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The Effectiveness of an Elective About Fertility Awareness-Based Methods on Students' Knowledge: A Pre- and Post- Evaluation of Nursing and Medical Students

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ABSTRACT

Objective: To assess the effectiveness of an elective to improve students' knowledge of fertility awareness-based methods for family planning and to determine whether there was a difference in knowledge gained by student type and/or course structure.

Design: A quasi-experimental study of pre- and post-assessment scores among three different groups of healthcare students.

Subjects: In one group, 24 undergraduate nursing students in a semester-long hybrid course. In a second group, 16 second year medical students in a six-week hybrid selective course. In the third group, 80 fourth year medical students in a two-week online elective for a total of 120 students completing the elective from January 2018 to June 2020.

Intervention: All students completed a knowledge assessment before the course, and the identical assessment after the course, with a maximum possible score of 20. ANOVA and non-parametric tests were used for data analysis.

Main Outcome Measure: The main outcome measure was comparison of post-course scores to pre-course scores.

Results: The mean pre-course score of about 50% in the undergraduate nursing group (x) was lower than the medical students in the six-week course (y) and two-week course (z) both about 70%. However, there was no difference in the mean post-course scores between the groups, which was about 90%.

Limitations: Assessments were mandated, but lectures were not, which could skew assessment scores. Additionally, the study focused on students signing up for the elective so it may not be generalizable to all medical and nursing student populations. Finally, educational interests and demographics impacting a student's ability to learn and retain FABM knowledge is beyond the scope of this study.

Conclusion: This elective was effective in improving fertility awareness-based method knowledge of medical and nursing students. All student groups had strong post-course knowledge scores – 90% accuracy, regardless of course structure. A fully online elective has the potential to make this knowledge easily available worldwide.

Keywords: nurses, medical education, fertility awareness-based methods, family planning, curriculum

INTRODUCTION

Women can learn to chart the signs of the reproductive cycle with fertility-awareness based methods (FABMs), giving them the knowledge and tools to monitor their health and identify when they may be fertile or not for family planning purposes. Additionally, women can work with FABM trained medical professionals to receive more targeted diagnoses and comprehensive management of common gynecologic concerns. Researchers have demonstrated that 22-37% of women surveyed express interest in learning to use these natural methods of family planning; however, only about 3-4% of reproductive age females in the United States report using FABMs as a primary method of family planning.[1,2,3]

Accurate and complete information about FABMs is rarely included in medical or nursing school curricula**.** One study found that in the reproductive health curriculum of 20 accredited medical schools, FABMs were only included in 4% of all family planning mentions.[4] When FABMs were mentioned, most of the language was related to the outdated Rhythm Method. Failure to include information about

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evidence-based FABMs in medical or nursing school curricula impedes future professionals from using this information to provide more comprehensive family planning options to patients.[5,6] To address this gap in knowledge, a course was developed through Georgetown University School of Medicine to educate students about FABMs that have demonstrated effectiveness for preventing pregnancy.[7,8,9] Many of the methods taught in the course have been implemented internationally, with effectiveness studies done in various countries.[7] Consequently, these methods have global application for women of different backgrounds, nationalities, culture, and religions. Evaluating the impact of the elective can help assess whether the course expands students' knowledge of FABMs. Increasing students' knowledge about FABMs will lead to more physicians and nursing professionals who can provide more options in family planning and women's health. The purpose of this paper is to evaluate the effect of an online or hybrid course on FABM knowledge among medical and nursing students who completed the course on FABMs for family planning.
Our hypothesis is that an online or hybrid elective is an effective model for increasing nursing and medical students' knowledge about FABMs, and that nursing students will have a higher increase in knowledge after completing the course compared to the other student groups.

