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Agricultural Safety and Health Curriculum: Preparing the Next Generation of Rural Nurses

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ABSTRACT

The purpose of this study is to examine the impact of including/expanding agricultural health and safety curriculum in a prelicensure baccalaureate of nursing program on the nursing students' knowledge of agricultural health and safety. A convenience sample of baccalaureate nursing students in their first year of nursing school on two different campuses of a Midwestern college of nursing. Agricultural health and safety content was introduced with pre- and post-surveys completed after delivery of the agricultural health and safety education unit. Independent T-test ($p < .05$) performed on pre ($n = 135$) and post surveys ($n = 109$). There were no significant differences between baseline data on the two campus sites or between genders. There were statistically significant differences between baseline and post levels of knowledge, with an increase in perceived knowledge. Students "raised on a farm" or "that worked on a farm" and students "not raised on a farm" or "didn't work on a farm" had significantly different knowledge levels at baseline, and all groups had a statistically significant change in knowledge, but no significant posttest difference between groups. Incorporation of agricultural health and safety into a Bachelor of Science Nursing program can lead to significant knowledge increase and better prepare student nurses to provide care to patients with agricultural-related injuries and health concerns.

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Nursing education; agricultural safety and health; rural healthcare

Introduction

Agricultural workers have one of the highest injury rates when compared to other industry workers in the United States. Agricultural workers are at a very high risk for fatal and nonfatal injuries, and farming is one of the few industries in which family members (who often share the work and live on the premises) are also at risk for fatal and nonfatal injuries[1] The National Institute for Occupational Health and Safety reported in 2019, 410 farmers and farm workers died from a work-related injury, resulting in a fatality rate of 19.4 deaths per 100,000 workers in the United States.[1] Analysis of 6 years of agricultural injury and fatality data for a seven-state region reported 1046 agricultural injuries with 44% fatalities.[2] Tractor accidents were the leading cause of fatalities and injuries. Furthermore, all-terrain vehicles (ATV) were also a significant source of fatalities. Although fatalities were most frequent in the older populations, there appeared to be an increased risk in children as well.[2] Agricultural injuries are not only a national concern but also a global concern.[3] Agricultural injuries are often underreported, and non-fatal injuries are frequent and have been difficult to count.[4] Thus, states have developed multisource surveillance systems to help identify and learn more about non-fatal work-related agricultural injuries.[4]

Not only are fatal and non-fatal injuries a concern for the agricultural occupation but many farmers and agricultural workers suffer from occupationally induced acute and chronic health conditions.[5] In addition, environmental factors such as heat exposure are a concern as agricultural workers are 35 times more at risk of heat-related mortality compared to workers in other occupations.[6] Mental health is another key health concern as data has reported higher suicide rates per 100,000 farmers and agricultural workers compared to occupational suicide rates in all occupations.[7]

The literature reports a gap in health-care workers' knowledge about agricultural safety, injuries, and fatalities.[8–10] Agriculture is unique in that it involves all ages across the life span, thus necessitating the need for knowledge across both adult and pediatric realms. Families are raised on working farms with a substantial number of pediatric farm-

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related injuries. Studies focused on advanced practice pediatric nurses discussed a lack of preparation in this specialty group. For instance, Kilanowski surveyed 315 members of the National Association of Pediatric Nurse Practitioners (PNPs) and identified that PNPs were not knowledgeable about existing agricultural injury resources but were interested in continuing education.[8] Although 95% remembered their education included safety anticipatory guidance, only 8% said agricultural safety was included, and 58% believed it was important or very important to be knowledgeable. Kilanowski focused on youth and children's agricultural injuries in the pediatric nurse practitioner programs, reviewed PNP texts books, and found minimal information on safety in the agricultural home and work environment.[8] In addition, researchers surveyed 56 nurse practitioners (NPs) and physician assistants (PAs) and reported 78% of the NPs and 68% of the PAs reported feeling "somewhat uncomfortable" to "uncomfortable" concerning agricultural-related health issues and care. These same percentages of NPs and PAs were also interested in participating in continuing education.[9]

Other studies focused on agricultural youth and graduates of an agricultural health and medicine five-day intensive conference.[11–13] Education aimed at the youth has been directed at national Future Farmers of America (FFA) members and high school students involved in agricultural classes. The curriculum used within FFA Chapters has been found to be valuable in delivering safety education.[13] When an agricultural safety curriculum developed by public health nurses was used in high school agricultural classes, students scored significantly higher on knowledge about farm safety and attitude and intent to change work behavior than those that did not participate.[12]

