ORIGINAL ARTICLE



Evaluation of prenatal genetic counselors' abortion education and training as variables associated with self-efficacy

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Abstract

Revised: 17 December 2024

Prenatal genetic counselors in many states have modified their practices, considering new state-level abortion restrictions enacted after the 2022 US Supreme Court Dobbs decision. Therefore, genetic counselors' preparedness to counsel patients under these restrictions warrants new attention. Using a cross-sectional design, we assessed prenatal genetic counselors' self-efficacy given their exposures to abortion education during and after their graduate training and other variables potentially associated with selfefficacy. Participants were board-certified or eligible prenatal genetic counselors practicing in the United States. They completed an anonymous online survey, which assessed demographics, exposures to abortion topics, and the six-factor Genetic Counseling Self-Efficacy Scale (GCSES; subscale range 0 (low)-100 (high)), answered using context from a hypothetical prenatal case scenario. Kruskal-Wallis and Wilcoxon rank sum tests compared median GCSES factor scores for each demographic and curricular variable. Chi-square and Fisher's exact tests compared coverage of abortion topics according to location of graduate program (restrictive vs. protective state, per Guttmacher Institute). We analyzed 94 surveys (93% female, 53% aged <25-34, 66% restrictive states). GCSES scores skewed high (65.00-100.00). Higher scores on complex skills, communication, genetic testing, and basic psychosocial skills were associated with older age (p's < 0.01), more years since graduation (p's < 0.01), and more years' experience practicing as a prenatal genetic counselor (p's < 0.01); graduate program exposure to counseling about pregnancy termination option was associated with higher scores on complex skills, communication, and genetic testing (p's < 0.05). Participants reported high self-efficacy to address the prenatal scenario regardless of location of graduate program or current practice. Still, if graduate programs wish to increase their coverage of abortion topics, our results indicate that exposures to counseling the option of pregnancy termination through practical experiences, such as clinical rotations or role plays, are the most effective didactic tools for promoting self-efficacy in prenatal sessions.

KEYWORDS

abortion, abortion legislation, curriculum, education, genetic counseling, prenatal, selfefficacy, survey

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1 | INTRODUCTION

In June of 2022, the Dobbs v. Jackson US Supreme Court ruling overturned the precedent set by the 1973 US Supreme Court ruling on Roe v. Wade, thereby removing a pregnant individual's federal right to access an abortion without undue burden, prior to viability. Prior to the Dobbs decision, genetic counselors in states that had already adopted more restrictive abortion laws reported needing to modify their practices to account for these legal changes when they were first enacted (Jayaraman et al., 2021). Genetic counselors in states with existing early gestational age limits for abortion have also expressed experiencing an impact on their abilities to support patients in their reproductive decisionmaking (Koenig et al., 2019). For example, a focus group study of prenatal genetic counselors in Ohio, where abortion restrictions were implemented prior to the Dobbs decision, found that genetic counselors perceived that these laws have negatively affected their relationships with patients, as the mental and emotional burdens of navigating the restrictions had contributed to compassion fatigue and burnout (Heuerman et al., 2021). While genetic counselors had been expressing concerns regarding restrictive abortion legislation prior to the Dobbs decision, prenatal genetic counselors in more states may experience similar challenges with the onset of restrictive abortion laws post-Roe. According to an analysis of state policy trends by the Guttmacher Institute, as of this writing, 13 states have a total abortion ban and 4 states have a 6-week ban (Guttmacher Institute, 2024). These restrictive laws provide limited exceptions when there is a threat to the life of the pregnant person. However, this exception still places pregnant people at risk: for example, in the Dobbs v. Jackson case. medical organizations including, the American College of Medical Genetics and Genomics, the American Medical Association, and the American College of Obstetrics and Gynecology, filed a joint amicus brief to the Supreme Court, stating that the narrow language for exceptions places physicians in a difficult position, "either letting a patient deteriorate until one of these conditions is met or face possible loss of their medical licenses for performing an abortion in contravention of the Ban" (Brief for the American College of Obstetricians and Gynecologists et al. as Amici Curiae Supporting Petitioners, Dobbs v. Jackson Women's Health Organization, 2021). In addition to loss of medical licenses, certain laws, such as The Human Life Protection Act of 2021, enacted in Texas, also impose civil and criminal penalties on physicians that perform "illegal" abortions (Human Life Protection Act of 2021, 2021). A study of prenatal genetic counselors across the United States, conducted after the Dobbs decision, found that participants reported increased emotional and financial burdens for their patients, particularly in states with restrictive laws (Getchell et al., 2022). In states that are considered hostile to abortion, prenatal genetic counselors have affirmed that the uncertainty and lack of legal guidance regarding new abortion policies is one of the greatest challenges to their ability to counsel patients (Getchell et al., 2022).

What is known about the topic

Previous studies have found that genetic counselors believe restrictive abortion laws have negatively impacted their abilities to support patients' reproductive choices and have also placed additional emotional and financial burdens on their patients. To our current knowledge, there are no published studies that have sought to understand if prenatal genetic counselors feel prepared to counsel about pregnancy termination and what variables may contribute to preparedness and self-efficacy.

What this paper adds to the topic

Our study fills gaps in the literature by further assessing prenatal genetic counselors' educational exposures to abortion topics. We explore how these exposures may be associated with self-efficacy to address a prenatal counseling scenario involving a discussion of pregnancy termination. We also examine other variables that may foster self-efficacy to counsel about this topic.

Previous studies of genetic counselors' self-efficacy have indicated that knowledge about a particular subject impacts selfefficacy to counsel regarding this subject (Huser et al., 2022). However, information about genetic counselor knowledge of abortion topics is limited (Koenig et al., 2019). A 2019 study by Koenig et al. assessed prenatal genetic counselors' perceptions of abortion laws in restrictive states and concluded that there is a need for additional education about abortion legislation, both during and after genetic counseling graduate training. Additionally, authors of a study that examined prenatal genetic counselor perceptions of abortion legislation have argued that genetic counseling graduate curricula should specifically address abortion laws, abortion procedures, and coordination of patient care pertaining to abortions (Graziani et al., 2018). A recent study of abortion curricula in genetic counseling graduate programs surveyed genetic counseling program representatives and recent graduates of genetic counseling programs to collect information about how abortion topics were addressed in their programs (Sanchez et al., 2024). The authors concluded that there is considerable variability of coverage about abortion across genetic counseling programs and that further research is needed to assess which topics and education formats are most helpful in graduate education. Understanding how genetic counseling students and practicing genetic counselors are being exposed to abortion topics in their education can potentially aid in our understanding of genetic counselors' preparedness to address these topics in a prenatal session.

