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Research Note

Incorporating a learning unit on vaccine hesitancy into a first-year doctor of pharmacy immunization course

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ABSTRACT

Introduction: Vaccine hesitancy is a growing threat to public health. The objective of this research was to investigate the effect of incorporating a learning unit on addressing vaccine hesitancy into a doctor of pharmacy immunization delivery course.
Methods: The learning unit, implemented fall 2019 at the University of Rhode Island, involved two interactive lectures and an at-home assignment. A family medicine physician spoke about her experiences with vaccine-hesitant families, and students viewed video scenarios depicting a pharmacist talking with vaccine-hesitant patients followed by an in-class discussion. Data was collected using pre- and post-surveys and a one-year follow-up survey.
Results: Out of 125 students enrolled in the course, 121 completed the pre-survey, 113 the post-survey, and 120 the follow-up survey. For pre-/post-survey comparison questions, statistically significant improvements were seen in 9 of 13 items. The follow-up survey showed 83.4% of students had applied knowledge and 85.7% had applied skills gained from the learning unit.
Conclusion: Incorporating a learning unit on addressing vaccine hesitancy into a pharmacy immunization class resulted in improvements in student self-reported knowledge and comfort in talking with patients who are vaccine hesitant. Long-term use of self-reported knowledge and skills gained was seen one-year post-implementation.

Introduction

Vaccine hesitancy is a growing threat to public health.[1] Although childhood immunization rates remained high during recent years in the United States (US), the estimated percentage of children who received no vaccinations by age two increased from 0.9% to 1.5% for children born in 2011 and 2016, respectively.[2] This was a steady rise and marks an increase from 0.3% for children surveyed between 1995 and 2001.[2,3] Among children born in 2016 and 2017, vaccination rates were lowest for first two doses of influenza vaccine (58.1%), rotavirus vaccine series (75.3%), and hepatitis B vaccine birth dose (76.3%).[2] In a national survey, the proportion of pediatricians who reported parental vaccine refusals during the previous 12 months increased between 2006 and 2013 from 74.5% to 87%. When pediatricians were asked in 2013 to select perceived reasons for parental refusal, the most common reasons were parents viewing vaccines as unnecessary (73.1%), concerns about safety and adverse effects (66.6%), and concerns for autism or thimerosal (64.3%).[4] More recently, a US survey showed 6.1% of parents are hesitant about routine childhood vaccines and more than one in four

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were hesitant about the influenza vaccine.[5]

Public mistrust and fears about vaccination have existed since the first vaccine was created in the 18th Century.[6] Today, however, television and social media allow for widespread dissemination of mistruths and falsified data.[6–8] Anti-vaccine websites use a variety of persuasion techniques. They contain potentially misinterpreted scientific evidence coupled with anecdotal stories, quote doctors, and associate anti-vaccine messages with lifestyle norms and values, such as, independence, individuality, religion, and natural or holistic health.[8] These messages appeal to parents and anti-vaccine sentiments have widespread consequences. Recent outbreaks of measles in the US have been linked to intentionally unvaccinated children.[9]

Overcoming anti-vaccine and vaccine-hesitant attitudes in the US will be key to achieving herd immunity and long-term control of the current COVID-19 pandemic. Since December 2020, the percentage of Americans in a national survey who would "definitely not" get an FDA-authorized COVID-19 vaccine if available for free has remained about the same. In December 2020, 15% of Americans reported they would "definitely not" get a COVID-19 vaccine compared to 14% in January 2022.[10] In addition, 78% of adults have heard or read at least one common false statement about COVID-19 or COVID-19 vaccines and believe the statement is true or do not know whether it is true or false.[10]

A multifaceted approach is needed to increase vaccination rates in the US. Parents and patients consistently report health care providers as a trusted source of vaccine information, meaning physicians, pharmacists, nurses, and other health professionals have an important role in addressing vaccine hesitancy.[10–13] The benefits of education about vaccine hesitancy has previously been shown among other health profession students. A 2018 study showed significant improvements in student pharmacists' knowledge, attitudes, and skills regarding vaccine hesitancy after participating in an educational program on vaccine communication. Two patient simulation activities were conducted one week apart, and students completed an online self-study module.[14] At the University of Minnesota Medical School Duluth campus, first year allopathic medical students experienced new curricular elements related to vaccinations and vaccine-hesitant patients, including a problem-based learning case, didactic lectures, and an interactive lecture. Self-reported survey data showed a significant improvement in students' comfort in talking to patients about vaccination choices.[15] At another institution, a simulation experience involving parental vaccine refusal was integrated into a baccalaureate nursing program pediatrics course. After the experience, several themes emerged from student evaluations including students feeling better prepared to handle encounters with vaccine-hesitant parents.[16]

Approximately 90% of Americans live within five miles of a pharmacy, and patients may see their pharmacist more often than their primary care provider.[17,18] Thus, pharmacists and student pharmacists should be well prepared for counseling on vaccine hesitancy. The objective of this study was to investigate the effect of incorporating a learning unit on addressing vaccine hesitancy into a doctor of pharmacy (PharmD) immunization delivery course.

