

Original Research

Development and evaluation of an interprofessional student-led influenza vaccination clinic for medical, nursing and pharmacy students

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Abstract

Background: Students in their final years of medicine, nursing and pharmacy degrees were invited to participate in an interprofessional influenza vaccination training course and clinic. Twenty-four students (8 from each discipline) were selected to participate. After vaccination training these students administered free influenza vaccines under supervision in two student-led clinics to 546 students in health and allied health programs prior to their clinical placements. **Objective:** To evaluate the students' experience of the interprofessional vaccination training and clinic, and to evaluate the experiences of students who received their vaccination in the student-led clinic. **Methods:** Before and after participating, students completed a questionnaire evaluating their perceived knowledge of influenza vaccinations, and their skills and confidence in administering vaccinations and the Readiness for Interprofessional Learning Scale (RIPLS). Eighteen students completed both the pre- and post-questionnaires. All students who received their flu vaccination were also asked to complete a short patient evaluation survey. **Results:** The course resulted in significant increases in the students' perceived knowledge of influenza vaccinations (27.5% increase, $p < 0.001$), skills in managing patients receiving influenza vaccines (23.9% increase, $p < 0.001$) and confidence level to administer influenza vaccines (46.0% increase, $p < 0.001$). While there was no significant change in any subscales of the RIPLS, open-ended responses indicated that the students enjoyed and could see the benefits of meeting and learning with and from students from other health disciplines. Of the students who received their influenza vaccination, 97.7% were very likely or somewhat likely to recommend the clinic to fellow students. **Conclusion:** The interprofessional vaccination training and influenza vaccination clinic provided effective interprofessional vaccination training and afforded an authentic interprofessional experiential opportunity.

Keywords

Students; Influenza; Vaccination; Clinic; Interprofessional; Education; Vaccines; Medicine; Nursing; Pharmacy; Experiential; Australia

INTRODUCTION

Interprofessional Education (IPE) has been defined as occasions when two or more health professions learn with, from and about each other to improve collaboration and quality of care.^{1,2} IPE assists students to appreciate the qualities and skills each health discipline can bring to the health care team, and improve the students' collaborative teamwork in their future healthcare practice, leading to improved holistic healthcare and a shared responsibility for community health outcomes.^{3,4} As such, it is now widely accepted that IPE opportunities should be an integral part of all health care professional degree programs, preparing graduates that are "collaborative practice-ready".⁵

The University of Sydney offers Medicine, Nursing and Pharmacy degrees. Although many elements of these health care professional degrees are common across the

different professions, and the students enrolled in these courses attend the same campus for at least part of their study, there is little interaction between the different student groups, and at the current time few organized IPE activities. This is despite the fact that the Australian Medical Council,⁶ the Australian Nursing and Midwifery Accreditation Council,⁷ and the Australian Pharmacy Council⁸ all recommend that the curricula of each degree program should include interprofessional activities.

A second issue facing health care professional (HCP) education providers is that most professions require experiential placements to be incorporated into the degree. These placements are becoming increasingly difficult to source due to increased student numbers, and a reluctance of health care facilities to participate in student placements due to a perceived burden of educating students resulting from a disconnect between the expectations of the education and health systems.⁹ This has led to education providers developing simulated activities, or searching for alternatives that provide authentic experiential opportunities.¹⁰ One approach to providing these opportunities is the implementation of an entrustable professional activity (EPA) framework, ensuring that students develop, and are assessed on the knowledge, skills, and attitudes required to be effective practitioners.¹¹

An essential pre-placement requirement for students in health and allied health programs undertaking

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experiential placements in New South Wales (NSW) Health facilities during winter is that they receive an influenza vaccination before commencing their placement. Depending on the timing of the placement and the availability of the current influenza vaccine, some students have difficulties in accessing the vaccine in time for their placement. In order to address all three issues, we developed a student-led interprofessional influenza vaccination clinic where a group of students in the final years of medicine, nursing and pharmacy degrees undertook interprofessional vaccination training, and then these students administered influenza vaccine under direct supervision to students enrolled in health and allied health programs prior to their placements.

While student-led vaccination clinics have previously been run in the US over the past 20 years¹² and more recently in Canada,^{13,14} these have predominantly been single profession activities with some limited reports of clinics involving two professions, usually pharmacy and nursing.¹⁵ To the best of our knowledge this is the first time a student-led vaccination clinic has been carried out in Australia, and the first time anywhere that a student led vaccination clinic has involved medical, nursing and pharmacy students working and vaccinating together. A student-led vaccination clinic also provides the opportunity to develop vaccination as an EPA.