Since many prenatal genetic counselors believe that restrictive abortion laws have negatively impacted their practices, our study aims to clarify if these perceptions also reflect prenatal genetic counselors' self-efficacy to counsel patients in a session involving pregnancy termination and to evaluate variables that might be associated with self-efficacy. Additionally, this research aims to supplement existing knowledge about the ways that genetic counselors have been trained to counsel about abortion during and after their genetic counseling graduate programs. The primary research question aims to explore what variables and educational exposures are associated with a prenatal genetic counselors' self-efficacy to counsel patients about pregnancy management options, including termination.

2 | METHODS

2.1 | Study design and participants

A cross-sectional, anonymous, online survey was used to gather responses from individuals who met the following eligibility criteria: American Board of Genetic Counseling (ABGC) board-certified and board-eligible genetic counselors that self-identify as currently practicing in a prenatal or reproductive specialty in the United States. Study participation was voluntary. This study was reviewed, approved, and received certified exempt status by the UCLA Office of the Human Research Protection Program on November 13, 2023 (IRB#23-001677).

2.2 | Recruitment procedures

Participants were recruited using The National Society of Genetic Counselors (NSGC) Student Research Survey Program, direct recruitment, and snowball sampling. The survey was opened on November 22, 2023 and closed to additional responses on March 14, 2024. The NSGC Student Research Survey Program sent an emailblast with this study's recruitment statement and link to participate to all NSGC members via their members only list-serv. A second, follow-up recruitment email-blast was sent through this program to the same list-serv, approximately 2 months after the initial email was distributed. Publicly available contact information, published through NSGC's online 'Find a Genetic Counselor' tool, was used to identify additional participants for direct recruitment. The public directory was filtered to only include genetic counselors that self-reported as practicing in a prenatal specialty and as being open to student contact. Each person that met these criteria was contacted individually, via the email address that was publicly available in the directory. Only one email was sent to each individual on the list. We also asked individuals with contacts in the prenatal genetic counseling space for assistance in distributing the survey to any groups or individuals that may be eligible to complete the survey. These individuals were provided with the IRB-approved recruitment statement and link to the survey to distribute to these contacts. The recruitment statement instructed individuals to disregard the message if they had already completed the survey, to avoid duplicate responses.

2.3 | Instrumentation

The anonymous, online survey was created and administered through Qualtrics. Survey questions screened participants for their eligibility to participate, followed by a set of questions pertaining to demographic information, including geographic location of genetic counseling training program and current practice, exposure to abortion education, and items assessing self-efficacy to provide genetic counseling, in the context of a hypothetical prenatal scenario (Appendix S1).

2.4 | Hypothetical prenatal scenario

We developed a hypothetical prenatal genetic counseling scenario that describes a potential case in which a genetic counselor may discuss the option of termination. The purpose of including this scenario was to provide participants with context to complete the survey's self-efficacy measure (Genetic Counseling Self-Efficacy Scale). The following vignette was provided:

> You have been scheduled to see a 31-year-old female at 21 weeks gestation, who presents for genetic counseling due to multiple fetal anomalies detected on ultrasound. The patient and their partner have been advised by their physician that the fetus is unlikely to survive very long after delivery. Hearing this news, they do not wish to continue the pregnancy.

2.5 | Outcome variable

The primary outcome variable for this study was self-efficacy. To measure this variable, participants were asked to complete the Genetic Counseling Self-Efficacy Scale (GCSES). This instrument is a validated measure that asks respondents to self-assess their ability to perform certain skills. The original GCSES was developed and underwent initial validation in 2018 in a study conducted by Caldwell et al. and further validation in a separate study in 2019 by Keller et al. Since these initial publications, the GCSES has been used to assess genetic counseling self-efficacy in a variety of contexts, including assessments of self-efficacy to counsel patients about specialized topics (Kamen et al., 2022).

The GCSES measure consists of 38 statements that represent genetic counseling core competencies. An example of one competency statement provided includes: "Facilitate client decisionmaking that is consistent with the values of the client." For each competency statement, participants were instructed to rate how certain they are of their ability to independently perform the competency, as if they were the genetic counselor in the hypothetical prenatal scenario. The possible responses were fixed increments of ILEY-Genetic -Counselors

ten (0, 10, 20, 30, etc.) on a scale from: "Not at all certain I can do" (0) to "Highly certain I can do" (100). Each item on the GCSES falls into one of six factors outlined in the original validation studies for the GCSES (Caldwell et al., 2018; Keller et al., 2019). The six factors, each representing a group of skills in genetic counseling, are as follows: Factor 1: Complex Skills, Factor 2: Communication, Factor 3: Genetic Testing, Factor 4: Basic Psychosocial Skills, Factor 5: Genetic Counseling Process, and Factor 6: Information Gathering. We calculated a GCSES sub-score for each factor for each participant. The sub-score was an average of the participant ratings for each item on the scale that corresponded to the given factor. These scores represent the participant's self-efficacy to perform the six core skills.

2.6 | Predictor variables

Demographic information collected from the survey includes age, gender, years since graduating from a genetic counseling program, years of practice in a prenatal specialty, geographic location of current practice (restrictive vs. protective state), and geographic location of genetic counseling training program (restrictive vs. protective state). To further foster respondent anonymity, each variable was collected as categorical data. More specifically, participant geographic location responses were collected as categorical data based on criteria from the Guttmacher Institute, which classifies states according to the level of restrictiveness of their abortion policies. The possible restrictiveness categories designated by the Guttmacher Institute, as of November 2023, include: Most Restrictive, Very Restrictive, Restrictive, Some Restrictions/Protections, Protective, Very Protective, and Most Protective. For the survey, we created three condensed categories, in which participants could select the response that listed their state (Appendix S1). The three possible survey categories were Restrictive States (Most Restrictive, Very Restrictive, and Restrictive), States with Some Restrictions/ Protections, and Protective States (Protective, Very Protective, and Most Protective).

Participants were also asked to select which (if any) topics related to pregnancy termination (abortion procedures, abortion legislation, and counseling the option of pregnancy termination) were covered during their genetic counseling training and if covered, to select how each topic was presented in their curricula from a list of six possible teaching modalities (e.g., didactic lecture, rotations, etc.). Participants were also asked to indicate if they believed their graduate training adequately prepared them to address abortion topics in prenatal sessions, using a 5-point Likert scale with possible responses ranging from "Strongly agree" to "Strongly disagree." This section of questions also asked participants to select which of the six possible teaching modalities (e.g., didactic lecture, rotations, etc.) were most helpful or would have been most helpful in their graduate education to prepare them to counsel in these scenarios.

2.7 | Data analysis

All data were analyzed using R Studio software, version 1.4.1717. Descriptive statistics were calculated for demographic variables. Kruskal-Wallis and Wilcoxon rank sum tests were used to compare median GCSES factor sub-scores for groups according to the following predictor variables: years since graduating from their genetic counseling graduate program, years of practice in a prenatal specialty, geographic location of current practice, geographic location of training program, and exposure to abortion education during graduate training. Chi-square and Fisher's Exact tests were used to compare coverage of abortion topics according to the geographic location of genetic counseling graduate programs.

