Research Square

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Development and Evaluation of an Interactive eLearning Module on LGBTQ+ Health for Graduate Nursing Student Education

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Abstract

Background

The LGBTQ+ community faces unique health challenges, with many issues arising from a lack of specialized training for healthcare providers. To address these disparities, educational programs focusing on LGBTQ+ health are paramount, with research demonstrating tangible benefits from these initiatives. This study details the development and evaluation of an eLearning module on LGBTQ+ health for students in either the Master of Science in Nursing (MSN) or the Doctor of Nursing Practice (DNP) program. This training module assessed changes in implicit bias, self-confidence, comfortability working with LGBTQ+ patients, and knowledge related to LGBTQ+ health. By examining these learning outcomes, inclusive clinical practice can be strengthened among nurse practitioners.

Methods

Based on existing literature, a 1–2-hour self-paced eLearning module on LGBTQ+ health was developed using Adobe Captivate, an authoring software. The module covered relevant terminology, health disparities, provider communication, and interactive recorded simulations. Students completed surveys before and after finishing the learning module, including self-reported results from two Implicit Association tests (IATs). Descriptive statistics were used to describe the data. Paired t-tests were used to measure learning outcomes from pre- to post-program.

Results

Sixty-eight third-year nursing graduate students were included in this study (n = 68). The majority of students had some formal training or exposure to LGBTQ+ health. There was a statistically significant improvement in nearly every item related to self-confidence and comfortability working with LGBTQ+ patients. Average scores on a five-question knowledge check increased significantly, although significance varied for each individual question. Implicit bias shifted significantly from the automatic preference towards straight people to the no automatic preference center. This shift was similar but non-significant for transgender people.

Conclusions

This self-paced, interactive LGBTQ+ health module significantly reduced implicit bias against gay people and improved students' comfortability and knowledge working with LGBTQ+ community. Continued expansion of educational initiatives addressing LGBTQ+ health is crucial for the preparation of future nurse practitioners.

Clinical Trial Number:

Not applicable.

Background

The LGBTQ+ community represents a diverse population with distinct health needs that often go unaddressed by traditional medical education. LGBTQ+ individuals face significant health disparities across a multitude of domains, including physical health, mental health, substance-use related health, and sexual health. For example, studies found that LGBTQ+ individuals were 2.5 times more likely to experience depression, anxiety, and substance misuse compared with their heterosexual counterparts.[1, 2] Similar issues are exacerbated for transgender and gender diverse communities, with 44% of transgender individuals considering suicide compared to 10% of cisgender respondents in another survey.[3] In addition, the risk of HIV infection was 28 times greater for gay and bisexual men than for heterosexual men.[4] Finally, one study found that lesbian and bisexual women received timely cervical cancer screenings at a 10% lower rate than heterosexual women.[5] Given the distinct challenges that the LGBTQ+ community faces, it is imperative that nurse practitioners are trained to treat the unique health needs of this population.

Despite these disparities, there is a lack of health education on LGBTQ+ health for nurse practitioners, physicians, and other healthcare providers at a national level. One study found that 75% of studies assessing LGBTQ+ health training were published within the previous six years.[6] Structured LGBTQ+ health education remains relatively new, and most practicing providers completed their education before evidence-based LGBTQ+ health training became widely accessible. Moreover, a 2015 study found that 80% of nurses in the San Francisco Bay Area had no education or training on LGBTQ+ issues at all.[7] Another 2011 study revealed that historically, the median instruction time for LGBTQ+ health-related topics at 150 American and Canadian medical

schools remained at 5 hours throughout the entire 4-year curriculum.[8] With this significant gap in education, it is unsurprising that LGBTQ+ individuals report mistreatment or negative experiences from their providers in healthcare settings at higher rates. Results from one national survey show that 8% of LGBTQ+ individuals reported refusal of care as a result of their sexual orientation, and 29% reported refusal of care as a result of their gender identity. Additionally, 9% reported harsh or abusive language as a result of their sexual identity, while 21% reported harsh or abusive language as a result of their gender identity.[9] On the other hand, creating inclusive clinical spaces for LGBTQ+ patients has been linked to greater patient comfort and satisfaction during their visits.[10] Thus, continued sustainment of LGBTQ+ health-related educational initiatives is crucial in improving future patient-provider relationships.

Modern healthcare training can take many forms, ranging from trainer-led education to independent online learning modules. Although there is limited evidence to suggest whether in-person or online training modules are more effective, each approach has tangible advantages and disadvantages.[11] In-person healthcare training can yield greater satisfaction due to real-time feedback and interactive environments, yet it is more costly and less flexible for participants. On the other hand, online training offers affordability, flexibility, and the ability to re-access materials. However, this training method requires learners to have appropriate technology and self-motivation to complete their trainings.[12, 13] Nevertheless, current training efforts significantly improved providers' ability to deliver LGBTQ+ affirming care in four key domains: knowledge of LGBTQ+ culture and health, skills necessary to work with patients from the LGBTQ+ community, attitudes towards patients from the LGBTQ+ community, and behaviors promoting LGBTQ+ affirming practices.[6] Evidently, studies have shown that these educational initiatives can have a meaningful impact on providers' readiness to provide affirming care for this community.