In NSW pharmacy graduates who have completed an approved vaccination training course can in their intern year administer specified vaccines under the direct supervision of an accredited pharmacist vaccinator. In 2019 we developed at the University of Sydney an approved vaccination training course for pharmacy students which met the learning outcomes of the National Immunisation Education Framework for Health Professionals,¹⁶ and the standards of the Australian Pharmacy Council.¹⁷ All Medical, Nursing and Pharmacy students selected to participate in the student-led clinic were required to complete a version of this training course which had been modified to remove the emphasis on pharmacists and make it more inclusive of all three healthcare professions as vaccinators, as the basis of the interprofessional learning activity.¹⁸

The clinic was originally scheduled to be held on campus in the mid-semester break, two weeks after the workshop. However, the emergence of the COVID-19 virus resulted in recommendations to provide influenza vaccinations earlier than usual to reduce the risk of people contracting two potentially serious infections simultaneously. This led to a significant increase in the demand for influenza vaccines which made it increasingly difficult for students to have a flu vaccination prior to their placements.¹⁹ While some students had placements postponed due to COVID-19, many placements went ahead as scheduled. With much of the NSW in semi-lockdown and future activities uncertain, we decided to conduct the student-led clinic in early April 2020, two weeks earlier than

originally planned. All students enrolled in health and allied health programs at the university who were scheduled to complete a clinical placement in a NSW health facility were offered the option of having their influenza vaccination in the student-led clinic. The clinic complied with the NSW Health recommended procedures for vaccination clinics under COVID-19 conditions.²⁰ During the first vaccination clinic, when it was apparent that demand exceeded the 300 vaccines available, we were asked if could source additional vaccines for another clinic. A second order of 250 vaccines was placed and a second clinic was scheduled in mid-May for students whose placements had been rescheduled to later in the year due to COVID-19.

The aim of this study was to implement and evaluate an interprofessional vaccination training program and a subsequent student-led influenza vaccination clinic for students enrolled in medicine, nursing and pharmacy degrees.

METHODS

Student Vaccinator Selection

Students in medicine (years 3 and 4 of a 4 year graduate-entry Doctor of Medicine degree), nursing (year 2 of a 2 year graduate-entry Master of Nursing degree and year 3 of a 3 year undergraduate Bachelor of Nursing degree), and pharmacy (year 2 of a 2 year graduate-entry Master of Pharmacy degree and year 4 of a 4 year undergraduate Bachelor of Pharmacy degree) were emailed a request for expressions of interest to participate in vaccination training and a student-led interprofessional vaccination clinic. Students were selected on the basis of their response to the question "Why do you want to participate in the student-led interprofessional influenza vaccination clinic, and what do you believe you will gain from the experience?" (300 words or less). The responses of the students who were selected indicated that the student wanted to participate in order to improve their knowledge and competency to administer vaccines, and because doing so would allow them to have a positive impact on public health. Eighteen students were selected to participate in the first clinic (6 each from Medicine, Nursing and Pharmacy). An additional group of six students (2 each from Medicine, Nursing and Pharmacy) were subsequently selected from the original expressions of interest for the second clinic. All students were sent an email inviting them to participate in the study prior to commencing the online pre-work for the course.

Vaccination Training Workshop

The training was conducted as a blended learning activity involving seven interactive online modules which students completed individually prior to a six hour interprofessional face-to-face workshop. The online modules covered topics including immunology, vaccine formulation, influenza



and influenza vaccines, government funded vaccination programs and the impact of vaccination on public health. The interprofessional workshop covered pre-screening and consent, set-up of vaccination area, correct handling of sharps and prevention of needle stick injuries, adverse reactions and management of anaphylaxis, and practice of intramuscular and subcutaneous injection techniques. The training and assessment were conducted by accredited nurse and pharmacist vaccinators. Students were also required to successfully complete an online anaphylaxis training¹⁸ and an accredited first-aid & CPR course.

The first activity involved a pre-screening and consent role-play. Groups of three students, one from each discipline, were provided with scenarios of different patients requesting an influenza vaccination. The different scenarios included different health conditions, allergic reactions, age or upcoming travel plans. One student played the patient and another student HCP in their discipline with the third student observing. After the role play, the students discussed how they would have responded to the patient based on their scope of practice and whether they would have suggested any additional vaccinations e.g. referring an immunocompromised patient to their general practitioner or suggesting a diphtheria, tetanus, pertussis (dTpa) booster for a soon to be grandparent. After role-playing the scenarios in their small group, any differences in actions of different health professionals were discussed at the class level. Throughout the practical workshop, any students who had previous experience of vaccination were encouraged to identify and discuss any differences in processes or techniques compared to what they had previously been taught.