For the purposes of analysis, the age variable was condensed into two categories, "<25-34" and "35-60+" given the small sample sizes in several of the original categories. Similarly, Likert scale responses "Strongly agree" and "Agree" were condensed into a single category, "Agree," and "Neutral," "Disagree," and "Strongly Disagree" responses were condensed into a single category "Disagree." To account for the relatively low number of responses that fell into the "Some Protections/Restrictions" category for geographic location, the three survey response options were condensed into two categories for the purposes of our analysis (Appendix S1). The two categories used for analysis are Restrictive States (Most Restrictive, Very Restrictive, Restrictive, and Some Restrictions/Protections) and Protective States (Protective, Very Protective, Most Protective). A significance threshold of 0.05 was used.

A priori power analysis conducted using G*Power software indicated a sample size of at least 53 participants was required to achieve a minimum power of 0.80, at an alpha of 0.05, for analysis using a multiple regression model, with eight anticipated predictor variables. Given the highly left-skewed (non-normal) distribution of GCSES sub-scores in our sample (i.e., most responses at the upper end of the GCSES scale), our analysis required the use of nonparametric statistical tests. Nonparametric analyses are considered less powerful compared to parametric statistical tests (e.g., multiple regression) (Vickers, 2005). The required sample size for nonparametric tests is expected to be 15% greater than that of the sample size required for parametric tests (Motulsky, 2016). In this case, the minimum sample size to achieve 0.80 power was updated to 61 participants.

3 | RESULTS

3.1 | Sample composition

Our survey received 98 total responses. Of these responses, 94 were included in the final analysis. One response was excluded because their answer to one of the two eligibility questions was left blank. Three others were excluded because they did not complete a majority of the GCSES items. One participant did not include a selection indicating their location of genetic counseling graduate program. This participant was excluded from analysis involving location of genetic counseling graduate program. Three survey responses included in the analysis had a missing response to one of the 38 items on the GCSES. Each participant's missing response was for a different GCSES item. These three missing values were resolved using simple imputation. Each missing response was replaced with the average rating for that item across all other participant responses.

Of the 94 analyzed responses, a majority of participants were female (93%), aged <25–34 (53%), graduated from a genetic counseling program located in a restrictive state (66%) and currently practiced in a restrictive state (66%) (Table 1).

3.2 | Genetic counseling program coverage of abortion topics

A majority of participants (91.49%) reported they received education about abortion topics as a part of their genetic counseling graduate

TABLE 1Sample characteristics.

Demographic	Frequency (% (n))
Age (n=94)	
<25	2.12 (2)
25–29	29.79 (28)
30-34	21.28 (20)
35–39	19.15 (18)
40-44	6.38 (6)
45-49	9.57 (9)
50-54	3.19 (3)
55–59	4.25 (4)
60+	4.25 (4)
Gender (n=91)	
Female	93.41 (85)
Male	6.59 (6)
Years since graduating $(n=94)$	
<1 year ago	10.64 (10)
1-4 years ago	31.91 (30)
5–10 years ago	20.21 (19)
More than 10 years ago	37.23 (35)
Years practicing in prenatal ($n = 94$)	
<1 year	10.62 (10)
1–4 years	35.11 (33)
5–10 years	17.02 (16)
More than 10 years	37.23 (35)
Location of practice ($n = 94$)	
Restrictive states	65.95 (62)
Protective states	34.04 (32)
Location of GC program ($n = 93$)	
Restrictive states	65.59 (61)
Protective states	34.41 (32)

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school curriculums. The topic that was most frequently reported by participants as covered during their graduate training was education regarding counseling patients about the option of pregnancy termination. Amongst the possible teaching modalities that participants could select, participants were exposed to this topic most commonly through experiences during their clinical rotations (76.74%) and didactic lecture (67.44%). Information about abortion procedures (dilation and evacuation, medication, etc.) was reported as a covered topic by 82.98% of participants and information about state-level abortion legislation was reported as covered by 79.78% of participants. The two most common teaching modalities reported as being utilized to convey information about abortion procedures and state-level abortion legislation were didactic lecture (88.5% and 78.7%, respectively) and rotation experience (62.8% and 60.0%, respectively) (Table 2).

3.3 | Coverage of abortion topics by location of graduate program

Of the participants from protective states, 91% reported that their genetic counseling program covered information about abortion procedures, while 79% of participants from restrictive states reported coverage of this information. Coverage of information about abortion legislation as a part of their genetic counseling graduate program curricula was reported by 85% of participants in restrictive states compared to 72% of participants from protective states. These differences in coverage of procedures and legislation did not reach statistical significance. Participants from restrictive and protective states both reported that their genetic counseling training programs provided education about counseling the option of termination at high frequencies (90% and 94%, respectively) (Table 3). Genetic counseling graduate program coverage of abortion topics and utilization of teaching modalities were also not found to differ according to other variables, including age, years since graduating from a genetic counseling training program, or years practicing in a prenatal specialty.

3.4 | Genetic counselor preparedness at time of graduation

Upon graduation from a genetic counseling training program, 66% of the participants sampled reported that they felt prepared to address abortion topics during a prenatal genetic counseling session. While a greater proportion of participants from protective states reported feeling prepared (78%) compared to the proportion of participants from restrictive states (61%). Rotation experience during graduate school was cited by participants as the exposure and teaching modality that was or would have been the most helpful for them to feel prepared to address abortion topics in a genetic counseling session (92.55%), followed by "Mock cases/role plays/standardized patients" (57.54%) (Table 2).

Nearly all participants also reported having exposure to abortion topics outside of graduate school (97.87%). The most frequently
 TABLE 2
 Abortion curriculum topics taught in genetic counseling graduate programs.