BACKGROUND

In 2018, Georgetown University School of Medicine began offering an online elective, *FABMs for Family Planning*, to educate medical students about the physiology underlying FABMs and the evidence for their effectiveness in helping couples prevent or achieve pregnancy. The class was approved as a two-week, online elective open to students around the world and as a six-week hybrid elective (online and in-person) offered to second year medical students at Georgetown University. In 2019, Carroll College began offering this elective to undergraduate nursing students over the course of the spring semester via a hybrid model. From January 2018 to June 2020, 120 students completed the elective, including 96 medical and 24 nursing students. This research project is designed to assess students' change in knowledge scores to determine if the elective is effective depending on the type of student enrolled and the educational delivery model.

FABMs are an umbrella term encompassing many methods of natural family planning. These include older methods that rely on calendar calculations and newer methods that rely on one or more observable external signs or biomarkers, including cervical mucus or fluid secretions, basal body temperature (BBT) or urinary hormones. Although these methods rely on different biomarker observations and guidelines for use, it is not uncommon for a single effectiveness rate to be reported for all natural methods.[9,10,11,12] This statistic is misleading, as it fails to distinguish between the different types of FABMs and leads healthcare professionals to assume all FABMs are not effective. This is not the case.[8] Modern methods have a "sound basis in reproductive biology," use physiologic data and are noted to have unintended pregnancy rates as low as 2-14% based on the highest quality research studies.[7,8,9,13,14]

There is a need for increased education about FABMs for both patients and medical professionals. In a review of studies in Europe, America, Asia, Oceania, and Africa, the fertility awareness knowledge amongst reproductive-aged people was categorized as low to moderate.[15] Similarly, one integrative review found that female participants underutilized FABMs and had low knowledge of when to conceive during their cycle.[16] Poor fertility awareness and less effective methods like withdrawal and calendar methods highlights the need for improved counseling.[17] Teaching patients to use these methods is a good opportunity for them to learn about fertility and reproduction and better understand their bodies.[18]

Healthcare professionals continue to underestimate the effectiveness of FABMs and there is a growing need for more education.[19,20] While most medical and nursing schools cover the topics of pregnancy, physiology, and sexually transmitted infections, there is a wide range of coverage of contraceptive methods, be it hormonal or non-hormonal, with most schools rarely mentioning FABMs.[4,21] Given that FABMs are non-hormonal, educate women about how their body works, and can be cost-effective, patients would benefit from counseling on the entire range of FABMs, in addition to the other contraceptive options.[22,23]

Research shows that brief courses about FABMs can be effective in increasing student's understanding and confidence. One study evaluated 462 students enrolled in the online elective "FABMs for Family Planning and Women's Health".[24] A pre and post course assessment evaluated students' knowledge and intent to present FABMs as a family planning option. More than 97% of students showed an increase in knowledge. Prior to the course, over half of participants responded that they do not mention, they mention with reservations, they mention only for select women, or FABMs are inapplicable. However, after the course over half of the participants responded that they would mention it as an option for most or all women.[24] Another study evaluated the knowledge and confidence gained by 196 third-year medical students after participating in two lectures about FABMs and their clinical application.[25] To determine whether the lectures had a significant impact on the students' knowledge of FABMs and their ability to provide them to their future patients, the researchers evaluated their pre-lecture knowledge and compared it to their post-assessment scores. They found that after completing the lecture, students had a significant increase in knowledge of FABMs and their confidence to provide them.[25] Since a brief, focused intervention with two in-person lectures was sufficient to

increase medical students' knowledge of FABMs, our study explored whether an expanded course would increase students' knowledge and whether differences exist depending on the type of student, course format and length of the course.

THE STUDY

Aims, Objectives, and Hypotheses

The aim of the study was to assess the impact and effectiveness of an online or hybrid elective on the FABM knowledge of enrolled students. We also sought to determine whether there was a difference in knowledge gained between medical and undergraduate nursing students, taking into consideration the format of the course. Our first hypothesis was that all students who took the course, regardless of the course format, would have an increase in FABM knowledge after completing it (Hypothesis 1). Our second hypothesis was that undergraduate nursing students in the semester-long hybrid course would have a higher increase in FABM knowledge when compared to medical students in either the two-week online course or the six-week hybrid course (Hypothesis 2).

