

ORIGINAL RESEARCH

Immunization training modules: Identifying student nurse learning

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ABSTRACT

Background and objective: Despite the importance of vaccination in disease prevention some people choose to remain unvaccinated. Nurses are influential in the choice to vaccinate. Considering the possibility of poor public understanding of vaccines and need for continued improvement in vaccination rates, it is essential for nurses to be knowledgeable and adept at addressing vaccine concerns, especially since the COVID-19 pandemic. Vaccination education formally begins in nursing school. The objective of this study was to identify nursing students' vaccine understanding by exploring information learned from formal online vaccine education specifically the Nursing Initiative Promoting Immunization Training Modules (NIP-IT).

Methods: Nursing students enrolled in a Community Health Nursing course were required to complete three online, self-study, modules entitled Vaccine Preventable Diseases, Vaccine Concerns, and Nursing Roles. The nursing students who completed these modules responded, in writing, to an open-ended prompt asking them to identify what new piece of information they learned. Responses gathered from 244 nursing students between September of 2016 and April of 2018 were categorized and grouped according to theme using a first and second cycle coding process. Responses containing more than one idea were considered separate responses and categorized accordingly totaling 273 responses.

Results: Nursing student responses revealed five major themes regarding new information learned from the online modules: (1) barriers to vaccination; (2) components of vaccines; (3) the influence of nurses; (4) vaccine-preventable diseases; and (5) community immunity.

Conclusions: Formal vaccine education is a critical component of a comprehensive nursing program. The nursing students in this study described information they learned when completing the NIP-IT modules, thus it was inferred the nursing students did not have a full understanding of vaccine concepts prior to viewing the modules. Formal nursing school vaccine education is essential in developing nurses capable of navigating vaccine issues and promoting health and preventing disease through vaccination advocacy.

Key Words: NIP-IT, Nursing initiative promoting immunization training, Nursing students, Immunization/vaccination education

1. INTRODUCTION

Vaccinations are critical to the health and wellness of individuals and communities, preventing between 2-3 million deaths each year.^[1] According to the Centers for Disease Control and Prevention,^[2] reducing vaccine-preventable diseases (VPDs) through vaccination is one of the ten greatest

public health achievements of the 20th century. The World Health Organization^[3] lists vaccine hesitancy, or the growing fear of vaccines, as one of the ten greatest threats to global health in 2019. Refusal of childhood vaccines has a negative effect on the health of individuals and communities,^[4] thus reinforcing the need for vaccination education

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to combat inaccurate information available to the public.^[5] Despite the success of vaccines in preventing VPDs, some parents refuse to vaccinate their children citing concerns of vaccine safety.^[6,7] Other common reasons parents refuse vaccines include a belief that natural immunity is superior to vaccine-acquired immunity, beliefs that the risks of vaccine administration outweigh the risks associated with VPDs, and the misconception that vaccines are associated with autism.^[8]

In 2019, amidst ongoing campaigns to address parental vaccine safety concerns and improve global vaccination rates, a novel coronavirus outbreak occurred in Wuhan, China. The novel virus, COVID-19, quickly became a worldwide pandemic.^[9] During the COVID-19 pandemic, hard-earned progress in worldwide vaccine education and uptake was lost.^[10] During this tumultuous time, vaccine safety, more than ever before, became a widely politicized and hotly debated topic in the media with an expansive divide between opposing points of view.^[11] Indeed, the COVID-19 pandemic has caused the greatest decline in vaccine uptake in 30 years.^[12] Consequently, there has never been a greater need for accurate vaccine-related information that promotes vaccine confidence.^[13]

Open and honest communication with parents who are vaccine-hesitant is one strategy to alleviate concerns while also assisting parents to separate factual vaccine information from misinformation.^[14] It is important for parents to receive accurate education on the risks and benefits of vaccines, as well as the risks associated with VPDs, so they can make informed decisions regarding the health of their children. Parents who are informed regarding vaccines are more likely to vaccinate.^[15]

As the most trusted profession,^[16] nurses are in a crucial position when it comes to providing accurate vaccine education to patients. Nurses are on the front lines of patient care, strengthening patients' knowledge and understanding of various health conditions, providing vaccine education, and easing parents' concerns regarding vaccinations.^[17] Given the critical role of nurses in offering vaccine education to parents, there is a need for enhanced vaccination education for nurses as an important part of the health care team.^[18] Identification of vaccination knowledge gaps in nursing students may allow nursing educators to better prepare students to act as vaccination advocates.