Торіс	Frequency (% (n))
Did your GC program curriculum include info about abortion procedures? (n = 94)	Yes: 82.98 (78)
If yes, what teaching modalities were used? $n = (78)^{a}$	
Didactic lecture	88.46 (69)
Rotation experience	62.82 (49)
Reading materials	47.44 (37)
Discussion	42.31 (33)
Mock cases/role plays	25.64 (20)
Other	1.28 (1)
Did your GC program curriculum include info about state abortion legislation? (n = 94)	Yes: 79.78 (75)
If yes, what teaching modalities were used? $(n = 75)^a$	
Didactic lecture	78.67 (59)
Rotation experience	60.00 (45)
Discussion	50.67 (38)
Reading materials	34.67 (26)
Mock cases/role plays	16.00 (12)
Other	2.67 (2)
Did your GC program curriculum include info about counseling the option of termination? $(n = 94)$	Yes: 91.49 (86)
If yes, what teaching modalities were used? (n=86) ^a	
Rotation Experience	76.74 (66)
Didactic Lecture	67.44 (58)
Discussion	55.81 (48)
Mock Cases/Role Plays	39.53 (34)
Reading Materials	30.23 (26)
Other	2.33 (2)
Upon graduation, did you feel prepared to address abortion topics in a prenatal session? $(n = 94)$	Yes: 65.95 (62)
Which exposures did/do you find most helpful to feel pr address abortion topics in a session? $(n = 94)^a$	repared to
Rotation experience	92.55 (87)
Mock cases/role plays	57.45 (54)
Didactic lecture	46.81 (44)
Discussion	46.81 (44)
Reading materials	20.21 (19)
Other	1.06(1)
Did you have exposure to abortion topics outside of	1.00 (1)
graduate school? (n = 94)	Yes: 97.87 (92)
graduate school? $(n = 94)$ What was the nature of the exposure? $(n = 92)^{a}$	Yes: 97.87 (92)
graduate school? (n = 94) What was the nature of the exposure? (n = 92) ^a Independent search online	Yes: 97.87 (92) 72.83 (67)
graduate school? (n = 94) What was the nature of the exposure? (n = 92) ^a Independent search online Employer provided resources	Yes: 97.87 (92) 72.83 (67) 64.13 (59)
graduate school? (n = 94) What was the nature of the exposure? (n = 92) ^a Independent search online Employer provided resources Conferences	Yes: 97.87 (92) 72.83 (67) 64.13 (59) 57.61 (53)
graduate school? (n = 94) What was the nature of the exposure? (n = 92) ^a Independent search online Employer provided resources Conferences Online webinars	Yes: 97.87 (92) 72.83 (67) 64.13 (59) 57.61 (53) 48.91 (45)

^aParticipants could select multiple responses, so total frequency counts may exceed 94.

4.35 (4)

Other

TABLE 3 Comparisons of abortion curricula by location of genetic counseling program.

Торіс	Restrictive states n=61 n (%)	Protective states n=32 n (%)	Chi-square with 1 <i>df</i> (p-value)
Abortior	n procedures		
Yes	48 (78.69)	29 (90.63)	1.34 (0.25)
No	13 (21.31)	3 (9.38)	
State-lev	vel abortion legislation		
Yes	52 (85.25)	23 (71.88)	1.62 (0.20)
No	9 (14.75)	9 (28.13)	
Counsel	ing about option of terr	nination ^a	
Yes	55 (90.16)	30 (93.75)	0.61 (0.71) ^a
No	6 (9.84)	2 (6.25)	
Felt prep	pared at time of graduat	tion	
Yes	37 (60.66)	25 (78.13)	2.15 (0.14)
No	24 (39.34)	7 (21.87)	

^aFisher's exact test was used for this topic as the frequency counts did not meet the minimum threshold for chi-square analysis; the value obtained from this analysis is the odds ratio (*p*-value).

reported external exposures were "Independent Search Online" (73%) and "Employer Provided Resources" (64%). Additionally, genetic counselors that selected "Other" as a response to the additional exposures they had beyond graduate school most frequently cited practical experiences, including "on the job experience" and "hands on clinical experience." Participants from restrictive states were more likely to report receiving exposure via independent on-line searches (79%) compared to participants from protective states (56%). This association was significant (p=0.038).

3.5 | Genetic counseling self-efficacy scores by factor

Participant GCSES factor sub-scores across all six factors were clustered at the high end of the scale (65.00-100.00), indicating an overall high self-efficacy to address the specific prenatal case scenario (Table 4). Higher scores on three GCSES factors-Complex Skills (Factor 1), Communication (Factor 2), and Genetic Testing (Factor 3)—were associated with older age (p's < 0.01), greater number of years since graduation (p's < 0.01), greater number of years in prenatal practice (p's < 0.01), and having opportunities during graduate school to learn about counseling patients about the option of termination (p's<0.05). A fourth factor-Basic Psychosocial Skills (Factor 4)—was also associated with age (p < 0.01), and years since graduation (p < 0.01) and in prenatal practice (p < 0.01). There were instances of statistical significance associated with Genetic Counseling Process and Information Gathering (GCSES Factors 5 and 6); however, these associations are likely a statistical artifact due to a profound ceiling effect in the GCSES scores rather than a