METHODS

Design

This project is a quasi-experimental study to examine students' change in their pre- and post-assessment knowledge scores. The primary outcome measure for this study was the increase in score from pretest to posttest to determine efficacy of the course to improve knowledge about FABMs for family planning. To assess FABM knowledge, students were given a pre- and post-course test with 20 identical multiple-choice questions pertaining to a woman's fertility, the different types of FABMs, the use of FABMs in family planning, and the medical uses of FABMs. The data were collected at the beginning of the course before students accessed the course content and at the end of the course after completing all the lesson quizzes, though quizzes could be completed without having viewed the lesson content.

Although the format varied between groups (two-week online, six-week hybrid, and one semester hybrid), the elective always included ten lessons that introduced the topic of FABMs and gave a brief introduction to each of seven methods. These methods included the Billings Ovulation Method, the Creighton Model, the Sympto-Thermal Method, the Marquette Method, the Standard Days Method, the TwoDay Method, and the Lactational Amenorrhea Method. All lectures were given by physicians or researchers trained in these methods.

Study Setting and Sample

All participants self-selected to enroll for the online elective course via their medical school (2nd year medical students), undergraduate nursing program (nursing students), or an educational non-profit organization and the Visiting Student Application Service (VSAS) (4th year medical students). Every student that completed the course was included in the study. There were no further exclusion criteria.

In the two academic years of 2018-2019 and 2019-2020, a total of 120 medical and nursing students completed the course and gave consent for the collection of their data. For the purposes of this paper, the students were further divided into three separate groups: nursing students in a semester-long hybrid course ("*x*", n = 24), second year medical students in a six-week hybrid selective course ("*y*", n = 16), and fourth year medical students in a two-week online elective ("*z*", n = 80). All these students comprise the population we evaluated and were included in the analysis.

Validity and Reliability

When it comes to validity, this study focused primarily on the impact of the course on students' knowledge of FABMs. The study sought to answer whether there was a difference in test scores. Other than completing the course and the course format, demographic characteristics were taken into consideration as potential influencers in knowledge gain.

To evaluate the impact of the educational intervention, we used a knowledge assessment tool with 20 multiple choice questions. These questions were written by physicians with expertise in FABMs and had been used in the elective in prior years, as well as in CME assessments. They were found to be a valid tool to assess students' knowledge (see Appendix). Additionally, a similar study completed by Danis et al. used ten of these questions as part of their pre- and post-assessment and were found to produce reliable results.[25] Although the complexity of the intervention was greater in our study, Danis et al. found significant differences in student knowledge after participating in the two lectures.[25]

We considered two factors that could potentially influence the results. The first was the type of student (medical school or nursing) and the second was the educational delivery model (online or hybrid). By dividing students into subgroups based on their academic path, we considered whether a higher baseline knowledge of women's health and FABMs would lead to a higher post score. Doing this helped with the internal validity of the study. Because we did not evaluate a sample and we reviewed the scores of all students in the cohort during the time of the study, the related results are generalizable to students who take the elective. Therefore, the external validity is also high.

Data collection

Upon enrollment, students completed a baseline questionnaire via an online survey describing their interest in the elective, previous knowledge of FABMs, and their future career goals. Demographic information, including sex, age, desired specialty, type of medical training program,

relationship status, religion, and motivation for enrollment in the course, was collected. Additionally, students completed identical pre- and post-knowledge assessments using multiple choice tests.

Data analysis

Data analysis was performed using SPSS for Windows, version 25. Analysis of variance techniques were used to test the hypotheses. As some of the data were not normally distributed, non-parametric tests were used to assess the data. A p-value of <0.05 was considered statistically significant.

Ethical considerations

All students involved in the study provided their consent for participation. Student pre- and post-assessment scores were cleaned and evaluated, but no identifying information was used. Moreover, this study received an IRB waiver from Georgetown University.