To provide effective vaccine education for student nurses, it is important to determine which concepts are most essential. The Nursing Initiative Promoting Immunization Training (NIP-IT) was designed specifically for nursing students and was created as a collaborative effort between the University of Oklahoma College of Nursing and the CDC.^[19] NIP-IT

consists of six evidence-based vaccine information modules that highlight essential vaccine information, such as the science and importance of vaccinations, VPDs, and prominent vaccine concerns.^[19] Currently, however, there are no published data analyzing the vaccination knowledge of nursing students who complete the NIP-IT modules. Therefore, the purpose of this study was to identify what new information student nurses learned from participation in the NIP-IT vaccine education program, thus illuminating what knowledge was not fully concretized prior to completion of the modules.

2. METHOD

2.1 Participants

To be eligible for inclusion in this study, participants were required to be a nursing student enrolled in an undergraduate Community Health Nursing Course at a private university located in the Western United States. The Community Health Nursing course is a required course and taught during the second semester of a six-semester baccalaureate nursing program. Participants were enrolled in the course between fall of 2016 and winter 2018 and each cohort had approximately 62 students. Attendance/participation points were earned during every class, thus 100% of students present responded to the prompt. Students in this specific nursing program average around 21 years of age.

2.2 Design

The study was a retrospective, descriptive design that received Institutional Review Board approval. Before a pre-determined date in class, students independently completed three NIP-IT modules entitled: Vaccine Preventable Diseases, Vaccine Concerns, and Nursing Roles available at <https://nip-it.org>. Following completion of the three modules, students were asked to respond, in writing, to the question, "Tell me something you learned from the NIP-IT modules that you did not know before." By discovering what students learned from the modules, the assumption was made that they did not have a firm understanding of the information prior to that time. Students recorded answers on a 3x5 index card that was collected during class. Students were not required to write their name on the 3x5 index card, received no points for responding, and had 10 minutes in class to respond to the prompt.

2.3 Data analysis

Out of 244 student responses two responses were disregarded, the first because the student did not watch the modules and the second because the response was unrelated to the modules and vaccinations. If students asked how many newly learned items they should list, the principal investigator clarified that one item was sufficient. Despite this instruction,

occasionally, a student responded with two or three lessons they learned. Multiple responses were separated and categorized independently; creating an additional 31 responses, increasing the number of responses from 242 to 273.

Data were verified by the primary investigator and entered into a Microsoft Excel (Excel version 16.16.10, 2018) spreadsheet. Data were then analyzed for themes by three independent researchers. Researchers reviewed first-cycle coding processes, which used initial and descriptive codes, to identify and label responses with topical similarities. Researchers then analyzed data using focused coding, a second-cycle cod-

ing process to relate categories to each other and to the contextual elements most salient in the initial coding process.^[20] Researchers convened with a qualitative expert and came to consensus on all identified themes.^[21,22]

3. RESULTS

Nursing student responses revealed five major themes regarding new information learned from the modules: (1) barriers to vaccination (n = 86; 32%); (2) components of vaccines (n = 58; 21%); (3) influence of nurses (n = 48; 18%); (4) VPDs (n = 39; 14%); and (5) community immunity (n = 24; 9%) (see Table 1).

Table 1. Information learned by nursing students after completing NIP-IT modules

Theme	Subtheme	# of Comments	% of Comments
Barriers to Vaccination		n = 86/273	32
	Autism Misinformation	n = 39/86	45
	Parental Concerns	n = 36/86	42
	Social/Environmental Barriers	n = 11/86	13
Components of Vaccines		n = 58/273	21
	Additives/Ingredients	n = 34/58	59
	Antigens	n = 11/58	19
	Vaccine Facts	n = 8/58	14
	Combined Vaccines	n = 5/58	8
Influence of Nurses		n = 48/273	18
VPDs		n = 39/273	14
Community Immunity		n = 24/273	9

3.1 Barriers to vaccination

The first of the five themes denoted an increased awareness of barriers to vaccination (n = 86/273; 32%). From this information, three main sub-themes emerged regarding barriers to vaccination: autism misinformation, parental concerns, and social and environmental barriers to vaccination.

The most common subtheme related to autism misinformation (n = 39/86; 45%). Participants became aware, for the first time, of the unfounded belief that there is a link between vaccines and autism held by a subset of the general population. One participant stated, "I didn't know that a lot of people believe that vaccines cause autism." Other participants were more specific pointing out the most commonly accused culprits of autism and the research disproving any such links sharing, "I thought it was so great to learn about thimerosal and how it is harmless and completely unrelated to autism," and, "I learned that through misinformation transfer, the [preservative] [thimerosal] found in some older vaccines, including MMR, was commonly associated with causing autism. I learned why this is not true and the truth about the

chemical's nature."