Data collection

Each student received an email containing the participant information sheet and a link to the online pre-course questionnaire on perceived knowledge, skills, confidence and attitudes, the pre-course Readiness for Interprofessional Learning Scale (RIPLS) questionnaire and links to the online prework modules. The questionnaires were hosted on Survey Monkey. Participation in the study was voluntary, and non-participants were not disadvantaged in any way. After completion of the training course, all course participants were emailed a link to the post-course questionnaire on perceived knowledge, skills, confidence and attitudes. Finally, after completion of the flu clinic students were sent a link to the post-course RIPLS questionnaire. Reminder emails were sent to all students one week after the initial emails. The course evaluation questionnaires were slightly modified from those we have used previously,²¹ to reflect the interprofessional nature of the group.

The course evaluation and RIPLS questionnaire consisted of a demographics section as well as questions employing

5-point Likert items (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, to 5 = strongly agree) to assess pre- and post-training perceptions of knowledge (6 items), skills (6 items), and confidence (3 items) in appropriately administering vaccines. Attitudes to HCP-administered influenza vaccinations (2 items) were also assessed. Scores for each category of the survey were obtained by averaging scores for all items in that category. The post-course survey included an additional two questions relating to the students' confidence in administering influenza vaccines. The pre-course survey included an open-ended response question: "What areas of knowledge would you like to see the course focus on?" The post-course survey included two open-ended response questions: "Provide at least two things that were the most beneficial about completing the vaccination course," and "Is there anything that you think could be covered in more detail in the course, either in the online pre-work or the face-to-face session?". To evaluate interprofessional attitudes before and after the vaccination clinic we used the adapted version of the RIPLS questionnaire.²² The adapted RIPLS questionnaire consists of 19 items which assesses Teamwork and Collaboration (in nine items), Negative Professional Identity (three items), Positive Professional Identity (five items), and Roles and Responsibilities (2 items).

Students involved in both the first and second clinics underwent identical training. The process for the second group of students was identical to that described above, and all data from both groups of students were combined.

Statistical analysis

Data collected from these pre- and post-course surveys were analysed using the SPSS 24.²³ Ordinal data was analysed by both parametric (t-test) and non-parametric (Mann-Whitney U test) tests; however, as with the previous studies,^{21,24} all statistical findings were the same for both tests, therefore the results reported are based on the t-test analysis. The Cronbach alpha (α) coefficient was used to evaluate the internal consistency of the questions using the 5-point Likert items. The modified RIPLS analyses were conducted on mean total scores and also means for each of the subscales (t-test).

Patient evaluation of student influenza vaccination clinic

All students enrolled in health and allied health programs who were scheduled to complete a placement in a NSW health facility during the influenza season were sent an email informing them of the availability of influenza vaccinations administered by final year medicine, nursing and pharmacy students under direct supervision of qualified vaccinators. In the first clinic in April 300 flu vaccinations were available on a first-come basis, with a further 250 vaccines available in a second clinic in May. The email contained a link to a Microsoft® Booking calendar where students booked their desired timeslot,



after which they received a confirmation email which included the patient information sheet and a consent form. All students received a reminder email on the evening prior to their appointment.

Students who received their influenza vaccination at the student-led clinic were invited to complete a patient experience questionnaire while they waited for the 15 min observation period after their vaccination. Students could access the questionnaire via scanning a QR code in the waiting area. In addition, all students were sent an email on the evening after their vaccination asking them to complete the questionnaire if they had not already done so.

Thematic Analysis

Responses to open ended questions were collected from the pre- and post-surveys and RIPLS and the Patient Evaluation Survey. The open-ended responses were coded on the basis of emergent themes using a general inductive approach.²⁵ The themes were manually analysed with an initial coding by the primary researcher and independent validation by the second investigator. Any variations in coding were discussed by the researchers and then agreed on.

The student-led clinic was a learning and teaching activity and as such did not require ethics approval. The study was approved by the Human Research Ethics Committee of the University of Sydney [2019/674] and [2020/578]. All data were deidentified and all information collected was stored confidentially and securely.

RESULTS

Characteristics of student vaccinators

A total 74 students (MD 12, BNurs 20, MNurs 28, BPharm 8, MPharm 6) responded to the email requesting expressions of interest to participate in the vaccination training and a student-led clinic. The overall demographics of the students who were selected to participate in the vaccination training and clinic were similar to the demographics of their cohort, with equal numbers of

males and females from medicine and pharmacy, and more females than males from nursing. All students who participated in the study were aged between 21-40 with the majority aged 21-30. Three medical students and three nursing students had prior experience of administering vaccines during placements (Table 1).