RESULTS

The study participants ranged in age from 19 to 43 years (mean = 26) with most students identifying as female (88.3%). Most were pursuing a medical degree and reported their relationship status as single (Table 1). Additional demographic information indicates 66 students identified as Catholic (55%), 51 as Other (42.5%), and three preferred to not answer (2.5%). Most were single and never married (65%), while 40 students indicated they were married (33.3%) and two preferred not to answer (1.7%).

In the pre-course background questionnaire, students were asked to self-report their level of familiarity with each of the following FABMs: Billings Ovulation Method, Creighton Model, Sympto-Thermal method, Marquette Method, Rhythm Method, Standard Days Method, Two-Day Method, and the Lactational Amenorrhea Method (Figure 1). If students could teach the method with authority, were able to explain the basics or used the method, they reported being "proficient or knowledgeable." If students knew some facts about the method, they reported being "familiar" with it. Students who did not know anything about the method or may have only heard of the term were classified as being "not at all familiar."

A comparison of students' pre- and post-course knowledge scores on 20 identical questions was completed to assess the impact of this elective. The pre-course mean score was 12.93 out of 20 (65%, SD = 3.07) and post-course mean score was 17.96 out of 20 (90%, SD = 1.58). Mean scores increased by 5.03 points upon completion of the course (Figure 2). A nonparametric Wilcoxon signed-rank test showed that this elective elicited a statistically significant change in scores ($Z = -9.157$, $p < 0.001$). In fact, 91.7% of students had an increase in score, 3.3% had a decrease in score, and 5.0% had no change in score.

Figure 1. Self-reported student familiarity with various FABMs via questionnaire. Green bar indicates "proficient or knowledgeable." Blue bar indicates "familiar." Yellow bar indicates "not at all familiar" or "have only heard of the method before." n=94.

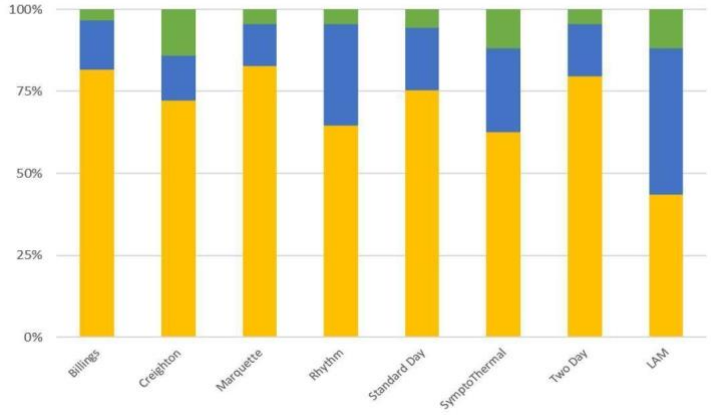
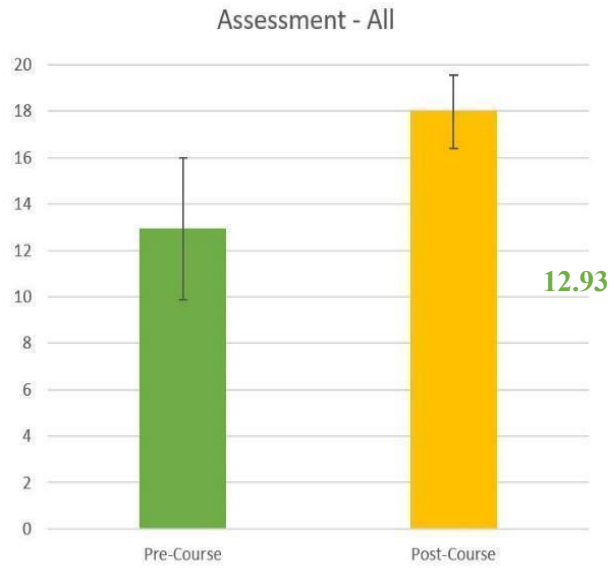


Figure 2. Mean student assessment scores significantly increased by the end of the FABM elective course (mean ± SD). n=120. Wilcoxon signed-rank test, $p < 0.0001$).