Methods

The University of Rhode Island is a public institution with a zero-to-six PharmD program. Most PharmD students enter directly from high school and approximately 130 students matriculate each year. First professional year (P1) students take a required course, Pharmacy Immunization Delivery, and become certified immunizers through the American Pharmacists Association Pharmacy-Based Immunization Delivery certificate training program. A new learning unit on vaccine hesitancy was incorporated into the final two weeks of this course during the 2019 fall semester. The learning unit consisted of two 50-minute interactive lectures two weeks apart and an at-home written assignment between the lectures. The written assignment was graded by the course coordinator and was worth 5% of the overall course grade. The investigation was deemed exempt by the institutional review board (IRB).

During the first interactive lecture, a family medicine physician spoke about her experiences with vaccine hesitancy. This physician works with multiple families who have been dismissed by other primary care practices for refusing vaccinations and she was recognized as a Centers for Disease Control Childhood Immunization Champion in Rhode Island. She presented on common vaccine misconceptions, provided case examples of vaccine-hesitant patients, and talked about the skills she's learned while conversing with such patients in practice. Throughout the discussion, she engaged the audience by asking students how they might respond to different vaccine-hesitant patients and allowed time for questions.

At the end of the first lecture, paper copies of the at-home written assignment were distributed to students. The assignment asked students to counter vaccine misconceptions, list online credible sources a parent or patient could use to find information about vaccines, critique a website that promotes false vaccine information, and complete a series of true/false statements. The assignment also instructed students to explain the "presumptive approach" and write about how motivational interviewing can be used to address vaccine hesitancy. Students had two weeks to complete the worksheet.

During the second interactive lecture, students viewed video scenarios created by the student investigators. The first video portrayed a pharmacist talking with a mother who is hesitant about her daughter receiving a missing varicella vaccine. The second video portrayed a pharmacist talking with a patient who is hesitant about receiving an influenza vaccine. In both videos, two fourth professional year students acted out the roles. In class, the videos were paused, and in small groups, students discussed how they would respond as pharmacists. The student investigators (AD and LS) facilitated the small group discussions asking students about their thoughts. After this, the videos were resumed and showed the pharmacist utilizing elements of motivational interviewing to address patient concerns. At the end of each video, students were asked to share with the larger class what the pharmacist did well and offer suggestions for improvement. After this activity, the student investigators went over the at-home assignment and students shared their answers.

Data was collected using voluntary pre- and post-surveys via Qualtrics (Qualtrics^{XM}). Both surveys used a five-point Likert rating (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree) to ask students about their attitudes, comfort in talking

with patients, and knowledge regarding vaccine hesitancy. Time was allotted at the start of the first lecture to complete the 15-item pre-survey and at the end of the second lecture to complete the 19-item post-survey. The pre-survey explained the research study and asked students to provide informed consent.

In November 2020, a one-year follow-up survey was conducted to assess long-term outcomes from the learning unit. A 10-item voluntary survey was sent via email to the same cohort of students who participated in the learning unit the previous year. No incentive was offered for filling out the survey, but students were allotted time during a second professional year (P2) course to complete. These students were now a few months into their P2 year, and most had completed an introductory pharmacy practice experience (IPPE). The survey explained the purpose of follow-up data collection and again asked students to provide informed consent. It was deemed exempt by the IRB and contained a combination of yes/no questions along with questions using a five-point Likert rating. Students had one week to complete the survey.

The Wilcoxon signed rank test was used to assess differences in median Likert ratings between pre- and post-survey questions. Numerical values were assigned to responses (0 = strongly agree; 1 = agree; 2 = neither agree nor disagree; 3 = disagree; 4 = strongly disagree). The Mann-Whitney *U* test was used to assess differences between the post-survey and the one-year follow-up survey. Proportions were used to evaluate qualitative questions regarding satisfaction with the learning unit. Analyses were conducted using SPSS, version 26 (IBM Corp.) and statistical significance was denoted as $P < .05$.

Results

Out of 125 students enrolled in the course, 121 students completed the pre-survey, 113 completed the post-survey, and 120 completed the follow-up survey. We excluded three pre-survey responses that were submitted later than 15 minutes into the first interactive lecture and four post-surveys that were started prior to 40 minutes into the second interactive lecture.