While numerous modalities are available for health education, active learning increases knowledge retention, improves clinical reasoning, and enhances student engagement compared to passive learning, which is often utilized in traditional lectures.[14, 15] In addition, allowing learners to have more control over their study behavior improved memory performance in one study.[16] As a result, an asynchronous, interactive learning model was chosen to create this educational learning module. This option offers unique advantages, including greater scalability and reduced reliance on resources like facilitators. Web-based programs can also reduce the need for transportation and the costs required for in-person sessions.[17] In addition, this model maintains the benefits of learner engagement, improving overall student satisfaction and perceptions of teaching clarity.[18, 19]

When considering current educational research, students pursuing careers in healthcare benefit from training in LGBTQ+ health. Researchers from the University of Colorado developed a 10-hour curriculum on LGBTQ+ health for preclinical medical and physician assistant students, assessing confidence and knowledge regarding LGBTQ+-specific care. Lectures, small group case-based discussions, and panels featuring members of the LGBTQ+ community were employed to deliver this training. Upon analysis of pre- and post-program surveys, the curriculum demonstrated success in elevating students' confidence; however, it did not yield significant gains in LGBTQ+ medical knowledge.[20] Similarly, researchers at Baylor University created a 1-hour curriculum on LGBTQ+ health, consisting of a 1-hour didactic lecture. In that 2018 study, third-year medical students who completed this curriculum demonstrated an increase in knowledge on LGBTQ+ health.[21]

This study describes the development, implementation, and evaluation of a self-paced eLearning module on LGBTQ+ health. The module was created to address gaps in graduate advanced practice registered nurse (APRN) education related to LGBTQ+ health at a large Midwest Public Academic Nursing Institution. This project was undertaken through the Health Equity Scholars Program, an institutional training grant from the Office of the Chief Wellness Officer, the College of Nursing, and the Office of Interprofessional Practice and Education for student and faculty projects addressing health equity. The module was titled *Bridging the Gap: Enhancing LGBTQ+ Awareness and Competency.* This project aimed to provide APRN students with a standardized introduction to LGBTQ+ health, whose knowledge of the LGBTQ+ community may be variable. Furthermore, this project sought to evaluate short-term changes in cognitive implicit bias, which can inadvertently impact patient care and consequently affect health outcomes.[22] In 2019, a systematic review of nearly 700 abstracts addressing bias in medicine between 2005 and 2017 found that only 13 described programs designed to decrease bias against LGBTQ+ patients, yet none of those studies analyzed changes in implicit biases among respondents.[23] By examining these multidimensional outcomes, this work offers insight into how structured, evidence-based learning interventions can shift nursing student attitudes and preparedness.

Methods

Design

This study utilized a quantitative design to explore the changes in implicit bias, learning outcomes, and knowledge of LGBTQ+ health among graduate nursing students.

Participants

This study was conducted with third-year graduate APRN students participating in the summer session between May and September 2025. The module was mandatory for students to supplement their curriculum in either the Master of Science in Nursing (MSN) or the Doctor of Nursing Practice (DNP) program.

Intervention Development

Five educational objectives were established to guide the development and implementation of this learning activity, aiming to enhance competency in caring for LGBTQ+ populations within clinical practice. These objectives included: (1) the ability to define and appropriately use terminology related to sexual minorities, gender-diverse and transgender individuals, and intersex communities; (2) identification and analysis of health disparities affecting LGBTQ+ populations across sociocultural, psychological, and institutional domains; (3) demonstration of inclusive communication skills and culturally responsive care strategies, particularly in addressing clinical and workplace challenges; (4) comprehension of general clinical practices, evidence-based screening recommendations, and standards of care specific to LGBTQ+ individuals; and (5) application of acquired knowledge through two standardized patient encounters incorporating multiple-choice questions and guided clinical reasoning to reinforce learning outcomes.

A comprehensive review of existing literature served as the foundation for developing this self-paced 1–2-hour LGBTQ+ health learning module. Notably, resources such as The World Professional Association for Transgender Health (WPATH) Standards of Care,[24] the Association of American Medical Colleges (AAMC),[25] and The Fenway Institute guided educational objectives.[26] Section 1 of the module (Terminology) was primarily derived from the National LGBTQIA+ Health Center, covering a variety of terms and phrases directly relevant to LGBTQ+ care.[27] In addition, Sections 2 and 3 (Introduction to Health Disparities, Improving Provider Communication) referenced peer-reviewed research articles, national surveys, and meta-analyses. These sections highlighted the gap in care for LGBTQ+ communities and the role that healthcare providers play in reducing those disparities. Finally, components of Section 4 (Interactive Patient Simulations) were written by Authors 1 and 2. Fictional encounters included a 20-year-old gay man and a 21-year-old man assigned-female-at-birth (AFAB). An additional document contains the scripted dialogue for each encounter [See Additional file 1]. Standardized patients were included to provide realistic scenarios that gave students an opportunity to apply knowledge gained from previous sections. An additional file includes a full list of content references [See Additional file 2].