	Mean GCSES st	ub-score (SD)					Median GCSES	sub-score (IQR)				
Variable	F1: Complex skills	F2: Communication	F3: Genetic testing	F4: Basic psychosocial skills	F5: Genetic counseling process	F6: Information gathering	F1: Complex skills	F2: Communication	F3: Genetic testing	F4: Basic psychosocial skills	F5: Genetic counseling process	F6: Information gathering
Age												
<25-34	88.48 (8.98)	93.53 (6.42)	95.20 (5.98)	93.52 (8.04)	97.47 (3.60)	98.32 (3.57)	91.25 (13.75)	96.25 (8.75)	96.88 (6.25)	96.00 (10.00)	98.33 (3.33)	100.00 (0.00)*
35-60+	94.16 (7.90)	96.56 (5.97)	97.53 (4.28)	97.09 (5.83)	98.67 (3.25)	99.02 (2.93)	98.13 (8.90)	100.00 (3.13)	100.00 (2.81)	100.00 (2.00)	100.00 (0.00)*	100.00 (0.00)*
<i>p</i> -Values **							<0.001	<0.01	<0.01	<0.01	<0.01	0.139
Years practicin	00											
<1 year	87.98 (9.15)	92.63 (7.85)	91.88 (9.11)	91.80 (8.19)	96.67 (4.23)	97.00 (5.54)	91.88 (12.81)	96.25 (4.69)	95.00 (6.88)	94.00 (11.50)	98.33 (3.75)	100.00 (2.50)
1-4 years	89.83 (8.56)	93.86 (6.68)	96.06 (5.13)	94.67 (7.35)	97.62 (3.75)	98.36 (3.54)	91.25 (10.00)	97.50 (10.00)	97.50 (5.00)	96.00 (8.00)	98.33 (3.33)	100.00 (0.00)
5-10 years	85.88 (10.08)	93.12 (6.19)	95.47 (3.73)	92.25 (9.49)	96.98 (4.09)	97.71 (3.59)	90.19 (14.06)	93.75 (11.56)	96.25 (6.88)	97.00 (12.50)	98.33 (3.33)	100.00 (6.67)
More than 10years	95.68 (6.52)	97.46 (4.98)	98.14 (3.99)	98.00 (4.52)	99.29 (2.19)	99.81 (1.13)	98.75 (5.63)	100.00 (2.50)	100.00 (1.25)	100.00 (1.00)	100.00 (0.00)*	100.00 (0.00)*
p-Values**							<0.001	<0.01	<0.01	<0.01	<0.01	0.027
Years since gra	duating											
<1 year	87.98 (9.15)	92.63 (7.85)	91.88 (9.11)	91.80 (8.19)	96.67 (4.23)	97.00 (5.54)	91.86 (12.81)	96.25 (4.69)	95.00 (6.86)	94.00 (11.50)	98.33 (3.75)	100.00 (2.50)
1-4 years	89.61 (8.59)	94.04 (6.42)	96.33 (5.07)	94.73 (7.38)	97.89 (3.09)	98.62 (2.97)	91.25 (10.00)	96.88 (10.00)	97.50 (5.00)	96.00 (8.00)	98.33 (3.33)	100.00 (0.00)
5-10 years	86.86 (10.03)	92.96 (6.66)	95.13 (4.02)	92.53 (9.16)	96.67 (4.78)	97.27 (4.24)	91.64 (13.75)	96.25 (11.25)	96.25 (8.13)	98.00 (13.00)	98.33 (3.33)	100.00 (6.67)
More than 10years	95.68 (6.52)	97.46 (4.98)	98.14 (3.99)	98.00 (4.52)	99.29 (2.19)	99.81 (1.13)	98.75 (5.63)	100.00 (2.50)	100.00 (1.25)	100.00 (1.00)	100.00 (0.00)*	100.00 (0.00)*
<i>p</i> -Values**							<0.001	<0.01	<0.01	<0.01	<0.01	0.023
Location of pra	ctice											
Restrictive states	90.66 (8.62)	94.62 (6.30)	96.07 (5.62)	95.13 (7.15)	97.66 (3.93)	98.05 (3.84)	92.50 (11.25)	97.50 (8.75)	98.75 (6.25)	100.00 (7.50)	100.00 (3.33)	100.00 (0.525)
Protective states	92.08 (9.53)	95.59 (6.54)	96.72 (4.85)	95.31 (7.63)	98.75 (2.24)	99.79 (1.18)	95.63 (11.56)	98.75 (6.57)	98.13 (5.00)	100.00 (8.00)	100.00 (1.67)	100.00 (0.00)*
p-Values**							0.224	0.274	0.748	0.772	0.350	<0.01
Location of GC	program											
Restrictive states	91.41 (8.22)	94.77 (6.16)	95.78 (5.65)	95.80 (6.29)	97.84 (3.55)	98.36 (3.53)	92.50 (11.25)	97.50 (10.00)	97.50 (6.25)	100.00 (6.00)	100.00 (3.33)	100.00 (0.00)*
Protective states	90.51 (10.32)	95.16 (6.89)	97.34 (4.73)	93.88 (8.89)	98.33 (3.39)	99.11 (2.80)	93.75 (12.81)	98.75 (7.81)	100.00 (4.06)	99.00 (10.00)	100.00 (1.67)	100.00 (0.00)*
<i>p</i> -Values**							0.974	0.617	0.135	0.475	0.275	0.288
Curriculum incl	uded abortion p	rocedures										
Yes	91.43 (9.08)	95.19 (6.34)	96.22 (5.52)	95.10 (7.67)	98.01 (3.60)	98.58 (3.37)	93.75 (11.25)	97.50 (8.75)	98.75 (6.25)	100.00 (7.50)	100.00 (3.33)	100.00 (0.00)*
No	89.73 (8.17)	93.75 (6.55)	96.64 (4.63)	95.63 (4.86)	98.13 (2.85)	98.96 (2.91)	90.96 (10.31)	95.00 (9.38)	98.13 (5.00)	97.00 (8.50)	99.12 (2.08)	100.00 (0.00)*
<i>p</i> -Values**							0.319	0.297	0.941	0.764	0.575	0.564
												(Continues)

TABLE 4 Bivariate analysis of genetic counseling self-efficacy sub-scores.