Many survey responses showed statistically significant improvements from pre- to post-survey. The largest changes were seen in students who reported having the necessary knowledge to respond to vaccine hesitancy concerns (median [M] = 1.24 vs. 0.63; Z = −5.44; $P < .001$), students who believed pharmacists are obligated to start a conversation when a patient declines a vaccine (M = 1.26 vs. 0.68; Z = −5.10; $P < .001$), and students who believed they have the necessary knowledge to advise patients where to look for credible immunization information (M = 1.09 vs. 0.50; Z = −5.05; $P < .001$). Students' comfort in talking with patients who are hesitant about receiving immunizations increased (M = 1.33 vs. 0.81; Z = −4.14; $P < .001$), they showed improvements in understanding why patients may believe vaccine misconceptions (M = 1.61 vs. 1.24; Z = −2.78; $P = .005$), and significant changes were seen in students who reported having the necessary knowledge to discern credible from non-credible online information regarding the

Table 1
Pre-survey and post-survey comparison.[a]

Survey question	*n*	Pre-survey	*n*	Post-survey	*P* value
		Median ± SD		Median ± SD	
1. Vaccines are safe	121	0.35 ± 0.53	113	0.09 ± 0.32	<.001
2. Vaccines are effective	121	0.31 ± 0.50	113	0.07 ± 0.29	<.001
3. I am hesitant about receiving immunizations	121	3.55 ± 0.81	112	3.77 ± 0.56	.03
4. I believe vaccine hesitancy is a problem in the United States	121	0.55 ± 0.61	112	0.52 ± 0.59	.64
5. Pharmacists are obligated to start a conversation when a patient declines a vaccine	121	1.26 ± 0.87	112	0.68 ± 0.59	<.001
6. Pharmacists have the time to start a conversation when a patient declines a vaccine	121	1.98 ± 1.06	111	1.77 ± 1.10	.17
7. I feel comfortable talking with patients who are hesitant about receiving immunizations	121	1.33 ± 0.95	111	0.81 ± 0.68	<.001
8. I feel that I have the necessary knowledge to respond to the concerns of a person who is hesitant to receive vaccines	121	1.24 ± 0.80	111	0.63 ± 0.57	<.001
9. Counteracting vaccine misconceptions is challenging	121	1.20 ± 0.95	111	1.40 ± 1.02	.10
10. I understand why patients may believe vaccine misconceptions	121	1.61 ± 1.04	111	1.24 ± 0.91	.005
11. I feel that I have the necessary knowledge to discern credible from non-credible online information regarding the safety and efficacy of immunizations.	121	0.88 ± 0.74	108	0.53 ± 0.56	<.001
12. I feel that I have the necessary knowledge to advise patients where to look for credible information about immunizations	121	1.09 ± 0.80	107	0.50 ± 0.54	<.001
13. I believe the pharmacy program should incorporate into the curriculum how to respond to patients who are hesitant about immunizations	121	0.59 ± 0.60	107	0.49 ± 0.57	.20

[a] Questions were answered using a Likert rating where 0 = strongly agree, 1 = agree, 2 = neither agree nor disagree, 3 = disagree, and 4 = strongly disagree.

safety and efficacy of immunizations (M = 0.88 vs. 0.53; Z = −3.81; $P < .001$). In addition, improvements were observed for student perceptions about vaccine safety (M = 0.35 vs. 0.09; Z = −3.94; $P < .001$) and vaccine effectiveness (M = 0.31 vs. 0.07; Z = −4.00; $P < .001$) (Table 1).

Results from the pre-survey showed 51.2% of students knew someone who experienced a vaccine-preventable disease, and out of 66.9% of students who were working in a pharmacy, 40.7% had experienced interactions at work in which patients were hesitant about receiving immunizations. Qualitative questions revealed 78.9% of students enjoyed the learning unit and 76.7% learned about vaccine misconceptions they were not aware of prior to the activity. More than 80% of students reported the guest speaker and video scenarios aided in their learning, while only 55.7% of students said the written assignment was helpful. An association between prior pharmacy work experience and students' comfort in talking with vaccine-hesitant patients was not identified (*U* test statistic, U = 1600; $P = .91$). In addition, no association existed between prior pharmacy work experience and students who understood why patients may believe vaccine misconceptions (U = 1473; $P = .38$).

The one-year follow-up survey showed 83.4% of students applied knowledge and 85.7% of students applied skills gained from the learning unit. In addition, 55.8% of students had interacted with a patient who expressed concerns about getting a future COVID-19 vaccine, and 81.5% of students believed patients seemed less hesitant about receiving the 2020–2021 influenza vaccine due to the COVID-19 pandemic (Table 2). Data comparing the post-survey to the one-year follow-up survey showed no difference in student comfort in talking with patients who are vaccine hesitant (U = 5865; $P = .21$). However, improvement was seen in students who reported having the necessary knowledge to respond to the concerns of a vaccine-hesitant patient (U = 5446; $P = .03$) (Table 3).