After compiling necessary literature to fulfill Educational Objectives 1–5, information was migrated to Adobe Captivate, an authoring software for eLearning content (Adobe Inc., 2023).[28] Interactive components were included throughout the module, such as an option to input the student's name, reversible flashcards, and periodic knowledge checks. Three actors were hired through the same large Midwestern university's College of Medicine Clinical Skills Education and Assessment Center (CSEAC) to film a recorded video of the created script. Two actors performed as standardized patients, and a third actor assumed the role of a simulated healthcare provider. Actors were independently selected, trained, and compensated in accordance with medical center guidelines. While sexual orientation and gender identity of patient actors were undisclosed and unknown, the simulation center made an effort to align the demographics of standardized patients with those of the characters. The recorded videos were incorporated into Adobe Captivate, enabling students to choose among different actions through multiple-choice questioning and view the rationale provided for the correct option.

Implementation

The module was periodically reviewed during development by one Adult-Gerontology Primary Care Nurse Practitioner (AGPCNP) faculty member. After finalization, the module was accredited by the American Nurses Credentialing Center (ANCC) for 1.2 nursing contact hours. Upon accreditation, the module was adopted into eight ARPN programs beginning in May 2025, spanning Adult-Gerontology Primary Care, Adult-Gerontology Acute Care, Family, Nurse-Midwifery, Pediatric Primary Care, Pediatric Acute Care, Psychiatric Mental Health, and Women's Health. An institutional website was also created to house information related to the module.[29]

Measures

Students finished pre-program and post-program surveys directly prior to and after finishing the module, respectively [see Additional file 3]. Students also completed Harvard's Implicit Association Tests (IATs), a validated measure of implicit bias, between straight and gay people (sexual bias), as well as cisgender and transgender people (gender bias).[30] Sexual and gender bias were measured on a 7-point Likert scale. Sexual bias ranged from a strong automatic preference towards straight people (1) to a strong automatic preference towards gay people (7), including a middle category with no automatic preference (4). Gender bias was measured similarly, with a range from automatic preference for cisgender individuals (1) to an automatic preference for transgender individuals (7).

A 6-point Likert scale, strongly disagree (1) to strongly agree (6), was used to assess learning domains, including 1) prior training and education, 2) self-confidence, and 3) comfortability treating LGBTQ+ patients, addressing their health needs, and discussing sexual risk reduction practices. These domains were separated across subgroups of the LGBTQ+ community; sexual minorities included gay men, lesbian women, bisexual individuals, and gender minorities included transgender individuals, nonbinary individuals, and gender-fluid individuals. Because the LGBTQ+ community includes diverse patient populations with distinct identities and health needs, evaluating these domains separately allowed for meaningful analysis of learning objectives. In addition, a brief five-question knowledge check was added to the end of both surveys to assess students' acquisition of information related to LGBTQ+ health. All knowledge check content was included in the learning module. Correct answers to knowledge check questions were not disclosed in the pre-program survey but were provided in the post-program survey. Students also reported demographic information, including race, ethnicity, age, sexual orientation, and gender identity, with an option to forgo a response.

Data Analysis

Descriptive statistics were used to describe the results. Demographic and categorical variables were described using frequencies and percentages, and quantitative variables were described using means and standard deviations. Only individuals with matching pre- and post-program survey identifiers were included ($n = 68$). Paired t-tests were used to measure the impact from pre- to post-program surveys in all ordinal variables and the five-question knowledge check scores. McNemar's tests were on the five individual items that comprise the knowledge check score. All analyses were done using R v4.5.1 (R Core Team 2025).

Results

Table 1 shows the demographics of those who participated in the survey [Insert Table 1]. The majority of students were White/Caucasian (84%), not Hispanic or Latino (88%), between 25 to 34 years old (54%), and identified as heterosexual (71%) and cisgender female (81%).

Table 1
Self-Reported Racial, Ethnic, Sexual Orientation, Gender Identity Demographics

Characteristic	N = 68[1]
Race	
African American	3 (4.4%)
Asian	3 (4.4%)
White/Caucasian	57 (84%)
Prefer not to say	4 (5.9%)
Other (please specify)*	1 (1.5%)
Ethnicity	
Hispanic or Latino	4 (5.9%)
Not Hispanic or Latino	60 (88%)
Prefer not to say	4 (5.9%)
Age	
18–24 years old	11 (16%)
25–34 years old	37 (54%)
34–44 years old	15 (22%)
45–54 years old	3 (4.4%)
55–64 years old	2 (2.9%)
Sexual Orientation	
Asexual	1 (1.5%)
Bisexual	9 (13%)
Heterosexual	48 (71%)
Homosexual	5 (7.4%)
Pansexual	2 (2.9%)
Prefer not to say	1 (1.5%)
Queer	1 (1.5%)
Unsure/questioning	1 (1.5%)
Gender Identity	
Cisgender female	55 (81%)
Cisgender male	10 (15%)
Male-to-Female transgender	1 (1.5%)
Prefer not to say	1 (1.5%)
Unsure/Questioning	1 (1.5%)

[1]n (%)

*"Hispanic" was selected as the response.