-Genetic -WILEY-Counselors

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Median GCSES sub-score (IQR)Median GCSES sub-score (IQR)F1: ComplexF2:F4: BasicF5: GeneticF5: GeneticF5: GeneticF6: InformationskillsCommunicationF1: ComplexF2:F3: GeneticF3: Genetic </th <th>Mean GCSES sub-score (SD)Media GCSES sub-score (QR)Media GCSES sub-score (QR)F1: ComplexF2:F3: GeneticF4: BasicF4: BasicF4: BasicF4: BasicF6: InformationskillsCommunicationestingkillsF1: ComplexF2:F4: BasicF6: Information9: 10(8:70)9: 50(6:18)9: 75(6:18)75: 6(8:15)8: 6(16)9: 75(6:16)9: 75(6:16)9: 10(8:70)9: 00(6:18)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(8:70)9: 00(5:10)9: 75(6:128)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 75(11:28)9: 75(11:28)9: 75(11:28)<td< th=""><th>4</th><th>(Continued)</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>8 of</th></td<></th>	Mean GCSES sub-score (SD)Media GCSES sub-score (QR)Media GCSES sub-score (QR)F1: ComplexF2:F3: GeneticF4: BasicF4: BasicF4: BasicF4: BasicF6: InformationskillsCommunicationestingkillsF1: ComplexF2:F4: BasicF6: Information9: 10(8:70)9: 50(6:18)9: 75(6:18)75: 6(8:15)8: 6(16)9: 75(6:16)9: 75(6:16)9: 10(8:70)9: 00(6:18)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(8:70)9: 00(5:10)9: 75(6:128)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 0.06(1:08)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 75(11:28)9: 10(10(7)9: 75(11:28)9: 75(11:28)9: 75(11:28) <td< th=""><th>4</th><th>(Continued)</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>8 of</th></td<>	4	(Continued)												8 of
F4: Basic F4: Basic F5: Genetic F6: Information F1: Complex F2: F3: Genetic F3: Genetic F3: Genetic F5: Genetic F5: Genetic F5: Genetic F6: Information F6: Information F6: Information F6: Information F3: Genetic F5: Genetic F5: Genetic F5: Genetic F5: Genetic F6: Information F6: Informatic F6: Information F	F1: Complex skillsF3: Genetic paychosocialF3: Genetic paychosocialF4: Basic paychosocialF3: Genetic paychosocialF3: Genetic paychosocialF3		Mean GCSES s	sub-score (SD)					Median GCSES	S sub-score (IQR)					12
skills Communication testing skills process gathering gathering skills process skills process gathering gathering skills process skills process gathering gathering skills process gathering	kills Communication testing kills Communication testing kills process gathering cluded state 95.87(5.71) 95.15(7.47) 95.15(7.47) 97.10(8.70) 97.5(6.25) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 100.00(7.00) 0.654 91.10(8.00) 91.10(8.00) 92.375(13.13) 98.75(13.13) 98.75(9.38) 100.00(7.00) 100.00(1.67) 100.00(1.00) 100.00(1.00) 100.00(1.00) 0.654 95.37(6.64) 98.42(3.12) 98.75(13.13) 98.75(13.14) 98.75(13.14)		F1: Complex	F2:	F3: Genetic	F4: Basic psychosocial	F5: Genetic counseling	F6: Information	F1: Complex	F2:	F3: Genetic	F4: Basic psvchosocial	F5: Genetic counseling	F6: Information	Lw
ocluded state abortion legislation 95.87 (5.71) 97.15 (7.47) 97.93 (3.57) 98.52 (3.52) 92.50 (1.88) 97.5 (6.25) 100.00 (700) 100.00 (3.33) 100.00 (0 91.10 (8.70) 95.00 (6.18) 95.87 (5.71) 95.15 (7.47) 97.93 (3.57) 98.52 (3.52) 92.50 (11.88) 97.5 (6.25) 100.00 (700) 100.00 (3.33) 100.00 (0 91.32 (9.94) 94.74 (7.25) 97.96 (3.23) 95.37 (6.64) 98.42 (3.12) 99.12 (2.18) 93.75 (13.13) 98.75 (9.38) 100.00 (3.75) 100.00 (7.00) 100.00 (1.67) 100.00 (0 91.32 (9.94) 94.74 (7.25) 97.36 (3.31) 98.42 (3.12) 99.12 (2.13) 93.75 (13.13) 98.75 (5.63) 100.00 (5.00) 100.00 (1.67) 100.00 (0 91.79 (8.64) 95.33 (6.31) 96.60 (5.07) 98.06 (5.07) 98.06 (5.07) 98.06 (5.07) 100.00 (6.00) 100.00 (2.92) 98.33 (7.5 84.21 (9.42) 90.78 (5.82) 92.77 (7.43) 89.75 (11.25) 98.13 (8.44) 98.75 (5.63) 96.000 (2.92) 90.000 (2.92) 90.000 (2.92) 90.000 (2.92) 90.000 (2.92) 90.000 (2.92) 90.000 (2.92) 90.000 (2.92) 91.0000 (2.92) 91.33 (3.33) <th>ocluded state abortion legislation 95.87 (5.71) 97.15 (7.47) 97.30 (3.57) 97.50 (1.18) 97.50 (8.75) 97.5 (6.25) 100.00 (7.00) 100.00 (3.33) 100.00 (0.00) 91.10 (8.70) 95.00 (6.18) 95.87 (5.71) 95.37 (5.44) 97.32 (3.57) 98.52 (3.52) 98.75 (13.13) 98.75 (6.25) 100.00 (7.00) 100.00 (1.67) 100.00 (0.00) 91.10 (8.70) 94.74 (7.25) 97.30 (3.23) 95.37 (6.44) 98.42 (3.12) 98.75 (13.13) 98.75 (6.25) 100.00 (7.00) 100.00 (1.67) 100.00 (0.00) 91.70 (8.64) 94.74 (7.25) 95.37 (6.51) 96.42 (3.12) 98.75 (11.25) 98.13 (8.44) 0.910 0.607 0.697 0.694 91.77 (8.64) 95.33 (6.31) 96.65 (0.73) 98.91 (2.95) 98.13 (8.44) 98.75 (5.00) 100.00 (2.92) 100.00 (2.92) 100.00 (2.92) 100.00 (2.92) 91.77 (8.64) 95.33 (5.31) 96.33 (5.23) 98.33 (5.24) 98.13 (8.44) 98.75 (5.63) 95.03 (2.25) 90.00 (2.92) 100.00 (2.92) 100.00 (2.92) 100.00 (0.00) 91.77 (8.64) 95.30 (</th> <th></th> <th>skills</th> <th>Communication</th> <th>testing</th> <th>skills</th> <th>process</th> <th>gathering</th> <th>skills</th> <th>Communication</th> <th>testing</th> <th>skills</th> <th>process</th> <th>gathering</th> <th>/11</th>	ocluded state abortion legislation 95.87 (5.71) 97.15 (7.47) 97.30 (3.57) 97.50 (1.18) 97.50 (8.75) 97.5 (6.25) 100.00 (7.00) 100.00 (3.33) 100.00 (0.00) 91.10 (8.70) 95.00 (6.18) 95.87 (5.71) 95.37 (5.44) 97.32 (3.57) 98.52 (3.52) 98.75 (13.13) 98.75 (6.25) 100.00 (7.00) 100.00 (1.67) 100.00 (0.00) 91.10 (8.70) 94.74 (7.25) 97.30 (3.23) 95.37 (6.44) 98.42 (3.12) 98.75 (13.13) 98.75 (6.25) 100.00 (7.00) 100.00 (1.67) 100.00 (0.00) 91.70 (8.64) 94.74 (7.25) 95.37 (6.51) 96.42 (3.12) 98.75 (11.25) 98.13 (8.44) 0.910 0.607 0.697 0.694 91.77 (8.64) 95.33 (6.31) 96.65 (0.73) 98.91 (2.95) 98.13 (8.44) 98.75 (5.00) 100.00 (2.92) 100.00 (2.92) 100.00 (2.92) 100.00 (2.92) 91.77 (8.64) 95.33 (5.31) 96.33 (5.23) 98.33 (5.24) 98.13 (8.44) 98.75 (5.63) 95.03 (2.25) 90.00 (2.92) 100.00 (2.92) 100.00 (2.92) 100.00 (0.00) 91.77 (8.64) 95.30 (skills	Communication	testing	skills	process	gathering	skills	Communication	testing	skills	process	gathering	/11
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91.32 (9.4) 94.74 (7.25) 97.96 (3.23) 95.37 (6.64) 98.42 (3.12) 99.12 (2.18) 93.75 (13.13) 98.75 (9.38) 100.00 (3.75) 100.00 (9.00) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 100.00 (1.67) 0.694 0.644 0.910 0.607 0.694 0.647 0.691 0.0607 0.694 0.691 0.000 (1.67) 0.607 0.694 0.691 0.000 (1.67) 0.607 0.694 0.691 0.000 (1.67) 0.607 0.694 0.694 0.691 0.000 (1.67) 0.607 0.694 0.694 0.691 0.000 (1.67) 0.607 0.694 0.694 0.691 0.000 (1.67) 0.607 0.694 0.694 0.691 0.000 (1.67) 0.607 0.694 0.694 0.694 0.694 0.694 0.694 0.694 0.694 0.697 0.694 0.694 0.694 0.607 (1.63) 0.6913 0.613 0.613 0.6	91.32 (9.4) 94.74 (7.25) 97.96 (3.23) 95.37 (6.64) 98.42 (3.12) 93.75 (13.13) 98.75 (9.38) 100.00 (3.75) 100.00 (1.67) 100.00 (1.67) 100.00 (0.00)* 0.47 0.570 0.888 0.091 0.910 0.607 0.694 0.694 0.177 (8.64) 95.03 (5.01) 95.06 (5.07) 95.08 (3.50) 98.91 (2.95) 98.91 (2.95) 93.75 (11.25) 98.13 (8.44) 98.75 (5.00) 100.00 (2.92) 100.00 (0.00) 94.21 (9.42) 90.78 (5.82) 92.97 (7.43) 89.75 (11.93) 97.50 (3.33) 95.83 (5.27) 98.13 (8.44) 98.75 (5.03) 100.00 (2.92) 100.00 (2.92) 100.00 (2.92) 100.00 (2.92) 100.00 (0.00)* 84.21 (9.42) 90.78 (5.82) 97.50 (3.33) 95.83 (5.27) 98.13 (8.44) 98.75 (5.63) 96.00 (2.92) 98.33 (7.50) 100.00 (0.00)* *		91.10 (8.70)	95.00 (6.18)	95.87 (5.71)	95.15 (7.47)	97.93 (3.57)	98.52 (3.52)	92.50 (11.88)	97.50 (8.75)	97.5 (6.25)	100.00 (7.00)	100.00 (3.33)	100.00 (0.00)*	Y-
0.670 0.888 0.091 0.910 0.607 0.694 ncluded counseling about the option of termination 0.671 98.91 0.938 0.091 0.910 0.607 0.694 91.79(8.64) 95.33(6.31) 96.60(5.07) 95.70(6.57) 98.91(2.95) 93.75(11.25) 98.13(8.44) 98.75(5.00) 100.00(6.00) 100.00 (2.92) 100.00 (0 84.21(9.42) 90.78(5.82) 92.97(7.43) 89.75(11.93) 97.80(3.50) 93.38(8.13) 93.38(8.13) 93.38(8.13) 93.37(5.63) 95.00(22.5) 98.33(7.5) 98.33(7.5) • • • • • • • • 0.007 0.001 0.0000 98.33(7.5) 98.33(7.5) 98.33(7.5) 98.33(7.5) 98.33(7.5) 98.33(7.5) 98.33(7.5) 98.33(7.5) 91.34 90.047 0.282 0.267 0.033 0.034 0.047 0.267 0.013	0.670 0.888 0.091 0.910 0.607 0.694 0.694 0.041 0.910 0.607 0.694 0.647 0.267 0.633 0.01		91.32 (9.94)	94.74 (7.25)	97.96 (3.23)	95.37 (6.64)	98.42 (3.12)	99.12 (2.18)	93.75 (13.13)	98.75 (9.38)	100.00 (3.75)	100.00 (9.00)	100.00 (1.67)	100.00 (0.00)*	-Ge Co
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	d <i>p</i> -values = statistically significant (<i>p</i> < 0.05).	*							0.033	0.024	0.047	0.282	0.267	0.013	