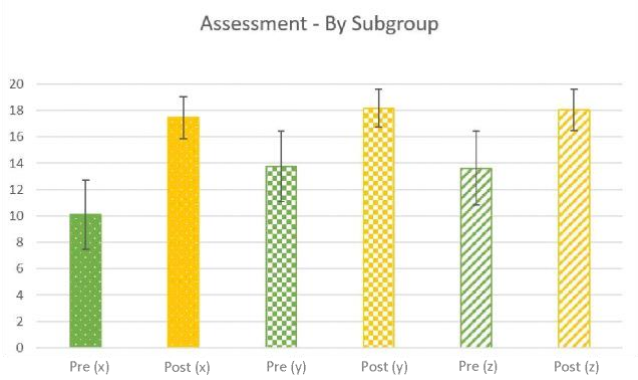
Further analysis was done to determine any differences amongst the groups (Figure 3). In general, every student group had low pre-assessment scores and experienced a significant increase in mean scores. The nursing student group had the greatest increase in scores. This group obtained nearly the same post-assessment scores as the other groups, despite having less knowledge of FABMs and women's health before taking the course.

Kruskal-Wallis test provided strong evidence of a difference between the pre-course mean scores of at least one pair of groups ($p < 0.001$). Dunn's pairwise tests were carried out for the three pairs of groups. Our analysis indicated strong

evidence for a difference between group ***x*** and the other groups ($p < 0.001$, adjusted using the Bonferroni correction). There was no evidence of a difference between the other pairs.

There was a statistically significant difference between the point increases of each group as determined by one-way ANOVA ($F(2,117) = 9.958$, $p < 0.001$). A Tukey post hoc test revealed that the point increase from pre-course to post-course test was statistically significantly higher amongst group *x* (7.38 +/- 3.090 points) as compared to both groups *z* (4.44 +/- 2.929 points, $p< 0.001$) and *y* (4.44 +/- 2.250 points, $p < 0.006$). There was no statistically significant difference between the other groups ($p = 1.000$). Furthermore, a Kruskal-Wallis test showed no difference in post-course scores between any of the groups.

Figure 3. Mean student assessment scores of 20 identical questions at the beginning and end of the FABM elective course by subgroup. Increase in nursing students' scores was significantly higher as compared to selective students (ANOVA, $p = 0.006$) or medical students (ANOVA, $p = 0.000$). $n = 120$.



DISCUSSION

Based on the questionnaire results, most students were "not at all familiar" with any of the FABMs taught in this course. The outdated Rhythm Method developed in the 1930s and the postpartum Lactational Amenorrhea Method were the two most common methods with which students were familiar. Students were least familiar, knowledgeable, or proficient in the use of the Billings Ovulation Method, Marquette Model, Standard Days or TwoDay Methods, despite the extensive research (Marquette) or wide use of these methods internationally (Billings, Standard Days, TwoDay). This confirms that students have limited exposure to modern FABMs prior to and during their training. If students do not learn about FABMs in medical or nursing school, it is less likely they will offer them to their patients in the future. Patients deserve a comprehensive overview of all methods of family planning, including both hormonal and non-hormonal methods.

In conjunction, pre-assessment scores were low amongst all the student groups, likely corresponding to a lack of FABM-based curricula in their medical programs. Overall, there was a statistically significant increase between pre- and post-course assessment scores, with most students increasing their score regardless of which group they were in. Given these results, we found support for Hypothesis 1 and concluded that students who take the elective experience an increase in FABM knowledge. This score increase could be attributed to both the course content and the low pre-course scores. In that case, this online elective is effective in improving students' knowledge of FABMs. Because of this, the course may be able to address some of the disparities in learning about FABMs and the need for better counseling identified in Nilsson et al.[17] Moreover, the effectiveness of this course on student learning could help meet the growing need for more education about FABMs.[4,19,20]