Results from the two IATs were shown in Table 2 [Insert Table 2]. Implicit sexual bias moved significantly from a stronger bias towards straight people to the no automatic bias center ($p = 0.018$, 95% C.I. 0.04 to 0.38). This movement was observed with an increase in no automatic preference between straight and gay people, from 23 respondents (34%) to 31 respondents (46%), as seen in Fig. 1 [Insert Fig. 1]. Implicit gender bias saw a slight movement towards the no automatic preference center, but this shift was not statistically significant ($p = 0.321$). This shift was illustrated in Fig. 2 [Insert Fig. 2].

Table 2
Implicit Sexual Orientation and Gender Bias Scores (IAT)

Characteristic	pre[1] N = 68	post[1] N = 68	Difference	95% CI	p-value
Sexual Bias (Overall)	3.56 (1.34)	3.76 (1.19)	0.21	0.04, 0.38	0.018
What was the result of your implicit bias score between straight and gay people?					
Strong automatic preference for straight people compared to gay people	2 (2.9%)	0 (0%)			
Moderate automatic preference for straight people compared to gay people	15 (22%)	11 (16%)			
Slight automatic preference for straight people compared to gay people	15 (22%)	14 (21%)			
Little to no automatic preference between gay and straight people	23 (34%)	31 (46%)			
Slight automatic preference for gay people compared to straight people	7 (10%)	6 (8.8%)			
Moderate automatic preference for gay people compared to straight people	4 (5.9%)	4 (5.9%)			
Strong automatic preference for gay people compared to straight people	2 (2.9%)	2 (2.9%)			
Gender Bias (Overall)	3.65 (1.31)	3.72 (1.22)	0.07	0.07, -0.22	0.321
What was the result of your implicit bias score between cisgender and transgender people?					
Strong automatic preference for cisgender people compared to transgender people	3 (4.4%)	4 (5.9%)			
Moderate automatic preference for cisgender people compared to transgender people	13 (19%)	6 (8.8%)			
Slight automatic preference for cisgender people compared to transgender people	9 (13%)	13 (19%)			
Little to no automatic preference between cisgender people and transgender people	30 (44%)	33 (49%)			
Slight automatic preference for transgender people compared to cisgender people	7 (10%)	7 (10%)			
Moderate automatic preference for transgender people compared to cisgender people	5 (7.4%)	4 (5.9%)			
Strong automatic preference for transgender people compared to cisgender people	1 (1.5%)	1 (1.5%)			

[1]Mean (SD); n (%)

A large majority of students had some formal exposure to training related to sexual minorities, as seen in Table 3 [Insert Table 3]. In the pre-program survey, 59% of students reported completing 1–3 formal classes or training programs, and 12% of students reported completing greater than 4 classes or training programs. Regarding self-confidence and comfortability working with sexual minorities, all but three items saw a significant increase in post-program average scores ($p < 0.05$). The largest significant increases were the questions asking how comfortable the student was in asking patients who identified as heterosexual ($p < 0.001$, 95% C.I. 0.31 to 0.78) and as a sexual minority ($p < 0.001$, 95% C.I. 0.27 to 0.64) about their sexual history and practices. Both questions saw average scores increase from below moderately agree to firmly above.

Table 3
Learning Outcomes Related to Sexual Minority Communities

Group	Characteristic	pre[1] N = 68	post[1] N = 68	Difference	95% CI	p-value
Sexual Minorities	How much prior training and education do you have in the treatment of patients who are sexual minorities (i.e. gay men, lesbian women, bisexuals)?					
	0 formal classes or training programs	20 (29%)	18 (26%)			
	1–3 formal classes or training programs	40 (59%)	40 (59%)			
	Greater than 4 classes or training programs	8 (12%)	10 (15%)			
	I am comfortable asking patients who identify as heterosexual about their sexual histories and practices.	4.97 (1.08)	5.51 (0.70)	0.54	0.31, 0.78	< 0.001
	I am comfortable asking patients who identify as a sexual minority (i.e. gay men, lesbian women, bisexuals) about their sexual histories and practices.	4.93 (1.03)	5.38 (0.75)	0.46	0.27, 0.64	< 0.001
	I am comfortable addressing risk reduction in terms of sexual behavior with patients who identify as heterosexual.	5.04 (1.03)	5.51 (0.70)	0.47	0.26, 0.69	< 0.001
Gay Men	I am confident treating patients who identify as gay men.	5.29 (0.83)	5.44 (0.78)	0.15	-0.01, 0.30	0.058
	I am comfortable addressing the specific health needs of patients who identify as gay men.	5.22 (0.86)	5.41 (0.78)	0.19	0.03, 0.35	0.018
	I am comfortable addressing risk reduction in terms of sexual behavior with patients who identify as gay men.	5.16 (0.89)	5.41 (0.78)	0.25	0.10, 0.40	0.002
Lesbian Women	I am confident treating patients who identify as lesbian women.	5.44 (0.74)	5.47 (0.74)	0.03	-0.10, 0.16,	0.658
	I am comfortable addressing the specific health needs of patients who identify as lesbian women.	5.31 (0.80)	5.46 (0.72)	0.15	0.00, 0.29	0.049
	I am comfortable addressing risk reduction in terms of sexual behavior with patients who identify as lesbian women.	5.24 (0.81)	5.44 (0.72)	0.21	0.04, 0.38	0.018
Bisexual Individuals	I am confident treating patients who identify as bisexual.	5.38 (0.75)	5.47 (0.74)	0.09	-0.05, 0.23	0.203
	I am comfortable addressing the specific health needs of patients who identify as bisexual.	5.19 (0.80)	5.41 (0.74)	0.22	0.10, 0.34	< 0.001
	I am comfortable addressing risk reduction in terms of sexual behavior with patients who identify as bisexual.	5.15 (0.83)	5.38 (0.77)	0.24	0.09, 0.38	0.002