The second subtheme was an understanding of the existence of a wide range of parental concerns (n = 36/86; 42%). For instance, some participants merely acknowledged the existence of parental vaccine concerns stating, "I didn't know how many fears [parents] had about vaccines," or, "I thought it was interesting how many people don't understand the importance of vaccines, and all of the concerns they have." Other participants went a step further expressing not only their new awareness of vaccine concerns, but also the research addressing/disproving common misperceptions. As one participant stated, "I didn't know that vaccine schedules were an issue for some mothers. I had never thought that [the number of vaccines] might be an issue. I also learned that [the recommended vaccine schedule] isn't too much for the kids. It's really only a fraction of all the stressors on their immune system."

While the first two sub-themes were specific vaccine concerns and thus potential barriers to vaccination, the third sub-theme included issues regarding social determinants of

health (n = 11/86; 13%). As an example, one participant shared, “I learned more about the barriers that prevent people from getting vaccinated, such as social/economic barriers and health care system barriers. I didn’t know how many things prevent people from getting vaccinated besides being uneducated about them.” Another participant reported, “Before doing the modules, I was unaware of all the barriers involved with vaccines. The environmental factors that keep patients from being vaccinated (long lines, etc.) never crossed my mind before.”

3.2 Components of vaccines

The second theme regarding new information learned from the NIP-IT modules was a new understanding of vaccine components (n = 58/273; 21%). Within this theme there was one major and three minor subthemes. The major subtheme concerned the components of vaccines, such as additives and ingredients (n = 34/58; 59%). Participants acquired understanding of how vaccines were made or reported surprise as they learned about public alarm regarding ingredients such as aluminum, mercury, and thimerosal. In addition, many participants learned about evidence demonstrating the safety of such ingredients. One participant expressed, “I learned vaccines have aluminum in them, but that infants get less aluminum from all vaccines than all the [breastmilk] or especially formula milk in the same timeframe.” Another student shared, “I learned that mercury is only contained now in multi-dose vials of the flu vaccine, that it is ethyl mercury (not harmful & disposed of quickly by body), and that its purpose is to preserve vaccines.”

The first minor subtheme was regarding antigens and the number of antigens in vaccines (n = 11/58; 19%). Participants learned concepts not previously understood about the number of antigens in vaccines and how this number has decreased over time, and/or the existence of parental fear concerning overexposure to antigens. One participant shared why parents should not fear antigens, saying, “I learned that vaccinations account for [0.00006-0.006%] of young children’s exposure to antigens [by age 6], so statistically speaking, ‘too many vaccines too soon’ need not be a concern for parents.” Another participant expressed, “I didn’t know that even though there are more vaccines now than there were 20 years ago, there are actually less antigens in all of them combined than there were in the original vaccines.”

The second minor sub-theme included facts participants learned about vaccines through the modules (n = 8/58; 14%). Participants portrayed the broad scope of this category by making statements such as, “I learned that they took something out of vaccines that actually were not harmful to try to calm the public,” and “1 in 1,000,000 MMR vaccines result

in an abnormal [reaction].”

The third minor sub-theme, regarding combined vaccines, was only mentioned by five participants. One student expressed this newfound knowledge stating, “Something I learned from the modules that I didn’t know before was that some of the vaccines are combined. I thought they were each separate and spread out. I now know the benefits in getting the vaccines together and sooner though.”

3.3 Influence of nurses

The third most common theme was how vital the nurse is in promoting and advocating for vaccinations (n = 48/273; 18%). Participants learned the important role nurses play as patient educators to increase patients’ knowledge and understanding of vaccinations. One participant gave a response that represented the positive impact of nurses on promoting vaccinations, “I feel like I understood the importance of the nurse’s role in consistently educating patients about the importance of vaccines. Our open responses about the risks and benefits of vaccines greatly influence their own decisions toward vaccines.” Another participant shared, “I learned how important the nurse’s role is in education about vaccinations. We have a huge influence and can help clear up any misconceptions/worries parents have.”

3.4 Vaccine-preventable diseases

A number of participants (n = 39/273; 14%) learned something new about VPD’s while completing the training modules. The most commonly mentioned VPD was varicella (chickenpox), but influenza/Hib, hepatitis, human papillomavirus (HPV) and pertussis were also mentioned. Responses regarding VPDs included statements such as, “I didn’t realize how devastating these VPDs can be and how having vaccines has lulled us into believing they’re no big deal and nothing to worry about,” and, “It was really fascinating to learn more about diseases, their history, & immunizing against them. It was good to connect the diseases with real people and real consequences.”

3.5 Community immunity

The final theme was community immunity (i.e. herd immunity) or protection offered to unvaccinated individuals as a result of being surrounded by a large number of vaccinated individuals (n = 24/273; 9%). Participants learned what community immunity was and the influence of community immunity on the overall health of community members. As one participant stated, “I learned about herd immunity and how there is a certain percentage of the community that needs to be vaccinated in order to protect others who have not or cannot be vaccinated.” Another participant shared similar thoughts stating, “I learned more about herd immunity

and the power it has to protect people but also that it is not enough to consider yourself safe, with less people receiving vaccinations there have been more breakouts of VPDs.”

