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RESEARCH ARTICLE

Evaluation of student-pharmacists' experiences in COVID-19 vaccination clinics

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Abstract

Objective: To examine the impact that participation in 2019 coronavirus disease (COVID-19) vaccination clinics had on students' self-assessed ability to vaccinate and secondarily, to examine the impact these experiences had on student perspectives of pharmacist engagement in public health. **Methods:** Student pharmacists who volunteered in COVID-19 vaccination clinics were invited to complete an anonymous, electronic survey consisting of items pertaining to their self-assessed ability to vaccinate and attitudes towards pharmacist engagement in public health in a retrospective pre/post-experience. **Results:** Students indicated that the experiences were valuable, participation increased their comfort level with vaccination, and they were better prepared to engage in vaccination following engagement. Additionally, student attitudes toward pharmacist engagement in public health improved after engagement. **Conclusion:** Participation in COVID-19 vaccination clinics had a positive effect on students' self-efficacy toward vaccination and their attitudes toward pharmacist engagement in public health. Similar opportunities should be promoted to student-pharmacists to facilitate their professional development.

Introduction

The 2019 novel coronavirus disease (COVID-19) has challenged the healthcare system, overwhelming hospitals, long-term care facilities and pharmacies, and has caused millions of deaths worldwide (Centers for Disease Control and Prevention, 2021; Hayden & Parkin, 2020; Tanne, 2021). COVID-19 has been a significant societal and economic burden, and state and local governments have advised or mandated quarantines, masking, social distancing, and vaccination (Duan et al., 2020).

As of June 2022, the US Food and Drug Administration has approved the use of two mRNA vaccines, the Pfizer-BioNTech vaccine for patients aged 16 years and older and the Moderna vaccine for patients aged 18 years and older (US Food & Drug Administration, 2021a). Both are available as an emergency use authorisation (EUA) for patients that are six months old or older (US Food & Drug Administration, 2022). An adenovirus vaccine marketed by Janssen (Johnson & Johnson) is available for use in adults through an EUA (US Food & Drug Administration, 2021). The Public Readiness and Emergency Preparedness (PREP) Act allows qualified pharmacy technicians and interns to administer COVID-19 vaccines under the supervision of a licensed pharmacist (Ninth Amendment to declaration under the Public Readiness and Emergency Preparedness Act for medical countermeasures against COVID-19, 2021).

During the peak of the COVID-19 pandemic, an increase in pharmacy workload without the allocation of additional resources occurred, overwhelming community pharmacies (Hayden & Parkin, 2020). As part of their commitment to their established partners and outreach to their community, the University at Buffalo (UB) School of Pharmacy and Pharmaceutical Sciences (SPPS) provided faculty and

students with resources to assist with mass COVID-19 clinics. Pharmacy student engagement in immunisation initiatives has been shown to increase vaccination capacity, and has positively impacted patient education and patient satisfaction (Church *et al*., 2016). A study by Hess *et al*. (2020) highlighted how the immersion of pharmacy students in community pharmacies can increase access to COVID-19 vaccines while refining their vaccination skills. From an academic perspective, it was hypothesised that participation in the vaccination clinics could improve pharmacy students' knowledge and skills of vaccine administration while enhancing the educational experience through active learning and meeting the experiential education or co-curricular credit (Accreditation Council for Pharmacy Education, 2016). The primary objective of this study was to examine the impact that participation in COVID-19 vaccination clinics had on students' self-assessed ability to vaccinate. The secondary objective was to examine the impact of these experiences on student perspectives of pharmacist engagement in public health.

Methods

This study was determined to be exempt by the UB Institutional Review Board. The UB SPPS Pharm.D. programme is a four-year degree programme with the fourth professional year consisting exclusively of advanced pharmacy practice experiences. The typical class size is approximately 120 students.

In the spring 2021 semester, the UB SPPS coordinated immunisation clinics with local area pharmacies to assist with vaccination during the COVID-19 pandemic. All enrolled first (P1), second (P2), third (P3) and fourth (P4) year professional pharmacy students were sent an email request to volunteer at the COVID-19 vaccination clinics. Upon volunteering, students were provided access to an online folder containing the EUA documents, which they were encouraged to review prior to the clinic attendance. Students were able to attend multiple vaccine clinic experiences. Upon completion, students submitted a documentation form to receive either co-curricular or experiential education credit.