Changes in perceived Knowledge, Skills, Confidence, and Attitudes of participants

As previously found when used with pharmacy students,²¹ the course evaluation questionnaire was reliable in measuring perceived Knowledge, Skills, Confidence, and Attitudes across the vaccination training course (Cronbach α = 0.820 to 0.922). Analysis of the pre-course questionnaire showed no difference in any of the sub-scales between students in the different health professions, and only the Confidence sub-scale was significantly different ($p < 0.012$) between students who had prior experience of administering vaccines compared with those who had no experience.

Comparison of the pre- and post-course results show a clear increase in all factors contributing to perceived Knowledge of influenza vaccines and Confidence in administering the vaccines. The vaccination training program significantly improved the perceived Knowledge ($p < 0.001$), Skills ($p < 0.001$), and Confidence ($p < 0.001$) subscales (Table 2). In the Skills sub-scale the only item which did not show a significant increase after the training program was the item relating to obtaining informed consent from a patient, however this item was high in the pre-course questionnaire, which would be expected for health care professional students in the final year of their degree. While identifying anaphylactic reactions and administering an adrenaline autoinjector (Epipen®) did increase significantly, the increase was less than that seen in many other items. The pre-course value of the Attitudes subscale was high at baseline and increased to a lesser degree ($p < 0.017$).

After completing the vaccination training program, 100% of students strongly agreed or agreed that they were confident in providing vaccinations to patients, and that

Table 1. Characteristics of students who participated in the influenza vaccination clinic and completed the questionnaires

		Clinic participation	Prior vaccination experience	Course Questionnaire completion		RIPLS Questionnaire completion	
				Pre	Post	Pre	Post
Profession	Gender	N	N	N	N	N	N
Medicine	Female	4	1	3	2	4	3
	Male	4	2	4	2	4	4
Nursing	Female	7	2	6	6	6	6
	Male	1	1	1	0	1	1
Pharmacy	Female	4	0	4	4	4	4
	Male	4	0	3	4	4	3



Table 2. Changes in Knowledge, Skills, Confidence and Attitudes of participants after the influenza vaccination training course			
Item	Mean Pre-course Score \pm SD (N=21)	Mean Post-course Score \pm SD (N=18)	P-value
Perceived Knowledge	3.47\pm0.83	4.43\pm0.39	<0.001
I am knowledgeable on my current state or territory influenza vaccination standards	3.42 \pm 1.18	4.33 \pm 0.49	<0.002
I am knowledgeable on the mechanisms of action of influenza vaccines	3.54 \pm 1.02	4.28 \pm 0.46	<0.004
I am knowledgeable on the efficacy of influenza vaccines	3.67 \pm 1.01	4.39 \pm 0.50	<0.004
I am knowledgeable on the contraindications for influenza vaccines	3.13 \pm 1.15	4.61 \pm 0.50	<0.001
I am knowledgeable about the common adverse events which may occur following the administration of influenza vaccines	3.58 \pm 1.02	4.61 \pm 0.50	<0.001
I am knowledgeable to discuss influenza infections and influenza vaccinations with patients	3.50 \pm 0.93	4.33 \pm 0.49	<0.001
Perceived Skills	3.63\pm0.70	4.50\pm0.43	<0.001
I know how to recognise an anaphylactic reaction	4.25 \pm 0.79	4.67 \pm 0.49	<0.042
I know how to correctly administer adrenaline and an EpiPen®	4.17 \pm 0.82	4.72 \pm 0.46	<0.008
I know how to recognise and treat a vasovagal attack (syncope, fainting)	3.54 \pm 1.10	4.56 \pm 0.51	<0.001
I know how to obtain informed consent from a patient	4.17 \pm 0.82	4.56 \pm 0.51	<i>n.s.</i>
I know which patients I should refer to their GP for influenza vaccination	3.08 \pm 1.25	4.33 \pm 0.69	<0.001
I know how to create and implement influenza vaccination protocols appropriate for my profession	2.54 \pm 1.18	4.41 \pm 0.58	<0.001
Confidence	3.21\pm1.04	4.69\pm0.35	<0.001
I am confident that I can identify patients eligible to receive the influenza vaccine under the National Immunisation Program	3.21 \pm 1.06	4.39 \pm 0.50	<0.001
I am confident that I know how to administer an influenza vaccine	3.04 \pm 1.43	4.83 \pm 0.38	<0.001
I am confident that I can administer an influenza vaccine	3.38 \pm 1.38	4.83 \pm 0.38	<0.001
Attitudes	4.27\pm0.71	4.72\pm0.46	<0.017
Administering vaccines can improve the job satisfaction of health professionals	4.08 \pm 0.83	4.61 \pm 0.61	<0.022
Allowing a range of health professionals to administer vaccines will improve public health by reducing adverse effects of infectious diseases in the community	4.46 \pm 0.72	4.83 \pm 0.38	<0.036

ns-not significant

they would be confident in implementing a vaccination program in their practice setting.