Abbreviation: GCSES, Genetic Counseling Self Efficacy Scale.

"Interpretation of p-value significance is limited due to insufficient variation in responses of at least one group.

on analysis of median sub-GCSES scores **p-Values are based meaningful association, given the lack of variation in scores for these analyses (Table 4).

Bivariate analysis demonstrated that genetic counseling selfefficacy factor sub-scores were generally not associated with location of genetic counseling training program, location of practice, genetic counseling training program coverage of abortion procedures or state-level abortion legislation, and genetic counselor feeling of preparedness at the time of graduation. Factor 6 alone was found to be significantly associated with genetic counselor location of practice (p < 0.01). This association is likely a statistical artifact rather than a meaningful association, given the lack of variation in scores for this factor (Table 4).

DISCUSSION 4

The purpose of this study was to assess educational exposures to abortion topics and other variables that may be associated with prenatal genetic counselors' self-efficacy to provide counseling that includes a discussion of pregnancy termination. We found that age, years since graduating from a genetic counseling graduate program, years practicing in a prenatal specialty, and genetic counseling graduate program inclusion of counseling the option of termination were associated with self-efficacy factor sub-scores. Specifically, Factor 1: Complex Skills, Factor 2: Communication, and Factor 3: Genetic Testing, were associated with program inclusion of counseling the option of termination. Factors 1-3 contain items including, "Identify appropriate resources, services, and support for a client" (Factor 1: Complex Skills), "Respond to ethical and moral dilemmas that may arise in genetic counseling practice," (Factor 2: Communication), "Facilitate client decision-making that is consistent with the values of the client" (Factor 2: Communication), and "Modify the case management plan as needed in order to incorporate changes in management and surveillance recommendations" (Factor 3: Genetic Testing). Confidence in ability to perform these skills in the prenatal case scenario could reasonably be expected to vary according to a genetic counselor's educational exposures and familiarity with counseling a termination session. In comparison, Factor 4 (Basic Psychosocial Skills) and Factor 5 (Genetic Counseling Process) may not be impacted by educational exposures to termination, given that skills such as, "Respond with empathy to a client's emotions and concerns" (Factor 4: Basic Psychosocial Skills) and "Establish a mutually agreed upon genetic counseling agenda with the client" (Factor 5: Genetic Counseling Process), are competencies expected to be foundational to a genetic counseling session, regardless of indication. However, further studies are required to assess these speculations and determine which items are most relevant to a session involving discussions of pregnancy termination. Factor 6: Information Gathering, contains three items related to collecting a family history, drawing a pedigree, and asking targeted questions about a client's medical history. These competencies are also foundational skills that occur in nearly all

genetic counseling sessions, regardless of indication. In the original GCSES validation study by Caldwell et al., Factor 6 was the highest scoring competency reported across their sample, likely since 'Information Gathering' is one of the first skills that genetic counseling students obtain in their education. In our study, Factor 6 being significantly associated with program inclusion of counseling the option of termination may suggest that this educational exposure could influence differences in participants' approach to information gathering in the scenario presented. Alternatively, it is possible that the ceiling effect imposed from the limited and high range of scores (86–100), with 78 out of 94 participants scoring over 98 out of 100, may have inflated any potential differences between participant groups. Regardless, further studies should aim to clarify these findings.

While our study is the first to our knowledge to report an association between prenatal genetic counselors' self-efficacy scores and exposure to information about counseling the option of pregnancy termination during graduate training, similar associations between education and self-efficacy have been reported for other topics. A 2022 study of gender-affirming care in genetic counseling by Huser et al. found that genetic counselors who received information and education about gender-inclusive genetic counseling, via online education modules, saw significant increases in their GCSES scores in a pre-and post-test comparison. This suggests that self-efficacy in genetic counseling can be increased with educational interventions. The findings from our analysis also indicate that specific educational topics and formats may contribute more to genetic counselor selfefficacy than others. For example, exposure to information about abortion procedures and legislation did not appear to be significantly associated with self-efficacy in our study. Our study also addresses the value of practical exposures, such as rotation experience and role plays, as methods for students to obtain experience with abortion counseling. A majority of participants reported that role plays, mock cases, and standardized patients were valuable exposures, in terms of increasing feelings of preparedness to address the hypothetical prenatal scenario presented. These sentiments were also expressed by the cohort sampled in a recent 2024 survey of abortion curricula in genetic counseling graduate programs by Sanchez et al.