[1]n (%); Mean (SD)

The three items that did not see a significant increase were the three questions asking how confident the student was in treating patients who identified as gay, lesbian, and bisexual. It is important to note that these questions had a pre-program average score above a 5 and ended with each question having a post-program average score in the 5.4 range, firmly between moderately and strongly agree.

A large majority of students had some formal exposure to training related to gender minorities, as seen in Table 4 [Insert Table 4]. In the pre-program survey, 57% of students reported completing 1–3 formal classes or training programs, and 7.4% of students reported completing greater than 4 classes or training programs. Regarding self-confidence and comfortability working with gender minorities, all items saw significant increases from pre- to post-program surveys. All items started slightly below moderately agree (5) and moved to between moderately and strongly agree, with the largest movement being the item asking how comfortable the student was with discussing biological sex with patients who identified as a sexual minority ($p < 0.001$, 95% C.I. 0.34 to 0.75).

Table 4
Learning Outcomes Related to Gender Minority Communities

Group	Characteristic	pre[1] N = 68	post[1] N = 68	Difference	95% CI	p-value
Gender Minorities	How much prior training and education do you have in the treatment of patients who are gender minorities (i.e. transgender, nonbinary)?					
	0 formal classes or training programs	24 (35%)	21 (31%)			
	1–3 formal classes or training programs	39 (57%)	40 (59%)			
	Greater than 4 classes or training programs	5 (7.4%)	7 (10%)			
	I am comfortable asking patients who identify as a gender minority (i.e. transgender, nonbinary) about their sexual histories and practices.	4.88 (0.97)	5.25 (0.87)	0.37	0.20, 0.54	< 0.001
	How often do you ask patients for their pronouns?					
	Never	3 (4.4%)	1 (1.5%)			
	Not often	20 (29%)	20 (29%)			
	Sometimes	22 (32%)	18 (26%)			
	Often	17 (25%)	14 (21%)			
	Always	6 (8.8%)	15 (22%)			
	I am comfortable asking a patient for their pronouns.	4.96 (1.03)	5.24 (0.90)	0.28	0.10, 0.46	0.002
	I am comfortable discussing biological sex with patients who identify as a gender minority (i.e. transgender, nonbinary).	4.71 (1.12)	5.25 (0.89)	0.54	0.34, 0.75	< 0.001
	I am comfortable making referrals (i.e. surgical, behavioral health) for gender-affirming care for patients who identify as a gender minority (i.e. transgender, nonbinary).	5.00 (0.95)	5.24 (0.87)	0.24	0.06, 0.41	0.01
	I am comfortable prescribing therapies (i.e. gender-affirming hormone therapy) for patients who identify as a gender minority (i.e. transgender, nonbinary).	4.49 (1.38)	4.96 (1.18)	0.47	0.26, 0.69	< 0.001
Transgender	I am confident treating patients who identify as transgender.	4.97 (0.96)	5.37 (0.83)	0.4	0.20, 0.60	< 0.001
	I am comfortable addressing the specific health needs of patients who identify as transgender.	4.90 (0.98)	5.29 (0.83)	0.4	0.20, 0.59	< 0.001
Nonbinary	I am confident treating patients who identify as nonbinary.	4.97 (0.90)	5.37 (0.84)	0.4	0.24, 0.55	< 0.001
	I am comfortable addressing the specific health needs of patients who identify as nonbinary.	4.84 (0.97)	5.25 (0.85)	0.41	0.24, 0.59	< 0.001
Gender Fluid	I am confident treating patients who identify as gender fluid.	4.84 (1.15)	5.28 (0.97)	0.44	0.27, 0.62	< 0.001
	I am comfortable addressing the specific health needs of patients who identify as gender fluid.	4.81 (1.12)	5.21 (0.91)	0.4	0.21, 0.58	< 0.001

[1]n (%); Mean (SD)

As seen in Table 5, average scores on the five-question knowledge check increased from 3.04 questions out of 5 correct to 3.72 questions correct ($p < 0.001$, 95% C.I. 0.42 to 0.94) [Insert Table 5]. Students demonstrated higher scores on all individual items; two of these increases were statistically significant (Question 1, 3), while the other three were non-significant (Question 2, 4, 5).