The authors did not find any studies in the literature that focused on agricultural safety education for undergraduate BSN student nurses. A single article discussed that when providing RN to BSN students a unique clinical experience, participants perceived that their knowledge about farm safety, injury prevention, and development and implementation of a teaching plan increased.[14] The literature appears to focus on nurse practitioners, physician assistants, medical students, and licensed providers continuing education.[8–10,15–17] While it is important to educate providers, it is also necessary to educate the prelicensure nursing students who will be delivering direct patient care. Baccalaureate-prepared nurses are caring for the agricultural worker in several roles, including acute care, clinics, community nursing, and in public health arenas. Nurses need to be knowledgeable on how to treat, communicate, and educate the agricultural community as it relates to safety. The purpose of this study is to examine the impact of including/expanding agricultural health and safety curriculum in prelicensure baccalaureate of nursing program on the nursing students' knowledge of agricultural health and safety. This article will discuss the incorporation of agricultural safety and health into the curriculum of a nursing program in the first semester of the nursing curriculum and future implementation plans.

Methods

The agricultural health and safety curriculum was introduced around current concepts within a concept-driven curriculum. Concept-based curriculum (CBC) is an approach to curriculum design that emphasizes "big ideas" that span multiple subject areas or disciplines. Agricultural health and safety concepts were introduced in a semester one basic nursing course focusing on health promotion within the safety concept and occupational health exemplar. Content incorporated included concepts from an intensive week-long Agricultural Health and Safety Conference shown in Table 1. The Agriculture Health and Safety nursing education was a 2-hour lecture with class participation activities. Faculty that taught the course had attended and completed post exam requirements of a four-day intensive Agricultural Health and Safety Conference. The education was leveled to first year nursing students as the first step toward incorporating the content. Future steps for implementation include an agricultural safety review of literature in the Evidence-Based Practice Course (Semester 2) and agricultural population health being included in the Patient Populations Course (Semester 3). Within the Patient Populations course nursing students will go to Agricultural Field Days to actively engage the community through an Immersive Virtual Reality (IVR) safety game. IVR will be used to demonstrate agricultural health and safety hazards to nursing students and public populations in upcoming semesters.

Table 1. Curriculum concept topics.

Topics Covered for Agricultural Health and Safety
Respiratory diseases
Agricultural Chemicals & Pesticides
Zoonotic infections
Veterinary Pharmaceuticals
Mental Health
General Environmental hazards
Acute and Chronic Trauma (Tractors, ATVs, Grain Entrapment)
Musculoskeletal diseases
Noise, vibration, heat, cold injuries
Skin diseases
Cancer in Agricultural populations
Primary Prevention
Secondary Prevention
Tertiary Prevention
Resources

Setting

The study was conducted on two campuses of a Midwestern university college of nursing. One campus serves a rural community and the other an urban community surrounded by rural communities.

Sample

Nursing students enrolled in the traditional BSN program during their first semester of their nursing curriculum. Pre-survey n = 135, post-survey n = 109.

First year intervention

First-semester Health Promotion Course Intervention

(1) Nursing students enrolled in Semester 1 BSN program were asked to voluntarily take a survey on self-perceived knowledge of agricultural health and safety prior to the presentation of content.
(2) Agricultural Health and Safety course content was presented. Faculty presented content derived from a four-day intensive Agricultural Health and Safety course provided by Central States Center for Agricultural Safety and Health.
(3) Nursing students were asked to voluntarily complete a post survey on self-perceived knowledge of Agricultural Health and Safety after the presentation of content.

Tool

Data was collected with a tool initially developed to measure attitude, behavior and knowledge of students who completed either the *Agricultural Medicine: Occupational and Environmental Health for Rural Health Professionals* course in the state of Iowa or *Agricultural Health and Medicine* course in the state of Victoria in Australia.[15] The tool was designed to address Kirkpatrick's four levels of evaluation, reaction, learning, behavior, and result. This study used the knowledge questions anchored with a 7-point Likert scale using anchors such as "not very knowledgeable at all" (1) and "being very knowledgeable" (7). The survey was consistent with the concepts presented. For example, the survey questions "knowledgeable of prevention measures for agricultural injuries" or "knowledgeable of agricultural resources", matched the concepts of health promotion prevention, community resources, and health disparities.

Data analysis

Descriptive statistics were completed on the data and an Independent T-test performed on pre/post surveys: n = 135 baseline surveys and n = 109 ($p < .05$). There were no significant differences between baseline data on the two campus sites or between genders. Because there were no differences between groups, the two sites were treated as one data set.