No significant difference in pre- and post-course scores were found between the different health professions. There were significant increases in the perceived Knowledge, Skills and Confidence scales of each of the different health professions. The increase was similar across the three professional groups for most sub-scales, with the greatest increase seen in the Confidence of pharmacy students and nursing students ($p < 0.008$). The mean scores for Attitudes of all students were high in the pre-course survey, and although they all increased in the post-course survey. Only the increase for the pharmacy students was significant ($p < 0.05$). However, it should be noted when comparing the different health professions that the numbers of students in each group are small.

Readiness for Interprofessional Learning Scale

The maximum possible score for the modified RIPLS was 95 and mean total scores were high both pre- (79.9 \pm 7.2, $n = 23$) and post-clinic (83.6 \pm 6.0, $n = 21$) with no

significant difference ($p = 0.066$). The mean scores for both the Teamwork and Collaboration and Professional Identity subscales of the RIPLS were high at baseline and post-clinic. The Teamwork and Collaboration subscale (9 items, maximum score 45) changed from 41.5 \pm 3.8 ($n = 23$) to 42.6 \pm 3.4 ($n = 21$) ($p = 0.321$) whereas Professional Identity changed from (25.3 \pm 3.5 ($n = 23$) to (27.3 \pm 3.1 ($n = 21$) out of a maximum of 30 (with items 10-12 reverse scored) showed a slightly significant increase ($p = 0.048$). The scores for the Roles and Responsibilities subscale of the RIPLS (maximum score 10) were low at commencement of the module (4.7 \pm 1.6, $n = 23$) and remained low at completion of the module (4.5 \pm 1.6, $n = 21$), with no significant difference ($p = 0.661$). No differences between pre- and post-module scores were found for total RIPLS or subscale scores between the 3 professional groups of students (t-test).

The most common response to the post-course question "Provide at least two things that were the most beneficial about completing the interprofessional vaccination training program" was meeting and working/learning



with other HCP students.

N4 "Practical experience, meeting IPL teammates."

M3 "... 2) interacting with students from other health disciplines."

P5 "Working inter professionally is invaluable in gaining a better understanding of how to [sic] the healthcare system functions."

Students also responded that they benefited from learning or revising practical vaccination skills, gaining confidence in administering vaccines, understanding how vaccines work and being able to contribute to public health."

N5 "Learning about how vaccines work and also gaining confidence in the administration of vaccines."

M2 "A chance to revise my vaccinating skills."

P2 "...was helpful in gaining a better understanding of why vaccinations are so important to the community and helped my feel confident about counselling patients on vaccinations."

Overall, the students believed that the course covered everything in sufficient detail although some students suggested the workshop could include more vaccination practice and more role plays on counselling about vaccinations. One student suggested that the online pre-work could be completed in interprofessional groups to increase communications and knowledge exchange.

Experience of students who were vaccinated.

Of the 546 students vaccinated, 123 (22.5%) had not previously received an influenza vaccination, and 279 (51%) completed the patient experience questionnaire.

Overall, 98.5% were very satisfied (90.3) or somewhat satisfied (8.2) with the FMH Student-led influenza vaccination clinic, and 97.7% of students were very (92.5) or somewhat likely (5.2) to recommend the vaccination

clinic to fellow students.

Thematic analysis of open-ended responses indicated that the students who received their influenza vaccination at the student led clinic were very appreciative of the opportunity and supportive of the clinic being an ongoing initiative.

R44 "Wow, great initiative. The students and staff were pleasant and professional and the whole process was very streamlined and effortless... I hope in future years FMH is able to expand this offering."

R121 "No waiting, very quick and easy. Friendly students and ample time to discuss and ask questions."

R179 "I'm so impressed Very well organised, very friendly, and very professional."

R127 "Excellent service. Thoroughly hope that it continues in future, cannot recommend it highly enough."

R188 "XXX did an awesome job. He was very welcoming and professional, keep doing what you're doing!"

Other comments provided suggestions for future improvements and related mainly to increased days/times and locations of the clinic, with the most negative comments regarding the location.

R24 "Location wasn't super convenient, but worth the extra travel..."

DISCUSSION

In the present study we developed a student-led interprofessional influenza vaccination clinic where students in the final years of medicine, nursing and pharmacy degrees undertook vaccination training, and then these trained students administered influenza vaccine under direct supervision to students enrolled in health and allied health programs prior to their clinical placements.