Table 5
Changes in Knowledge Check Test Scores Pre- and Post-Program

Characteristic	pre[1] N = 68	post[1] N = 68	Mean Difference	95% CI	p-value
Average Test Score	3.04 (0.87)	3.72 (0.99)	0.68	0.42, 0.94	< 0.001
1. In the United States, what percent of transgender patients have been refused care by their provider as a result of their gender identity?	31 (46%)	45 (66%)			0.008
2. What kind of cancer are women who identify as lesbian more vulnerable to?	63 (93%)	67 (99%)			0.13
3. The LGBT community has the greatest rates of what?	35 (51%)	40 (59%)			0.3
4. What disorder can lead to XX chromosomal individuals identifying more often as men?	19 (28%)	38 (56%)			< 0.001
5. What is the difference between sexual orientation and gender identity?	59 (87%)	63 (93%)			0.13

[1]Mean (SD); n (%) Correct

Discussion

The interactive eLearning module significantly improved APRN students' confidence in caring for LGBTQ+ individuals and their comfort in addressing specific health needs, risk-reduction strategies, and gender-affirming care referrals across nearly all domains. Our results revealed a significant change in implicit bias toward gay people, while implicit bias toward transgender people did not change significantly. Sexual minority implicit bias moved away from an automatic preference for straight people to little or no automatic preference between straight people and gay people. These findings are promising given the relatively brief duration of the learning module; however, further development of educational materials focused on gender minorities is needed to address persistent implicit biases. It is unfortunate that these IATs do not include other subgroups, such as bisexual individuals in the sexual minority category, or gender-diverse or intersex individuals in the gender minority category. Nevertheless, whether this shift in sexual minority implicit bias remains temporary or exists longitudinally cannot be determined in the present study. Future studies addressing implicit bias are crucial, particularly for nursing students whose interactions with patients can directly shape clinical outcomes.[31, 32]

Although most students had prior exposure to health education related to sexual and gender minority communities (1–3 formal classes or training programs), the module still demonstrated successful learning outcomes. Two questions that did not show statistically significant improvements were related to confidence in treating gay men, lesbian women, and bisexual people. Given that most students had some previous knowledge of LGBTQ+ health, they may have had more exposure and therefore more confidence working with gay men, lesbian women, and bisexual people, who comprise a large proportion of the LGBTQ+ community. This was unsurprising due to evidence suggesting higher acceptance of sexual minorities than gender minorities, although such perceptions may vary depending on the rater's identity.[33, 34] While many studies examine LGBTQ+ health uniformly, others highlight the importance of addressing the health needs of different subgroups separately.[35, 36] As technological advancements continue to shape learning, examining various modalities and their outcomes offers insight into the future of health education.

Students performed adequately on the five knowledge check questions in the pre-program survey, with a statistically significant increase in total scores after completing the module. Content knowledge helps provide additional context in educational research, particularly because self-reported data can be subject to measuring bias.[37] When individual items were examined rather than aggregated student scores out of five, variability was observed across questions. Two of the three questions without statistically significant changes had a high proportion of correct responses even in the pre-program survey (Question 2 = 93%, Question 5 = 87%). This may help explain a lack of significance, given the smaller margin for a score improvement. Unfortunately, correct answers to Question 3 ("*The LGBTQ+ community has the greatest rates of ___?")* remained low across pre- and post-program surveys, signaling a lack of student understanding or knowledge retention. Nevertheless, the proportion of correct responses increased for each individual item in the knowledge check regardless of statistical significance. Although it was not possible to prevent students from searching up answers to questions, correct answers were not displayed initially in the pre-program survey.

Although the module was compact in content, our results demonstrate that improvements to students' knowledge, self-confidence, and comfortability are feasible within a short time commitment. However, it remains unclear whether these improvements are attributable to the interactive components of the learning module, to the practice included in the patient simulations, or solely from

the content provided. A large proportion of students who completed the pre-program did not complete the post-program (n = 72), resulting in a moderately small sample size (n = 68). Due to technological limitations, the module needed to be completed in one sitting, which may have deterred some students from responding to both surveys. Other limitations include a relatively homogenous sample size, encompassing mostly White/Caucasian, cisgender female, and heterosexual students. Furthermore, efforts were taken to prevent students from skipping over content and immediately taking the post-program survey to record their completion. This included a requirement to interact with all the content presented on each slide of the module. Yet, because of the self-paced nature of the module, it was not possible to verify whether students genuinely engaged with the content. These limitations exist broadly across learning outcomes research, and some studies report lower engagement levels with self-paced modules.[38]

Conclusion

This study revealed short-term changes as a result of completing a learning module, which significantly reduced implicit bias against gay people, among other improvements across comfortability and knowledge working with LGBTQ+ populations. Given the brevity of this intervention, future studies can focus on the longitudinal effects of more comprehensive LGBTQ+ health curricula. Re-evaluating these learning outcomes, including self-confidence, comfortability, factual knowledge, and implicit bias at extended intervals, such as six months or one year, can reveal which domains are retained more effectively and which may decline over time. Taking into account the potential influence of student identity on baseline and outcome measures can also highlight the effects of in-group and out-group variation in a learning environment.[39] Of note, the module was not intended to replace existing curricular content related to LGBTQ+ health in our graduate nursing programs. Instead, the module provided a standardized introduction to supplement LGBTQ+ content in the College of Nursing. Similar initiatives have found success among medical and health professions programs across the country, though few, if any, studies also evaluate changes in implicit bias among students. Continued expansion of a comprehensive LGBTQ+ health curriculum that integrates self-paced and traditional learning is essential for preparing future nurse practitioners to work with this vulnerable population.