All students that documented participation in a COVID-19 vaccination clinic were asked to complete an anonymous electronic survey on Survey Monkey (San Mateo, CA). The survey was administered in the early autumn 2021 semester and was open to students for three months. The survey was to be completed once and took approximately 10-15 minutes to complete. Students who did not respond were emailed with reminders every three weeks.

The survey consisted of five sections. The first section consisted of demographics, the number of COVID-19 vaccination clinics the student participated in, activities the student engaged in during the experience(s), and the extent of their vaccination experience prior to spring 2021. The second section included survey items asking students to assess their vaccine administration skills, which was developed based on two other available assessments (COVID-19: vaccinator competency assessment tool, 2020; Skills checklist for vaccine administration, 2021). The third section included items assessing student perspectives regarding the role of pharmacists in public health. The fourth section included items pertaining to interprofessional collaboration utilising the *Collaboration* subscale of the Interprofessional Collaborative Competency Attainment Survey (ICCAS) and the ICCAS validation study (Archibald, Trumpower, & MacDonald, 2014; Schmitz *et al*., 2017). The reliability and validity of the ICCAS instrument have been examined with participants from a variety of health profession programmes with evidence in support of using the instrument for measuring self-report retrospective pre- and post-interprofessional education intervention competency attainment (Archibald *et al*., 2014; MacDonald *et al*., 2010; Schmitz *et al*., 2017). The items for assessing vaccine administration skills and the role of pharmacy in public health used a retrospective pre- and post-experience rating and a seven-point Likert scale identical to that of the ICCAS. The final section included questions evaluating the experience(s) using a seven-point Likert scale (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, and 7 = strongly agree).

All statistical analyses were conducted using SPSS Statistics 24 (IBM Corp., Armonk, NY). Descriptive statistics were utilised to calculate pre-and post-vaccine administration skills and beliefs regarding the role of pharmacy in public health. Pre- and post-responses for each item were compared using the Wilcoxon Signed Rank Test. The effect size was computed for each comparison, which estimates the size of the difference or change (Rosenthal, 1994). The pre- and post-programme ICCAS *Collaboration* mean scores for each student who reported

collaborating with other healthcare professionals were reported and compared using a paired sample t-test, including calculating the effect size. When tests for significance were conducted, $p < 0.05$ was considered significant. Effect size values less than 0.2 are considered very small and meaningless, greater than 0.2 and up to 0.5 are considered small but meaningful, greater than 0.5 and up to 0.8 are considered medium, and greater than 0.8 are considered large (Cohen, 1977).

Results

A total of 92 students participated in a COVID-19 vaccination experience, with 70 students completing the survey (response rate = 76%). Prior to participation in the COVID-19 vaccination experience, 40% of students indicated having little to no experience, while an equivalent number of students reported having quite a bit to a lot of experience. Student participation in the vaccination clinics is summarised in Table I. Approximately 90% of the students who participated were in the P2 or P3 year of the programme. Students played an active role in all facets of vaccination during these experiences.

Table I: Student pharmacist (n = 70) participation in COVID-19 vaccination clinic experiences

Item	n (%)
Professional year	
P1	4 (5.7)
P2	41 (58.6)
P3	21 (30.0)
P4	3 (4.3)
Missing	1 (1.4)
Number of COVID-19 vaccination experiences	
1	15 (21.4)
2-5	26 (37.1)
6-9	4 (5.8)
10+	24 (34.3)
Missing	1 (1.4)
Activities took part in during COVID-19 vaccination experience(s) †	
Intake/registration	51 (72.9)
Patient education	64 (91.4)
Vaccine preparation (eg, draw up in syringe)	60 (85.7)
Vaccine administration	59 (84.3)
Post-vaccination patient monitoring	55 (78.6)

† More than one could be selected

The pre- and post-experience descriptive and comparison results for the items related to vaccination skills and beliefs regarding the role of pharmacists in public health are presented in Tables II and III, respectively. All vaccination skills and pharmacist engagement in public health items demonstrated a statistically significant increase from pre- to post-experience. Both thirteen (81%) items relating to vaccination skills and three (50%) items relating to pharmacist engagement in public health demonstrated a medium effect size. All other differences as determined by effect size were deemed to be small.