Table 3. Percentage increases in Knowledge, Skills, Confidence and Attitudes pre- and post- the influenza vaccination training course according to profession

	Medicine		Nursing		Pharmacy	
	Pre (SD) (N=7)	Post (SD) (N=4)	Pre (SD) (N=8)	Post (SD) (N=7)	Pre (SD) (N=8)	Post (SD) (N=7)
Perceived knowledge	3.43 (0.58)	4.17* (0.33)	3.37 (0.99)	4.36* (0.39)	3.67 (0.87)	4.72* (0.33)
Perceived skills	3.52 (0.47)	4.17* (0.33)	3.76 (0.63)	4.45* (0.50)	3.52 (1.02)	4.76* (0.31)
Confidence	3.38 (0.84)	4.58* (0.42)	3.53 (0.90)	4.61** (0.43)	2.81 (1.14)	4.89*** (0.17)
Attitudes	4.36 (0.57)	4.63 (0.48)	4.00 (0.88)	4.50 (0.58)	4.57 (0.45)	5.00* (0.00)

Student t-test pre - post *p<0.05, **p<0.01, ***p<0.001



Table 4. Summary of Readiness for Interprofessional Learning Scale (RIPLS) data					
		Pre		Post	
		Mean ± SD	Subscale Total	Mean ± SD	Subscale Total
Teamwork and Collaboration	1. Learning with other students will make me a more effective member of a health care team	4.52 ± 0.51	41.5 ± 3.8	4.57 ± 0.93	42.6 ± 3.4
	2. Patients would ultimately benefit if health care students worked together to solve patient problems	4.74 ± 0.45		4.81 ± 0.87	
	3. Shared learning with other health care students will increase my ability to understand clinical problems	4.52 ± 0.73		4.62 ± 0.92	
	4. Communications skills should be learned with other health care students	4.57 ± 0.73		4.71 ± 0.46	
	5. Team-working skills are vital for all health care students to learn	4.83 ± 0.39		4.95 ± 0.22	
	6. Shared learning will help me to understand my own professional limitations	4.48 ± 0.79		4.62 ± 0.59	
	Learning between health care students before qualification would improve working relationships after qualification	4.65 ± 0.65		4.95 ± 0.22	
	7. Shared learning will help me think positively about other health care professionals	4.52 ± 0.67		4.57 ± 0.60	
	8. For small-group learning to work, students need to respect and trust each other	4.65 ± 0.49		4.76 ± 0.44	
Professional Identity	9. 'I don't want to waste time learning with other health care students	4.13 ± 1.18	31.0 ± 4.2	4.71 ± 0.56	*33.8 ± 3.0
	10. 'It is not necessary for health care students to learn together	4.48 ± 0.90		4.52 ± 0.68	
	11. 'Clinical problem solving can only be learnt effectively with students from my own school	4.09 ± 1.28		4.57 ± 0.68	
	12. Shared learning with other health care students will help me to communicate better with patients and other professionals	4.17 ± 0.83		4.19 ± 1.21	
	13. I would welcome the opportunity to work on small group projects with other health care students	4.30 ± 0.97		4.67 ± 0.73	
	14. I would welcome the opportunity to share some generic lectures, tutorials or workshops with other health care students	4.09 ± 1.00		4.62 ± 0.59	
	15. Shared learning and practice will help me clarify the nature of patients' or clients' problems	4.22 ± 0.80		4.67 ± 0.48	
	16. Shared learning before and after qualification will help me become a better team worker	4.39 ± 0.94		4.81 ± 0.40	
Roles and Responsibilities	17. I am not sure what my professional role will be	2.04 ± 0.88	4.7 ± 1.6	1.90 ± 0.77	4.5 ± 1.6
	18. I have to acquire much more knowledge and skills than other students in my faculty	2.70 ± 1.19		2.62 ± 1.16	
	TOTAL RIPLS SCORE		80.1 ± 7.2		83.9 ± 6.0

*Indicates item is reverse scored; * p < 0.016

Post course questionnaires showed increases in the Knowledge (27.5%, p < 0.001) and Skills (23.9%, p < 0.001) sub-scales (Table 2) similar to increases found in previous studies of pharmacy students after completing vaccination training.^{21,24} The Attitudes sub-scale, which was high in the pre-course questionnaire, also increased significantly but to a lesser degree (10.6 %, p < 0.016).

As a combined interprofessional group the Confidence sub-scale increased (46%, p < 0.001) which is less than the increase seen in previous studies of only pharmacy students. However, in the present study for pharmacy

students alone it increased by 74% (p < 0.001, Table 3) which is similar to the previous studies.^{21,24} This difference most likely reflects the greater exposure of medicine and nursing students to vaccination and injection techniques, with 38% of students in these two disciplines reporting prior vaccination experience (Table 1). Although it is interesting to note that even with their greater experience of vaccinations there was still an increase in Confidence in both medicine and nursing students after they had completed the vaccination training (p < 0.05).

