participants during IPE sessions (Courtenay, 2013). Such distinctions may also contribute to students feeling underprepared, reducing the likelihood of forming a productive and engaging IP learning environment (Anderson et al., 2009; Shelvey et al., 2016).

Participants reported that the session did not provide opportunities to allow medical students to teach pharmacy students. The difference in knowledge and format of cases was a barrier to providing medical students the opportunity to teach. This finding needs to be considered by those introducing, reviewing and delivering IPE sessions; reflecting whether scenarios provide each profession with equivalent learning and teaching opportunities.

Pharmacy students tend to have a greater knowledge of basic pharmacology than medical students, but not in the application of pharmacological knowledge (Keijsers et al., 2014) therefore suggesting that, due to the differences in basic knowledge and experience between the students, pharmacy students found input from the medical faculty particularly valuable in providing a medical perspective to prescribing, which was not reported here by medical students.

Pharmacy students reported that communicating with medical students was a valuable experience; improving their confidence to approach doctors and potentially removing barriers between professions, a finding consistent with the literature (Hawkes et al., 2013; Birley et al., 2014). Furthermore, pharmacy graduates, based in secondary care, reported that they had applied these skills to communicate with HCPs, particularly recently qualified junior doctors. Previous studies found that doctors in their first year of qualifying made most prescribing errors but are responsible for the majority of prescribing (Dean et al., 2002; Dornan et al., 2009; Ryan et al., 2014). Poor communication between junior doctors and pharmacists has been identified as a possible barrier to effective feedback regarding prescribing errors (Bertels et al., 2013). Although difficult to ascertain whether efficient communication reduces prescribing errors, feedback from pharmacists is essential in allowing

junior doctors to reflect on their practice and improve patient safety (Reynolds *et al.*, 2017).

Medical and pharmacy participants reported that the IPE session was more beneficial for medical students in terms of BNF proficiency and improved therapeutic knowledge. However, pharmacy students reported some benefits from teaching, interacting and working collaboratively with medical students to improve confidence and provide opportunities to interact with other HCPs before graduation. Although students may directly benefit from interdisciplinary education in terms of changing attitudes, knowledge and skills, there is limited evidence of the effects of IPE in terms of patient-centred outcomes within clinical practice due to the complexity of measuring such interventions (Cooper *et al.*, 2001; Brashers *et al.*, 2015).

In this study, students indicated that they would welcome further IPE, aligned with research suggesting that IPE should be integrated into course programmes, as opposed to implementing ad-hoc sessions (Long *et al.*, 2014). Medical students also questioned the timing of the IPE session, suggesting this session was too early within the curriculum. Similar therapeutics/prescribing IPE sessions at other institutions have taken place within the final year of medical studies (Anderson *et al.*, 2009; Anderson & Lakhani, 2016). Gilligan and colleagues (2014) reported that the timing of an IPE session is dependent on the topic of choice. It is therefore important that learning outcomes are appropriate for each profession and, in instances where pre-existing knowledge is limited, that students may benefit from focusing on teamwork and collaboration in earlier years of their studies and tackling more clinically-based scenarios before graduation (Davidson & Lucas, 1995). Subsequent cohorts of medical and pharmacy students at Cardiff University have benefitted from the feedback of these earlier cohorts. IPE is now embedded at various stages within both programmes, which starts early in the first year of study covering a diverse range of topics of mutual benefit.

Students reported positive outcomes relating to changes in learner reactions (Kirkpatrick level 1). Feedback from both medical and pharmacy participants indicated that they enjoyed the IPE session and valued learning with other HCPs, a finding consistent with the literature (Reeves, 2000; Quinn *et al.*, 2008). Students indicated a greater mutual understanding of knowledge and an appreciation of the approach students took in tackling clinical scenarios. This enhanced pharmacy graduates' attitudes and perception of doctors, encouraging collaboration within the clinical practice (Kirkpatrick level 2a). Pollard and Miers (2008) similarly found that after nine to

twelve months post-qualification, former HCP students reported longer-term positive attitudes towards collaborative working following undergraduate IPE. Students reported that they acquired improved communicative skills in approaching others outside their profession (Kirkpatrick level 2b). By understanding the role of HCPs and removing hierarchical barriers (perceived by students) individuals stated they were more engaged and responsible to contribute to patient care plans (Visser *et al.*, 2019). Furthermore, pharmacy graduates reported that the IPE session had an impact following qualification; improving confidence and empowering graduates to approach and communicate with doctors (Kirkpatrick level 3). No evidence of organisational change was reported by either profession (Kirkpatrick level 4a), and evidence of a positive impact on patient outcomes following the session was limited (Kirkpatrick level 4b). Both groups reported IPE as a potential gateway to understanding the roles of other HCPs, including improving communication and integration of healthcare, which may positively impact patient outcomes.