4. DISCUSSION

By asking participants what they learned from the NIP-IT modules, one can conclude that they did not know the information beforehand. The broad areas where nursing students reported learning new information illuminate large gaps in the understanding of vaccines and the science of immunization prior to completing formal education. To close these gaps it is vital for nursing students to receive thorough vaccination education during their undergraduate program and prior to entering the workforce. Nursing students need to be armed with vaccine knowledge to be better educators and to answer tough questions addressing patient/parental confusion arising from an ever-growing, vaccine-hesitant culture.

This study demonstrates the need for student nurse vaccine education. Undergraduate nursing programs should prepare student nurses to be knowledgeable advocates for vaccination. However, there are no specific requirements for vaccine education in nursing schools.^[23] Researchers report health care professional curricula are inconsistent in preparing students (medical, nursing, pharmaceutical, etc.) to provide clear vaccine education to patients. Researchers participating in the VAXED Project, a study analyzing the vaccination training of a number of medical professionals in Canada, discovered broad variability in undergraduate training and self-rated competence.^[24] Additionally, Pelly et al.^[24] reported inconsistency in the allocation of class time devoted to vaccination training, ranging from a minimum of <1 hour to a maximum of 52 hours. Recognizing deficits in vaccine education for health care professionals, researchers in Belgium established an entire summer school program on vaccinology, targeting the knowledge gaps of students.^[25]

A wide variety of methods may be successful in educating nursing students on current vaccination issues, immunization science, and potential barriers to vaccination. The NIP-IT modules, used in this study, are a valuable resource easily incorporated into nursing curricula. The NIP-IT modules are readily accessible, user friendly, and free. NIP-IT is an excellent example of a vaccination-training program covering essential elements of vaccine education. NIP-IT education can stand-alone or serve as an effective foundation to construct college-specific vaccination curricula.

In addition to the NIP-IT modules, there are other resources available to facilitate integration of vaccine training and immunization teaching materials into the undergraduate nurs-

ing education. One such resource is the Immunization Resources for Undergraduate Nursing Education (IRUN) group/publication.^[26] The IRUN committee, developed by the Association for Prevention Teaching and Research and the CDC, has created tools and simulation suggestions to enable nursing schools to incorporate formal vaccine education into their curriculum. By including formal vaccine/immunization training into undergraduate nursing programs, thus, preparing nurses to be better advocates for vaccination, nursing schools will be doing their part to increase vaccination rates and address the public health issue of declining vaccination rates.

By whatever method, nursing schools should sponsor vaccine and immunization science education for their students. This study demonstrates, prior to formal vaccine education, student nurses have knowledge deficits in the following concepts which should be, at a minimum, included in formal nursing school vaccine/immunization education: (1) potential barriers to vaccination; (2) components of vaccines; (3) influence of nurses; (4) VPDs; and (5) community immunity. With this enhanced education, nursing students will have a broader and deeper understanding of vaccination and the science of immunization prior to entering the workforce.

4.1 Limitations

Limitations of this study include a young student cohort, evaluating only one university, and not requiring a pre-assessment to identify student knowledge prior to intervention. Therefore, the results of this study are not representative of all student populations and cannot be generalized to other undergraduate nursing programs. Evaluating students at only one university also impairs generalizability. An additional limitation of this study was not knowing each students' baseline vaccination understanding prior to completing the NIP-IT modules, or if there was more than one new piece of information learned from the modules. It is possible the nursing students learned a plethora of new information, but only reported one per the instructions of faculty.

4.2 Future implications

Analyzing responses following completion of the NIP-IT modules provided a broad understanding of student knowledge gaps based on the assumption that learning something new means the information was not known prior to the formalized vaccination training. The results of this study should be used as a stepping-stone toward incorporating thorough, formal vaccination education in undergraduate nursing programs. The quantity and fundamental nature of information learned, as a result of completing the NIP-IT modules, demonstrates that undergraduate nurses do not have a basic

understanding of the science of vaccination prior to nursing training. Without formal vaccination training nursing students will be ill-prepared to effectively respond to common vaccine concerns upon entry in the workforce, making the need for formal vaccination education in nursing programs even more critical.

5. CONCLUSION

Student responses in this study revealed that formalized vaccination training (NIP-IT modules) increased nursing stu-

dent learning about barriers to vaccination, components of vaccines, the influence of nurses, VPDs, and community immunity. Considering the valuable learning that took place, formal vaccine education is an essential component of a comprehensive nursing program. Thorough and formal vaccine education in undergraduate nursing programs is critical in developing nurses capable of promoting health and preventing disease through vaccination advocacy.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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