Abbreviations

LGBTQ+
Lesbian, Gay, Bisexual, Transgender, Queer+
APRN
Advanced Practice Registered Nurse
MSN
Master of Science in Nursing
DNP
Doctor of Nursing Practice
WPATH
World Professional Association for Transgender Health
AAMC
Association of American Medical Colleges
AFAB
Assigned Female at Birth
CSEAC
Clinical Skills Education and Assessment Center (The Ohio State University)
AGPCNP
Adult-Gerontology Primary Care Nurse Practitioner
ANCC
American Nurses Credentialing Center
IAT
Implicit Association Test

Declarations

Ethics approval and consent to participate

This study was determined to be exempt by The Ohio State University College of Medicine Institutional Review Board. All participants were aged 18 years or older and provided informed consent prior to participation.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests or disclosures to report.

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Authors' contributions

G.X. designed the learning module and authored the methodology, discussion, and conclusion sections. A.B. led the literature review for the learning module and the manuscript, and coordinated the filming of simulated clinical encounters. J.M. performed data analysis and interpretation, and created all figures and tables presented in the manuscript. C.S. supervised the study implementation and played a major role in overseeing the manuscript preparation. All authors reviewed and approved the final manuscript.

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Figures

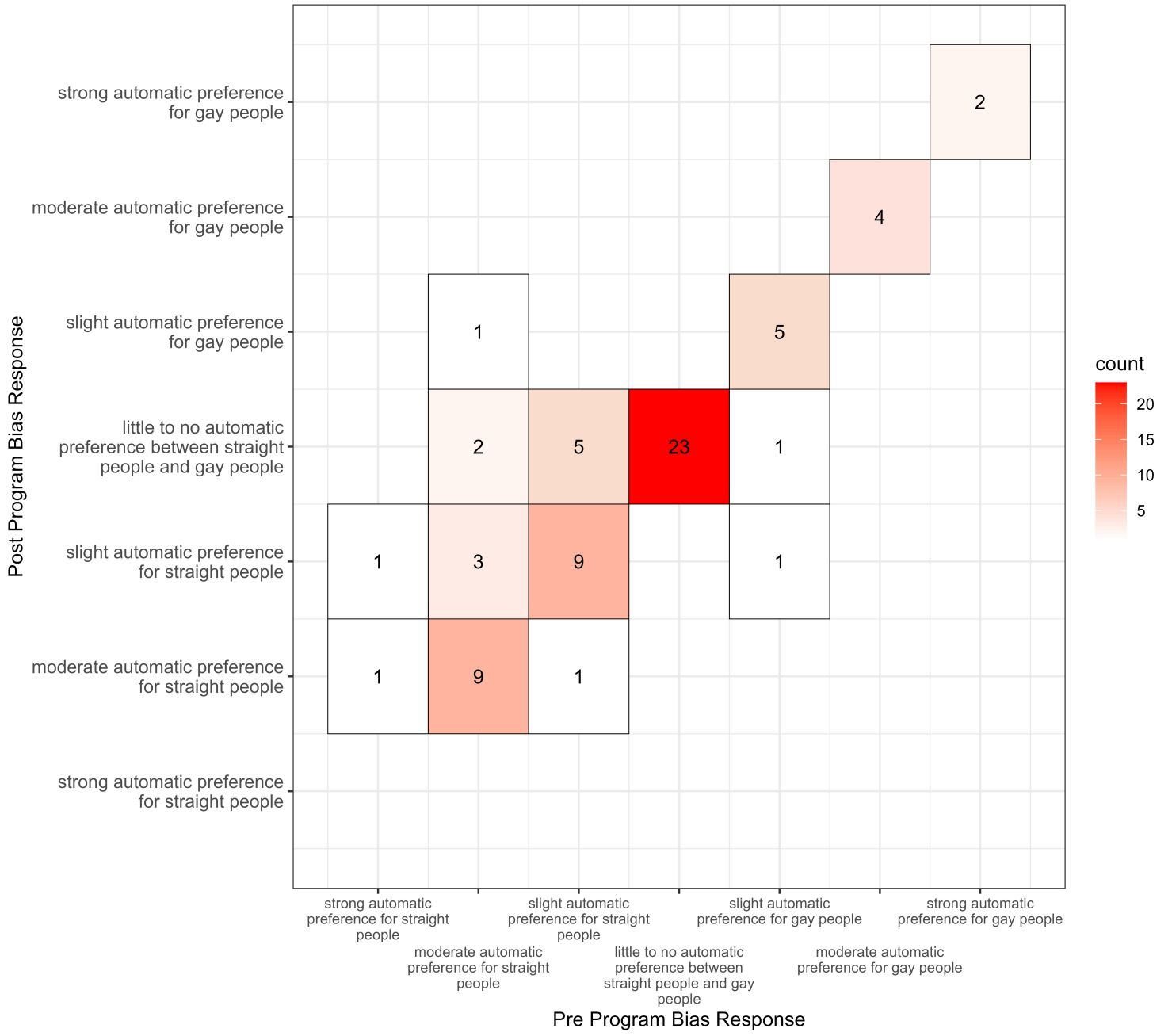


Figure 1

Implicit Bias Results Between Straight and Gay People Across Pre- and Post-Program