Although this course was initially offered to medical students, it is now offered to nursing and other health professional students as well. This study compared the various subgroups that have taken the course to determine whether there were any differences among the learners. Interestingly, we found that nursing students had a markedly lower baseline knowledge yet had a significantly higher increase in score upon completing the course. Thus, our results provide evidence for Hypothesis 2, indicating that nursing students in the semester hybrid course format obtained a greater knowledge of FABMs than medical students in the two-week online course format or the six-week hybrid course format. Based on these results, the elective may be an effective addition to any nursing school curricula. This is an essential finding that builds on the implications of one review that assessed the role of nurses in providing patients with FABM knowledge.[16] Nursing students should be able to utilize the knowledge gained from this elective in order to help their future patients correctly identify their fertile window and time intercourse for conception.

Since this course focuses on the research underlying these methods and does not present the information from a religious perspective, the knowledge gained by students can contribute to increasing the number of physicians and nurses who understand the science supporting FABMs and subsequently offer these methods to patients. This is important since the findings of one study indicated only 0.5-7.4% use natural methods for religious reasons.[26] This will help to expand the use of these methods among a broader population, not only for family planning purposes but also to address a range of women's health issues such as endometriosis and polycystic ovarian syndrome.[7] Identifying these conditions early on through charting can help clinicians and nurses to provide treatments before the medical conditions worsen.

Given that about half of students did not identify as Catholic,

there is a greater chance that students are taking the course to better understand the science behind FABMs, which they can then take with them into their practice. Moreover, the need for increasing the acceptance of the use of FABMs is important. The results for both hypotheses provide evidence that this course is effective at increasing students' knowledge of FABMs, which can then be used to advocate for their implementation in routine care. Consequently, those who take this course and utilize the knowledge they obtain in practice should be prepared to meet the growing demands of women for a more holistic, natural, and hormone-free approach to their health and family planning needs.[8,27,28]

Subsequently, the results of this study correspond and add to the findings of the Danis et al. study.[25] In that study, researchers found that even a brief, two-lecture course on FABMs increased students' knowledge and confidence when comparing their pre- and post-assessments. Similarly, we found that offering a longer course varying from two weeks to a full semester also increased student knowledge of FABMs and their confidence in offering them to future patients. Although the results were similar between these two studies, it is important to note that this study reviewed a course that is offered in an online and hybrid format. Given that, there is a possibility that other medical programs can offer more online and hybrid electives to provide greater flexibility and yield similar outcomes to strictly in-person courses.

Finally, there are very few studies comparing the learning between students of different professional schools, so it is difficult to generalize learning capacity among groups.[29,30] In most cases, no matter the type of learning intervention, all students increased their knowledge. The significant results of this study indicate that this elective can be offered to nursing or medical students and have a positive impact on the knowledge they gain, regardless of the type of student or course format.

Limitations

Our inclusion criteria specified that all students completed the pre-course and post-course assessments. Although they were supposed to participate in all the lectures prior to completing the post-course assessment, a student could have chosen not to watch a pre-recorded lecture and still completed the final. If we had mandated that every lecture be completed, we may have seen an even larger increase in scores. Our post-course assessment was completed immediately after completion of the course. In order to determine longer-term retention of content, it would be worthwhile to send out a subsequent questionnaire 3 months post completion of the elective. Additionally, this study only looked at students who took the elective. Accordingly, the results may not be generalizable to the general medical and nursing student populations. While we considered the type of student and course format for this study, we did not look at how different educational interests, race, or sex impact the ability of a student to learn and retain knowledge about FABMs. These characteristics and variables could have influenced students' knowledge gain, but their direct impact was outside of the scope of this study.