Overall, there were significant increases in all items that



	Response	% Response
1. It was easy to make an appointment for my vaccination.	Strongly Agree	82.9
	Agree	14.2
	Neither Agree nor Disagree	0.4
	Disagree	0.0
	Strongly Disagree	2.5
	N/A	0
2. The location of the vaccination clinic was convenient.	Strongly Agree	57.5
	Agree	28.7
	Neither Agree nor Disagree	10.2
	Disagree	1.1
	Strongly Disagree	2.5
	N/A	0
3. The information I received regarding my vaccination appointment was clear.	Strongly Agree	73.1
	Agree	22.5
	Neither Agree nor Disagree	1.8
	Disagree	0.0
	Strongly Disagree	2.5
	N/A	0
4. Before receiving the influenza vaccine I was given ample opportunity to ask any questions relating to the vaccination.	Strongly Agree	66.2
	Agree	23.6
	Neither Agree nor Disagree	6.2
	Disagree	0.7
	Strongly Disagree	2.2
	N/A	1.1
5. I felt comfortable asking my vaccinator any questions I had about the influenza vaccine.	Strongly Agree	69.1
	Agree	21.8
	Neither Agree nor Disagree	3.6
	Disagree	0
	Strongly Disagree	2.5
	N/A	2.9
6. My vaccinator was able to answer any questions that I had regarding the influenza vaccination.	Strongly Agree	58.4
	Agree	20.0
	Neither Agree nor Disagree	4.4
	Disagree	0
	Strongly Disagree	2.2
	N/A	15.0
7. It was explained to me that I had to wait in the clinic for 15 minutes after I had received the influenza vaccine.	Strongly Agree	81.5
	Agree	14.9
	Neither Agree nor Disagree	0.4
	Disagree	0.7
	Strongly Disagree	2.2
	N/A	0



contributed to the Knowledge and Skills sub-scales (Table 2). In the Skills subscale all individual items increased significantly with the exception of the item on knowing how to obtain informed consent. This item was scored high (4.17 ± 0.82) in the pre-course questionnaire. All three student groups scored this item highly in the pre-course questionnaire and none of them had a significant increase between the pre- and post-course questionnaire. However, it was scored very highly by medical students who are based in hospitals in years 3 and 4 of their degree and are therefore likely to have gained much practice in obtaining consent from patients. Identifying anaphylactic reactions and administering an adrenaline autoinjector (Epipen®) also scored highly in the pre-course questionnaire. This may reflect that all students had experienced Epipen® training as part of their studies, and all completed first aid training and online anaphylaxis module prior to attending the workshop.

Although the student vaccinators were directly supervised for all vaccinations, no supervisor was required to intervene at any point. Although supervisors were not formally interviewed in this study, no incidents or near misses were raised by any supervisor during the daily debrief session. From informal comments made by the supervisors, the students rapidly demonstrated competency after approximately five to ten vaccinations. This provides support that there is consistency between students' self-perception and actual development of skills.

Entrustable Professional Activities (EPAs) have been designed to integrate academic learning with activities required for practice.²⁶ The EPA model is increasingly being used in the entry level degrees of many health professions to prepare students for practice,²⁷⁻²⁹ ensuring that they have the required combination of knowledge, skills, and attitudes to be effective practitioners. EPAs are assessed on a five-point scale of observable behaviours:³⁰

1. Observation but no execution, even with direct supervision
2. Perform with direct, proactive supervision
3. Perform with reactive supervision (i.e. on request and quickly available)
4. Supervise at a distance and/or post hoc
5. Supervise more junior colleagues

The American Association of Colleges of Pharmacy (AACP) Academic Affairs Committee has 15 core EPAs, that new graduates are expected to perform with limited supervision (Level 3 performance). One is "Ensure that patients have been immunised against vaccine-preventable diseases." which includes identifying whether a patient is eligible for vaccine, administering and documenting recommended immunisations to an adult and performing basic-life support.³¹ Using the EPA assessment scale, the student vaccinators in our study would be assessed at level 2/3, as there was always a

supervisor present in the room. However, once each supervisor assessed that the student was competent to administer vaccines, the level of supervision became less rigorous.

As would be expected with a group that self-selected to participate in vaccination training and the clinic, and who were then further selected based on their expression of interest submission, their attitudes to vaccination were highly positive in the pre-course questionnaire. Although the Attitudes sub-scale did increase in the post-course survey, this increase was less significant than the increase in the other sub-scales and was mainly due to the significant increase in the pharmacy students. This is in contrast to previous studies of pharmacy students that have shown no significant increase change in the Attitude sub-scale after vaccination training,^{21,24} however the reason for this is not clear.