Discussion

Vaccine hesitancy is a public health problem that threatens to reverse years of progress in eliminating vaccine-preventable diseases and slow control of the current COVID-19 pandemic. Pharmacists are likely to encounter vaccine-hesitant patients in practice and should be equipped with skills to counter common vaccine misconceptions, encourage such patients to receive vaccines, and educate individuals about credible online resources.

Incorporating a learning unit on addressing vaccine hesitancy into a P1 immunization class resulted in improvements in student self-reported knowledge and comfort in talking with patients who are vaccine hesitant, and student perceptions about vaccine safety and effectiveness. Although statistically significant improvements were seen in 9 of 13 items for pre-/post-survey comparison questions, practical significance remains unclear. At baseline, self-reported knowledge and comfort, and perceptions about vaccine safety and effectiveness were relatively high. This left small room for improvement in median Likert rating scores.

Our project builds upon previous research, describes a different approach to preparing student pharmacists for encounters with vaccine-hesitant patients, and assesses long-term outcomes one year after the intervention. The approach outlined in our study is easily reproducible and provides a great opportunity for older student pharmacists to teach younger students. The student investigators were two third professional year students who wrote and filmed the videos, created the at-home assignment, and led the second interactive lecture. The learning unit could also be applied to medical, nursing, and other health profession programs.

This study has several limitations. First, we did not pair pre- and post-survey responses, so we could not evaluate individual growth. Instead, we analyzed changes in attitudes, comfort, and knowledge collectively as an entire group. Second, we did not anticipate students completing the surveys outside of designated class time. Therefore, we established exclusion criteria after students took the surveys to remove outliers from the data set. Third, not all students work in pharmacies while in school and may not encounter vaccine-hesitant patients. Thus, we believe the learning unit could be improved by adding practical application. This could be accomplished by

Table 2
One-year follow-up survey.

Survey question ($n = 120$)	Yes (%)			Not applicable (%)	
1. I completed an IPPE since the vaccine hesitancy module	99.2			–	
2. Since the vaccine hesitancy module, I have spoken to family/friends/others in my personal life who are vaccine hesitant	83.3			–	
3. Since the vaccine hesitancy module, I counseled a patient at work who was hesitant about receiving a vaccine other than a future COVID-19 vaccine	56.7			14.2	
4. Since the vaccine hesitancy module, I counseled a patient during my IPPE who was hesitant about receiving a vaccine other than a future COVID-19 vaccine.	36.7			–	
9. Since the vaccine hesitancy module, I interacted with a patient who expressed concerns about getting a future COVID-19 vaccine	55.8			–	
10. From my perspective, patients seem less hesitant about receiving the influenza vaccine this year due to the COVID-19 pandemic	81.5			–	
	Strongly agree (%)	**Agree (%)**	**Neither (%)**	**Disagree (%)**	**Strongly disagree (%)**
5. I feel comfortable talking with patients who are hesitant about receiving immunizations	27.5	55.8	13.3	3.3	0
6. I feel that I have the necessary knowledge to respond to the concerns of a person who is hesitant to receive vaccines	31.7	55.8	10	2.5	0
7. I have applied the knowledge gained during the vaccine hesitancy module	29.2	54.2	14.2	2.5	0
8. I have used skills gained during the vaccine hesitancy module	28.6	57.1	13.4	0.8	0

IPPE = introductory pharmacy practice experience.

Table 3
Post-survey and follow-up survey comparison.

Survey question	Survey	*n*	U test statistic	Z score	*P* value
I feel comfortable talking with patients who are hesitant about receiving immunizations	Post-survey Follow-up survey	111 120	5865	−1.254	.21
I feel that I have the necessary knowledge to respond to the concerns of a person who is hesitant to receive vaccines	Post-survey Follow-up survey	111 120	5446	−2.227	.03

incorporating vaccine hesitancy discussions and simulation activities into laboratory courses to reinforce skills learned. Lastly, we did not track outcomes in student learning beyond the one-year follow-up survey. It is unclear whether or not the benefits will carry into practice when students become licensed pharmacists.

Conclusions

Implementing a learning unit that taught student pharmacists about vaccine myths, how to counter such misconceptions, and techniques for responding to vaccine-hesitant patients resulted in improved attitudes, self-reported comfort in talking with patients, and self-reported knowledge about vaccine hesitancy. Our study suggests pharmacy programs should include education on vaccine hesitancy to better prepare students for challenging encounters in professional practice.

Disclosure(s)

None.

CRediT authorship contribution statement

Anne R. Dionne: Conceptualization, Methodology, Investigation, Writing – original draft. **Lauren Sittard:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Lisa B. Cohen:** Formal analysis, Supervision. **Brett Feret:** Methodology, Resources, Supervision. **Anne L. Hume:** Conceptualization, Methodology, Resources, Writing – review & editing, Supervision.

Declaration of Competing Interest

None.

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