### **Limitations**

Although the number of participants in the study was relatively small, cohorts of medical and pharmacy students were included who had taken part in a therapeutics/prescribing IPE session over two years at one university.

The researcher conducting all interviews was a medical student who had not attended the IPE session, reducing the risk of interviewer bias (Newman *et al.*, 1998). Using a faculty member to conduct interviews may have led to lower levels of candour in providing feedback about the session; therefore, using a student in this capacity would have mitigated potential social desirability bias (Van de Mortel, 2008). Additionally, the use of a peer interviewer provides straightforward access to the student cohort, where interviewees are more likely to engage in open debate (Mercer, 2007). Although the researcher, and interview technique, were consistent for all students, using a pharmacy student researcher could have triangulated data collection, gauging more personal, honest and accurate responses from their peers (Hockey, 1993; Chew-Graham *et al.*, 2002).

Students were followed-up for one to two years following their session. This provided sufficient time for medical students to value their IPE given their succeeding clinical and educational experiences, and likewise for pharmacy participants during their pre-registration training and first year as pharmacists. Due to the follow-up period, there was a risk of recall bias; however, following brief prompts, students were able

to reflect on cases, resources and learning from the session. Much of the current literature on IPE is often limited to the feedback relating to participants' knowledge or session satisfaction from one or more professions with far fewer studies reporting behaviour change as self-reports (Mattick & Bligh, 2003; Shelvey et al., 2016; Nazar et al., 2017; Almoghirah et al., 2021).

### Implications for interprofessional education

Interviews were a successful method for obtaining student feedback. Based on the findings from this study and existing literature, the authors present some additions to further recommendations, which could benefit higher institutions and those considering implementing, developing and evaluating IPE (Table III).

**Table III: Suggested recommendations for implementing, developing and evaluating IPE**

Recommendations
<b>1. Early and consistent delivery of IPE:</b> Ensure sessions are delivered throughout the curriculum starting at the earliest opportunity to encourage longitudinal IP learning and its relevance to future practice. Earlier sessions should clarify the professional roles of those involved, removing barriers and building working relationships.
<b>2. Sessions should complement curriculum:</b> Ensure topics align with each profession's curriculum; optimise utility by delivering the right session, to the right cohort, at the right time. Covering relevant and examinable topics will encourage attendance and engagement.
<b>3. Define relevant and specific learning objectives:</b> Communicate and assign roles to each profession during each session. Manage student expectations and focus by defining clear session learning outcomes, aims and objectives.
<b>4. Use multidisciplinary faculty members:</b> Include specific disciplinary members to deliver high-quality teaching through encouraging discussions around experience and expertise.
<b>5. Use interactive learning, utilising resources and space:</b> Encourage IP interaction through delivering simulation, case-based learning, practical skill workshops, and role play. Use small groups to encourage meaningful conversation and feedback between students and faculty within a tutorial environment.
<b>6. Narrow knowledge gap:</b> Ensure difficulty level complements students' existing subject knowledge and skills. Preparatory workshops and exercises may be required utilising multidisciplinary faculty members to ensure constructive alignment (Biggs & Tang, 2011).

### Future research

Now that IPE is embedded at Cardiff University, obtaining the experiences and reflections of the current IPE curricula would be useful. The longer-term outcomes of IPE have not been explored. Attempts at longitudinal studies have identified difficulties in the retention and follow-up of participants over time (Freeth et al., 2005). Therefore, further research is necessary to ascertain the impact of IPE on patient outcomes, which is supported by recent systematic reviews published since the present study was undertaken (Almoghirah et al., 2021; Spaulding et al., 2021; Mattiazzi et al., 2023).

### Conclusion

This study has demonstrated that both medical and pharmacy participants could recall a therapeutics/prescribing IPE session that had taken place up to two years earlier and reported that they had learnt with, from and about each other. Participants reported positive feedback relating to interprofessional working. Medical students reported increased proficiency in using prescribing resources and understanding pharmacists' roles. Pharmacy

participants reported increased confidence to approach and communicate with doctors, and other HCPs. The longer-term effects of IPE, including those on improving patient outcomes, need to be fully explored.

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### Conflict of Interest

The authors declare no conflicts of interest.

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