Table II: Pre- and post-clinic experience responses for items related to vaccination skills (n = 70)

Item	Pre		Post		Comparison	
	M (SD) [#]	Median (IQR)[#]	M (SD)[#]	Median (IQR)[#]	*p*[‡] value	Effect size[†]
Patient intake/education						
Check patient identity and screen for eligibility for vaccination	5.4 (1.60)	5.5 (4-7)	6.5 (0.76)	7.0 (6-7)	< 0.01	0.62[§]
Discuss benefits and risks of vaccination	5.2 (1.39)	5.0 (4-7)	6.6 (0.64)	7.0 (6-7)	< 0.01	0.71[§]
Address any concerns/questions the patient/caregiver may have regarding vaccination	4.9 (1.36)	5.0 (4-6)	6.5 (0.81)	7.0 (6-7)	< 0.01	0.74[§]
Clinical process						
Follow good practice in hygiene and infection prevention techniques	5.9 (1.58)	7.0 (5-7)	6.7 (0.73)	7.0 (7-7)	< 0.01	0.46[†]
Verify the vaccine is appropriate for administration (e.g. check the expiration date, verify if it is being stored appropriately)	5.7 (1.65)	6.0 (5-7)	6.4 (0.94)	7.0 (6-7)	< 0.01	0.50[†]
Prepare the vaccine according to the vaccine manufacturer's instructions	5.2 (1.89)	5.0 (4-7)	6.5 (0.99)	7.0 (6-7)	< 0.01	0.66[§]
Use the correct intramuscular injection technique	5.7 (1.59)	6.5 (4-7)	6.7 (0.71)	7.0 (7-7)	< 0.01	0.58[§]
Use strategies to reduce anxiety and pain associated with injections	4.9 (1.58)	5.0 (4-7)	6.3 (0.88)	7.0 (6-7)	< 0.01	0.70[§]
Advise patient/caregiver on what to expect after vaccination as appropriate (e.g. local injection site reactions, fever) and the management of these	5.3 (1.59)	6.0 (4-7)	6.6 (0.73)	7.0 (6-7)	< 0.01	0.68[§]
Monitor the patient after receiving the vaccine (e.g. monitor the patient for 15 minutes)	5.5 (1.68)	6.0 (4-7)	6.6 (0.75)	7.0 (6-7)	< 0.01	0.59[§]
Understand and follow the procedure for reporting any vaccine reactions	4.6 (1.73)	5.0 (4-6)	5.8 (1.26)	6.0 (5-7)	< 0.01	0.63[§]
Records procedures						
Schedule the patient for a follow-up dose when indicated	5.4 (1.82)	6.0 (4-7)	6.4 (1.00)	7.0 (6-7)	< 0.01	0.58[§]
Document the necessary information (e.g. product name/manufacturer, lot number, date, site)	5.8 (1.68)	7.0 (5-7)	6.6 (0.76)	7.0 (7-7)	< 0.01	0.56[§]
Use state/local immunisation registry to update the computerised vaccination history	4.6 (2.04)	5.0 (4-7)	5.8 (1.58)	6.0 (5-7)	< 0.01	0.55[§]
General						
Feel comfortable working/volunteering in a vaccination setting	5.4 (1.67)	6.0 (4-7)	6.6 (0.76)	7.0 (6-7)	< 0.01	0.63[§]
Feel anxious when I think about administering an injection[†]	4.7 (2.11)	5.0 (3-7)	5.2 (2.29)	6.0 (4-7)	0.03	0.27[†]

[#] The question prompts were "Before/after participating in the COVID-19 vaccination experience I was able to" and a 7-point Likert scale was used: 1= strongly disagree; 2 = moderately disagree; 3 = slightly disagree; 4 = neutral; 5 = slightly agree; 6 = moderately agree; 7 = strongly agree.

[‡] Wilcoxon signed-rank test was used to determine significance, defined as $p < 0.05$ between pre- and post-results. Statistically significant results are denoted with *.