Results

There were statistically significant differences ($p < .001$) between baseline and post levels of knowledge, with an increase in perceived knowledge. Students "raised on a farm" and students 'not raised on a farm" had significantly different knowledge levels at baseline ($p < .001$) and both students "raised on a farm" and students "not raised on a farm" had a statistically significant change in knowledge ($p < .001$) but there was not a significant posttest difference between groups. Finally, students "that worked on a farm" and students "that didn't work on a farm" had statistically different knowledge levels at baseline

(p = .001) and both students "that worked on a farm" and "that didn't work on a farm" had a statistically significant change in knowledge (p, .001), but there was not a significant posttest difference between groups. Scores on the pre-survey indicated the students felt most knowledgeable at identifying agriculture as a high-risk occupation and knowledgeable about the types of injuries. Although they felt knowledgeable in knowing the types of injuries, they rated how to treat the injuries and agricultural resources the lowest on the pre-survey. The largest change of means was seen in the knowledge of types of agricultural hazards and knowledge of how to treat an agricultural injury. See Table 2.

Discussion

The education and curricular changes made regarding agricultural health and safety information provided to the nursing students appear to make a difference in how equipped and knowledgeable the nursing students perceived they were in caring for the agricultural population. Historically, nurses and other health professionals have not considered themselves to be prepared to care for agricultural injuries.[10–12,14,15,18] Curricular changes made in our nursing program demonstrated the ability to address this gap and better prepare nurses to care for the agricultural population of the future. The region in which the study was conducted serves a large rural agricultural population, and the nurses were likely to see and care for individuals from this population. Schools of nursing need to consider the populations they serve. Additionally, nursing schools in states where agriculture is a dominant occupation should ensure they are preparing their students to care for the population they will serve.

Table 2. Survey questions.

Survey questions on agricultural knowledge	Pre-survey Mean	Post-survey Mean	Mean score increase
Knowledgeable of agricultural occupational hazards	4.28	5.63	1.35
Knowledgeable of why agricultural is such a high-risk occupation	4.66	5.80	1.14
Knowledgeable of the types of agricultural hazards	4.29	5.71	1.42
Knowledgeable of types of agricultural injuries	4.42	5.72	1.30
Knowledgeable of prevention measures for agricultural injuries	4.30	5.32	1.02
Knowledgeable of how to treat an agricultural injury	3.94	5.33	1.39
Knowledgeable of agricultural resources	3.93	5.30	1.37

There was evidence that those student nurses raised or working on a farm were more aware and/or educated than those students who were not. However, providing all students with education allowed those not familiar with the subject matter to improve at a greater level, overcoming the knowledge gap to the point that there was no statistical difference post-education. This would imply all students needed the education, even though starting at different levels. All groups learned, and the less knowledgeable students "caught-up" with the more knowledgeable students. Health promotion and safety concepts were easy to understand once the information was presented to the students. Health promotion related to primary, secondary, and tertiary prevention was presented in the content to the nursing students, but the tool used to evaluate effectiveness came from a medical model and did not address the question of how equipped the students felt they were related to health promotion. The *AACN Essentials* addresses nursing education for the 21st century and to shape the future workforce.[19] The addition of agricultural health and safety aligns with this call, including social determinants, health promotion, acute care and prevention measures. The National Academy of Sciences report on *The Future of Nursing 2020–2030* also calls nursing schools to strengthen curriculum, promote health equity, reduce disparities (including rural), and expand social determinants of health, which are important issues within agricultural health and safety.[20] Based on the final survey scores, there continues to be a need for further education to prepare student nurses to be competent and confident in their knowledge and to be "work ready" in the communities they will serve. Agricultural health and safety needs to be reinforced throughout the curriculum and discussed in courses such as Evidence Based Practice and Population Health.

Limitations

This was a small convenience study group, so further research is needed before generalization to the general populations of nursing students is

made. Because subjects were anonymous, the authors could not measure individual subject changes over time but only those of the group.

Conclusion

Incorporation of agricultural health and safety into a BSN program can lead to significant knowledge increase and better prepare student nurses to provide care to patients with agricultural-related injuries and health concerns. Students who "had not lived or worked on a farm" had a statistically significant lower baseline than students with farm experience, but with the education provided, all groups reported similar knowledge levels, demonstrating the education provided brought all groups to a consistent knowledge level. Ultimately, inclusion of agricultural health and safety education for BSN nursing students may improve health outcomes for patients within the agricultural industry.

It is important to prepare the generalist BSN graduate to care for the general population they serve. Schools that serve agricultural communities have a special call to include agricultural health and safety in their BSN curriculum.

Recommendations

Agricultural health and safety education should be incorporated into the nursing curriculum of students who will be serving this population and evaluated. However, faculty needs to be educated and prepared before delivering this content. Further research needs to be done to examine the impact of agricultural health and safety education. The next phase of this study involves an Immersive Virtual Reality (IVR) game, developed by the investigators and the University's Computer and Science Engineering senior design students. The IVR game will first be introduced to the nursing students and then as a tool, the student nurses will use to educate target populations. The IVR game was developed over the academic year and is ready for deployment. Pilot work on the dissemination of the game has begun. Further work on how agricultural education impacts patient care will also be completed following student graduation.

Disclosure statement

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