CONCLUSION

Our study adds to the findings of the study conducted by Danis et al., contributing evidence to the theory that these brief courses on FABMs can increase student knowledge.[25] Specifically, the results of our study revealed that the elective is an effective way to improve students' knowledge of FABMs. Currently, there is a knowledge gap in medical and nursing schools where offering courses about fertility-awareness based methods is not common practice. The elective in this study addresses that knowledge gap by offering lectures about each method, how they work, their effectiveness for family planning, and their applications for women's health. Though our data analysis revealed the course was effective at increasing student knowledge of FABMs, future studies of similar courses should focus on the potential influence of student demographics, such as race and sex, and the level of personal interest in women's healthcare.

This elective on FABMs for family planning was first offered in 2018. At the time of our analysis, 120 students had completed the course and since then larger cohorts have been participating each year. There is potential for further expansion of this elective to reach a greater number of students because it is one of few offered almost entirely online. Consequently, it is open to medical and nursing students across the United States and globally.

Given the recent significant investment in the FemTech industry and the proliferation of fertility apps for tracking the female cycle, it is imperative that future medical professionals have the opportunity to learn about FABMs and the science supporting their use. The results of our study revealed that the elective is one way that educators can provide this crucial knowledge to future medical professionals across the world, which would expand the reach of these methods to women internationally. Thus, this course will continue to be offered to diverse medical and nursing student populations. Universities should also consider to what extent they can provide this elective to interested students or develop other similar approaches to address the increasing need for future physicians and nurses to incorporate FABMs into their practices.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, or publication of this article.

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There was no external funding.

AUTHOR CONTRIBUTIONS

Marguerite Duane provided supervision and oversight of the research project and participated in the conceptualization of the study, development of the methodology, data collection and management of the project. She participated in the preparation of the published work, specifically writing the initial draft, and in the creation and presentation of the published work, specifically visualization/ data presentation.

Meredith Krutar participated in the conceptualization of the study, development of the methodology, data collection and verification of the overall replication/reproducibility of the results. She participated in the preparation of the published work, specifically writing the initial draft, and in the creation and presentation of the published work, specifically visualization/ data presentation. Due to her passing, she was unable to approve the final version for publication. Dr. Krutar's next of kin has been notified and confirm that she likely would have consented to authorship.

Kellie Wo participated in the data curation and formal analysis, as well in the preparation of the published work, specifically critically reviewing and editing the initial draft, and in the creation and presentation of the published work, specifically visualization/ data presentation.

Logan Waechtler participated in verification of the overall replication/reproducibility of the results, as well in the preparation of the published work, specifically critically reviewing and editing the manuscript at various stages.

DATA AVAILABILITY STATEMENT

The data underlying this article are available in the article and via the corresponding author.

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Table 1. Student demographics. n=120

Student Group	**Total**	**Nursing (x)**	**Selective (y)**	**Medical (z)**
Sample Size	n=120	n=24	n=16	n=80
	Freq (%)	Freq (%)	Freq (%)	Freq (%)
Sex				
Male	14 (12%)	0 (0%)	1 (6%)	13 (16%)
Female	106 (88%)	24 (100%)	15 (94%)	67 (84%)
Age group				
18-22	23 (19%)	23 (96%)	0 (0%)	0 0%)
23-27	64 (53%)	1 (4%)	15 (94%)	48 (60%)
28-32	25 (21%)	0 (0%)	1 (6%)	24 (30%)
33+	8 (7%)	0 (0%)	0 (0%)	8 (10%)
Average	26	21	25	28
Degree				
Medical	96 (80%)	0 (0%)	16 (100%)	80 (100%)
Nursing, midwifery	24 (20%)	24 (100%)	0 (0%)	0 (0%)
Marital Status				
Not Single (Married, Civil Union, etc.)	40 (33%)	6 (25%)	3 (19%)	31 (39%)
Single, never married	78 (65%)	18 (75%)	13 (81%)	47 (59%)
Prefer not to answer	2 (2%)	0 (0%)	0 (0%)	2 (2%)
Religion				
Catholic	66 (55%)	9 (38%)	8 (50%)	49 (61%)
Other	51 (43%)	15 (62%)	8 (50%)	28 (35%)
Prefer not to answer	3 (2%)	0 (0%)	0 (0%)	3 (4%)