[†] Effect size value represents a small effect

[§] Effect size value represents a medium effect

M = mean, SD = standard deviation, IQR = interquartile range

Table III: Pre- and post-student perspectives of pharmacist engagement in public health (n = 70)

Item	Pre		Post		Comparison	
	M (SD)[#]	Median (IQR)[#]	M (SD)[#]	Median (IQR)[#]	*p*[‡] value	Effect size[†]
Public health						
I understand the role of pharmacy in public health	5.7 (1.43)	6.0 (5-7)	6.6 (0.65)	7.0 (6-7)	< 0.01	0.60[§]
Pharmacy has an important role in public health	6.1 (1.44)	7.0 (6-7)	6.8 (0.56)	7.0 (7-7)	< 0.01	0.46[†]
It is important to work with other professions to address public health	6.2 (1.22)	7.0 (6-7)	6.7 (0.67)	7.0 (7-7)	< 0.01	0.67[§]
Students in my profession should learn about public health topics	6.2 (1.35)	7.0 (6-7)	6.7 (0.63)	7.0 (7-7)	< 0.01	0.39[†]
Training for healthcare professionals in public health should be with other professionals	6.0 (1.23)	6.5 (5-7)	6.5 (0.81)	7.0 (6-7)	< 0.01	0.50[§]
It is important for pharmacies to expand services offered (e.g. testing, increased immunisations, clinical)	6.4 (1.00)	7.0 (6-7)	6.7 (0.72)	7.0 (7-7)	< 0.01	0.37[†]

[#] The question prompts were "Before/after participating in the COVID-19 vaccination experience I was able to" and a 7-point Likert scale was used: 1 = strongly disagree; 2 = moderately disagree; 3 = slightly disagree; 4 = neutral; 5 = slightly agree; 6 = moderately agree; 7 = strongly agree.

[‡] Wilcoxon signed-rank test was used to determine significance, defined as $p < 0.05$ between pre- and post-results. Statistically significant results are denoted with *.

[†] Effect size value represents a small effect

[§] Effect size value represents a medium effect

M = mean, SD = standard deviation, IQR = interquartile range

Fifty-one (72.9%) respondents indicated they collaborated with other healthcare professionals and/or health profession students during the experience. The response to the item asking students about their ability to collaborate interprofessionally as compared to before the experience(s) were most frequently rated as somewhat better now (n = 21, 41.2%) and much better (n = 14, 27.5%) with some reporting about the same (n = 16, 31.4%) and no students selecting somewhat worse or much worse. The mean pre- and post- *Collaboration* ICCAS subscale score (out of seven points) were 5.05 (SD = 1.24) and 5.89 (SD = 0.95), respectively ($p < 0.01$).

Discussion

After participating in COVID-19 vaccination clinics, pharmacy students reported an improvement in their self-assessed ability to administer vaccines. Prior to the COVID-19 pandemic, 97.5% of pharmacy schools, including the UB SPPS, had implemented immunisation training as part of their curriculum, either through the American Pharmacist Association (APhA) pharmacy-based immunisation delivery programme or another, non-APhA immunisation certificate-type programme (Prescott & Bernhardi, 2019). Students with little to no experience outside of the immunisation training were paired with more experienced students, creating the opportunity for layered learning. This, paired with the hands-on experience that students received, was believed to have encouraged student confidence in their vaccination skills. The result demonstrated that a high percentage of pharmacy students were engaged in all aspects of the vaccination clinics from patient intake/registration to post-vaccination patient monitoring. These findings underscore the utility of engaging pharmacy students in community vaccination efforts and that they can provide a well-rounded experience to student learners by exposing them to all aspects of the clinic. Students were allowed to select more than one response for the activities they participated in, and it is likely that students served multiple roles during the vaccination clinics. This likely resulted in the global improvement in skills that was observed from pre- to post-experience.

In addition to the APhA training programme, the required immunisation curriculum at UB SPPS includes a patient assessment course covering assessment of vaccination status in P1 year; an adult immunisation class during the infectious disease therapeutic course in P2 year, and a

pediatric immunisation class during special populations therapeutic course in P3 year. Pharmacy students have also been involved in various, highly accepted public health engagements. For example, Hannings *et al.* (2019) evaluated patients' perceptions of pharmacy student coordination of mobile influenza vaccination clinics and reported that the majority of patients were comfortable with student immunisers and that they had already been using community pharmacists as their vaccine provider due to convenience and positive past experiences (Hannings *et al*., 2019).