Two of the three subscales and the overall RIPLS score were high in the pre-course questionnaire and increased only weakly after the vaccination clinic. This is similar to RIPLS results from other interprofessional activities.³²⁻³⁴ The Roles and Responsibilities sub-scale was low pre-course and did not change, however the internal consistency of this sub-scale, particularly in students, has been questioned by a number of studies.³⁵⁻³⁷ The RIPLS tool was one of the first instruments developed to study inter professional learning and is still widely used. Recent reports have suggested that in addition to the low internal consistency with some subscales, there are additional problems with the tool. These include psychometric discrepancies, unclear conceptual framework, uncertainty with what is actually measured, and the expectation that students can make judgements about skills and knowledge that they may not be familiar with.³⁸ It has also been suggested that RIPLS may not be suitable as a pre- and post-intervention measure.³⁸ However, other studies have confirmed the underlying factor structure³⁹, it's overall reliability but not the subscale reliabilities, and its appropriateness for measuring pre- and post-IPE changes.⁴⁰ Given, the ongoing debate regarding the RIPLS, the lack of IPE effect seen in this questionnaire may also reflect that despite its wide use, it may be suboptimal as a measurement tool.

After participation in the interprofessional vaccination training and vaccination clinic, there was no significant change in the RIPLS total score or any of the sub-scales. This is consistent with previous studies where students have self-selected to participate in an interprofessional activity. However, the open-ended responses clearly indicated that the students enjoyed meeting and learning with and from students from other health disciplines. Vaccination is in the scope of practice for doctors, nurses and pharmacists, and at times this overlap has led to tensions between some members of the different professions. In providing an interprofessional experiential



activity with all three professions all involved in screening patients, administering vaccines post vaccination observation, and recording of vaccination, students have been able to see that all three professions can equally contribute to the public health of their community through vaccination.

Of the students who received their influenza vaccine at the student-led clinic, 77.5% had previously received an influenza vaccination. The majority of the HCP students who were offered the vaccination were in the 18-34 year age group. This is significantly higher than the general population influenza vaccination rate for age range of 18-34 years, which averages 24%.⁴¹ This may be because HCP students have greater awareness of the importance of influenza vaccination. However, it should be noted that at least 50% (and perhaps as high as 70%) of the HCP students vaccinated are likely to have been required to receive an influenza vaccine for a placement in the previous year, rather than making an independent decision to get an influenza vaccination. This suggests that a Faculty supported student-led influenza vaccination clinic also has an important public health message for students.

The overwhelmingly positive comments from the students who received their influenza vaccination at the student-led clinic indicates the success of the clinic in providing vaccinations. In particular the comments on the professionalism and skill of the student vaccinators demonstrates the success of the training in developing the EPA for vaccination, and the clinical environment in the development authentic clinical skills.

Limitations of the study

The main limitation of the study is that student vaccinators self-selected to participate in the interprofessional vaccination initiative. The students were then further selected through an EoI process based on their statement regarding why they wanted to do the activity. Therefore, the students were likely to have positive attitudes to interprofessional activities and vaccination prior to their participation. The study is also limited by reliance on the student's self-reported perceived level of knowledge and skills. Additionally, there are only small numbers of students in each of the discipline subgroups. The small number of students in each of the discipline group limit generalisations to the broader cohorts.

CONCLUSION

The clinics proved to be extremely successful with a total 546 students receiving their influenza vaccination prior to their placement at a time when access to influenza vaccines was difficult. In addition, both the student vaccinators, and the students who received the vaccines were overwhelmingly positive about the initiative.

Although student-led vaccination clinics have previously been reported, to our knowledge this is the first inter-professional vaccination clinic where students from three different health professions were trained together, and all students participated in administering influenza vaccinations. We have also demonstrated that supervised activities such as this are an effective method of developing and assessing vaccination as an EPA, and that students can effectively run a vaccination clinic providing experiential learning in an alternative site to standard placements.

In addition, this was carried out under more difficult circumstances than usual due to the COVID-19 pandemic. With the great demand currently placed on vaccination services throughout the world, we have also demonstrated that appropriately trained HCP students could provide additional vaccinators and make a significant contribution to the COVID-19 vaccination effort.

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AUTHOR ROLES

JRH contributed to investigation, methodology, project administration, data curation, formal analysis, visualization and writing (original draft and editing). PRC contributed to conceptualization, methodology, project administration and writing (review and editing).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interests.

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