Response frequencies were indicated in red, with darker shading representing higher frequencies. A statistically significant shift toward the absence of automatic preference between straight and gay people was observed following completion of the learning module. Results were based on participants' self-reported IAT scores.

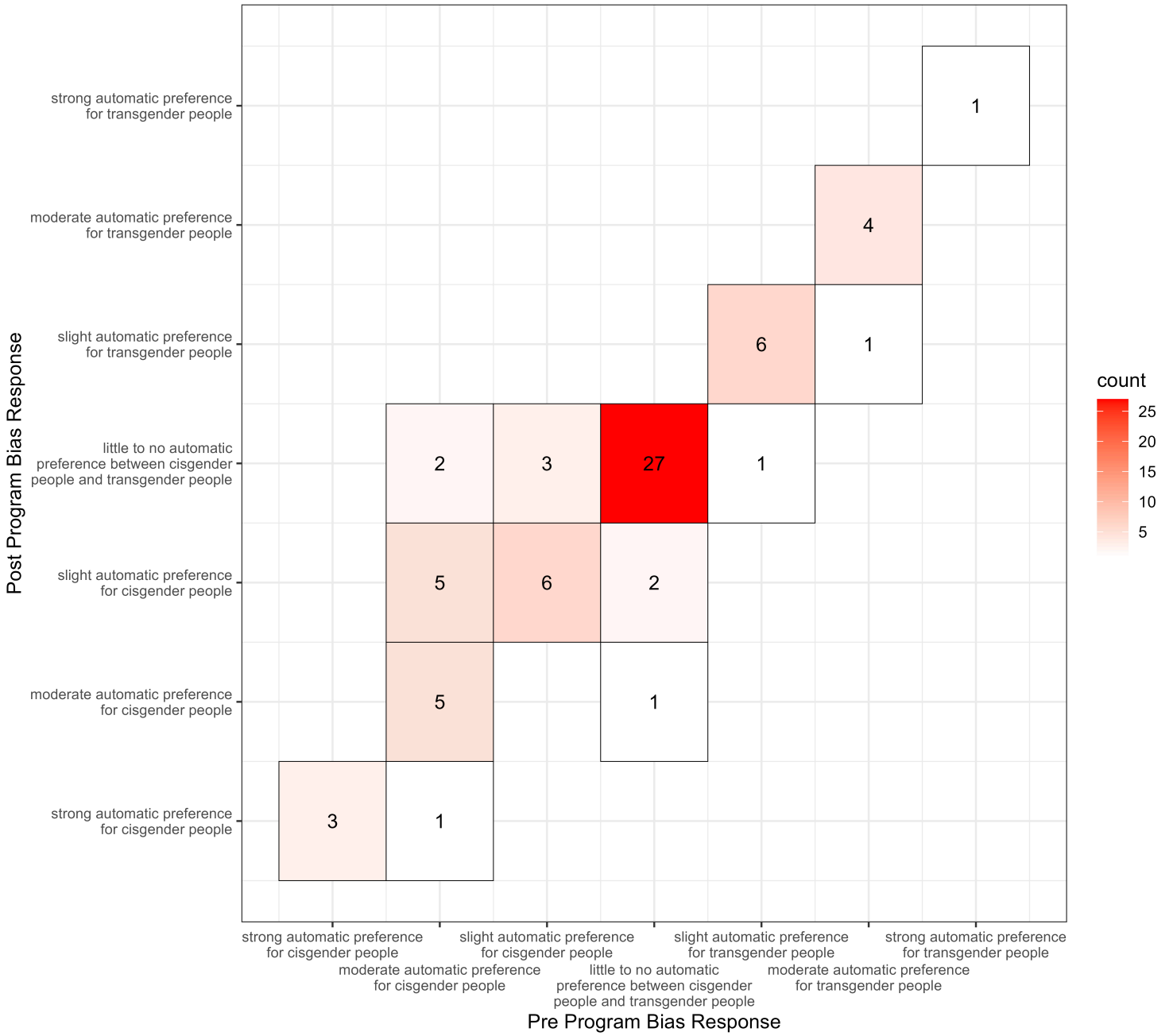


Figure 2

Implicit Bias Results Between Cisgender and Transgender People Across Pre- and Post-Program

Response frequencies were indicated in red, with darker shading representing higher frequencies. A slight shift toward the absence of automatic preference between cisgender and transgender people was observed following completion of the learning module, although this change was not statistically significant. Results were based on participants' self-reported IAT scores.

Supplementary Files

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