While the pharmacy profession is engaged in public health, there is a gap in public health training in the pharmacy curriculum. Although the Center for the Advancement of Pharmaceutical Education (CAPE) Educational outcomes and the Accreditation for Pharmacy Education (ACPE) support the inclusion of public health concepts in the curriculum, Chen *et al.* reported that there are still limited opportunities and emphasis for public health practices during the experiential programmes and co-curriculums (Accreditation Council for Pharmacy Education, 2016; Chen *et al*., 2021; Medina *et al*., 2013). Consequently, there remains a need to reinforce the importance of incorporating public health concepts into the pharmacy curriculum. The COVID-19 pandemic reinforced the crucial role that the pharmacy profession can play in a public health crisis. As the pandemic overwhelmed various sectors of the healthcare system, vulnerable populations fell behind on their immunisations (Murthy *et al*., 2021). Given their accessibility, community-based pharmacists and student immunisers play a key role in increasing vaccination rates (Schwerzmann *et al*., 2017; Strand *et al*., 2020). This initiative addressed this issue, while also educating students on the importance of pharmacist engagement in public health crises through immersive learning. Students' pre- and post-experience responses to the six survey items related to perspectives of pharmacist engagement in public health demonstrated significant improvements indicating that in a short period of time students' understanding of the pharmacist's role in public health and their attitudes toward learning more about this role can improve.

Students indicated being better able to collaborate in an interprofessional team following their experience, consistent with previous literature (Mohammed, Turner, & Funk, 2018). Weidmann *et al.*(2015) reported that interprofessional student-run clinics improved pharmacy education and allowed for the transfer of knowledge between disciplines. These findings corroborate the findings from this paper which indicate that real-world experiences with other health professionals or student health professionals positively impact the ability of pharmacy students to collaborate.

Most students (90%) that participated in the vaccine clinic experiences were in the P2 or P3 year of the programme. P1 students do not have their pharmacy intern permits and therefore are not legally allowed to immunise, per state regulations. Therefore, their interest in these experiences may have been low as they would have limited "hands-on" opportunities. P4 students were on Advanced Pharmacy Practice Experience (APPE) rotations and may have had limited time to volunteer. While participation was voluntary, P2 and P3 students are required to complete several co-curricular activities each year and participation in a vaccine clinic fulfils one of those requirements. Therefore, interest may have been greatest in P2 and P3 groups as they may have had the most time to volunteer, could participate in all elements of the clinic and participation fulfilled an annual co-curricular requirement.

One of the strengths of this study is the response rate of 76%, which is adequate to minimise the risk of nonresponse bias. Additionally, the survey items were created based on the framework of previously validated surveys for vaccination skills and interprofessional collaboration, such as the ICCAS framework. The findings from this study further fill in the gaps that remain unanswered in the pharmacy literature related to pharmacy students' role, as healthcare professionals, in public health efforts. While objective assessment of skills is important for student competency attainment, evaluation of self-efficacy can also be valuable. Self-efficacy, or a person's evaluation of their capability to perform a specific task successfully, is important and organisational research has demonstrated that self-efficacy shows a high correlation between perceptions of efficacy and subsequent task performance (Bandura, 1977; Gist, 1987; Lumish 2022; Yorra 2014). The data from this paper supports the incorporation of pharmacy students into COVID-19 vaccination clinics as a method to improve their self-efficacy related to vaccination skills.

The most important limitation of this study was the lack of a control group for comparison. Secondly, because selecting multiple answers for activities they participated in was permitted on the survey, cross referencing what a student did and their respective scores was not viable. Similarly, the responses on prior vaccination experiences cannot be matched to the students' pre- and post-experience responses. Consequently, it may be difficult to determine if there was any individual improvement in their pre- and post-experiences.

Participation in COVID-19 vaccination clinics had a positive effect on students' self-efficacy toward COVID-19 vaccinations and their attitudes toward pharmacist engagement in public health. These findings indicate that students found these experiences to be a valuable component of their education. Schools and colleges of pharmacy should promote similar opportunities to their students to facilitate their professional development.

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