The 2024 Sanchez et al.'s paper also identified no significant differences in reported coverage of abortion topics between genetic counseling programs located in restrictive vs. protective states, which is consistent with our findings. Genetic counselors' feelings of preparedness to counsel the option of abortion were also not found to be significantly different between restrictive and protective states in the Sanchez study. It appears the content of a genetic counselor's graduate education and their exposures to counseling about termination contribute to self-efficacy more than geographic location alone. Additionally, in our study, nearly all participants indicated they had experiences and exposures to abortion topics outside of their genetic counseling graduate training. It is possible that these external exposures may have played a more significant role in developing self-efficacy to address abortion topics in a prenatal genetic counseling session; however, further research is necessary to explore this possibility. The finding that participants in restrictive states were more likely to engage in independent online searches in order to obtain information about abortion topics also warrants further exploration in future research.

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The results from this study also add to the literature describing other variables that may impact genetic counselor self-efficacy, including age and years of experience. Findings from our analysis are consistent with other studies, which have also found that GCSES scores tend to be positively associated with genetic counselor age and years of experience. The 2019 study by Keller et al., which aimed to provide further validation of the GCSES, also found that higher self-efficacy scores amongst genetic counselors were associated with older age, more years of experience, and more experience providing direct patient care. Age and experience are expected to trend together, given that older individuals often have more experience. Therefore, we cannot discern the individual influence that either factor may have on GCSES scores.

4.1 | Study limitations

One of the limitations of this study includes the uneven distribution of responses across groups and small frequency counts in some response categories. The use of nonparametric tests in the analysis may have also obscured potentially significant associations. From the 2023 NSGC Professional Status Survey (PSS), of the genetic counselors that responded to the survey, 464 identified as practicing in a prenatal specialty; however, the true number is likely larger, as the PSS reported an estimated response rate of 45%. In our study, the 94 responses analyzed only reflect a small proportion of the total prenatal genetic counseling population. It is also possible that the genetic counselors who responded to this survey may differ from the larger population of prenatal genetic counselors in the United States. From the 2023 PSS, 93% of genetic counselors who responded to the survey identified as female, 60% had <10 years of experience as a genetic counselor, and 52% reported working in a restrictive state. In comparison, the genetic counselors in our study population were also a majority female (93%), had <10 years of experience (63%) and indicated they were practicing in a restrictive state (66%). For our study, a greater number of respondents from restrictive states could suggest that this topic is of greater relevance to prenatal genetic counselors from these states. To preserve participant anonymity, we did not collect participants' individual states of current practice or the names and states of particular genetic counseling graduate programs. Therefore, we are unable to verify if there is a similar distribution of responses from every state or genetic counseling graduate program.

Additionally, our survey was potentially subject to recall bias, given that some participants may not accurately remember aspects of their genetic counseling training program curricula, particularly if it has been several years since they graduated. Since the Dobbs decision occurred in June of 2022, it is also possible that updates to genetic counseling program abortion curricula, if they were made, may not have been implemented until 2023 or 2024. Representation from prenatal genetic counselors who received their graduate training during these years is limited in our study, and future studies should aim to include a greater proportion of this population in their sample.

This study also did not address all potential variables that may impact prenatal genetic counselor self-efficacy and future studies should aim to further refine which exposures to abortion topics are most impactful. For example, an additional confounding variable that was not addressed in this study is the possibility that genetic counselors in protective states may also face barriers to counsel about the option of pregnancy termination if they are employed by a faith-based institution that may not provide abortion care. Future studies should aim to distinguish the specific challenges that genetic counselors may face when counseling the option of termination, outside of state-wide legislative policies.

Lastly, our assessment of self-efficacy was limited to the context of the hypothetical prenatal scenario we posed. The scenario did not explicitly ask participants to imagine they were completing this session as a genetic counselor at their current location of practice. Therefore, it is possible that participants' may not have considered their state's abortion restrictions while providing their responses to the hypothetical scenario. Additionally, since this study did not present participants with a control scenario (a prenatal case in which a discussion of termination would not be expected), we cannot definitively conclude that GCSES sub-scores are specific to participants' self-efficacy to address a prenatal scenario involving pregnancy termination.

4.2 | Practice implications

The Accreditation Council for Genetic Counseling (ACGC) maintains the standards by which genetic counseling graduate programs become accredited and establishes the minimum required content areas. The 2023 ACGC Standards for Accreditation for Graduate Programs in Genetic Counseling state that content areas must include information about Social, Ethical, and Legal Issues in Genetics, including education about the National Society of Genetic Counselors (NSGC) Code of Ethics, as well as health disparities and other social determinants of health (Accreditation Council for Genetic Counseling, 2023). While there is not an explicit requirement to educate students about reproductive healthcare legislation, the NSGC Code of Ethics maintains that genetic counselors "Enable their clients to make informed decisions, free of coercion, by providing or illuminating the necessary facts, and clarifying the alternatives and anticipated consequences" (National Society of Genetic Counselors, 2017). Providing a patient with information about the option to terminate a pregnancy and offering resources to assist with this decision can reasonably be considered within this scope of genetic counseling practice under the NSGC Code of Ethics. In support of this sentiment, the 2022 Access to Reproductive Healthcare position statement by the NSGC affirms their commitment to sustained

access to abortion care and resources (National Society of Genetic Counselors, 2022).

While most participants in this study indicated they received education about counseling the option of termination during their genetic counseling training, it is notable that approximately 9% of participants reported not receiving this information, and 44% did not feel adequately prepared to address abortion topics in a prenatal session upon graduation from their program. As a standard, we would hope that 100% of graduates are provided with opportunities to practice counseling the option of pregnancy termination and feel adequately prepared to address the basic competencies in these sessions. Given these findings, there appears to be room for improvement in the ways that genetic counseling training programs prepare students to address these topics.

In our study, self-efficacy sub-scores were relatively high across the entire sample, regardless of participants' demographics. This may be viewed as an optimistic finding because it suggests that despite the reported challenges posed by restrictive abortion laws and discrepancies in educational content amongst genetic counseling programs, it appears that the prenatal genetic counselors in our sample still felt equipped to perform the core genetic counseling competencies in the prenatal case scenario we presented. However, if a genetic counseling program were to expand or supplement their prenatal curricula, our findings suggest that providing students with opportunities to practice counseling the option of pregnancy termination may be most impactful to self-efficacy of the variables we considered.

Rotation experience was indicated by participants to be the most helpful teaching modality to gain exposure to abortion topics and counseling. For genetic counseling programs that are unable to provide students with the opportunity to practice counseling the option of pregnancy termination through clinical rotations, standardized patient cases or role play scenarios may be additional ways to gain this practical exposure during graduate training. Additional educational experiences that were not addressed by this study are "away-rotations," in which students may complete virtual or in-person rotations at sites in different states. While the utility of these rotations is not known and requires further research, a 2024 study by Shane-Carson et al. (2024) found that overall, genetic counseling students' attainment of clinical competencies through remote rotations was comparable to in-person rotations. This suggests that virtual rotation experiences may help provide students with additional avenues to obtain skills in counseling abortion topics. Outside of genetic counseling, medical schools in restrictive states face challenges in providing students with clinical abortion training (Meurer et al., 2024). The study by Meurer et al. identified that Visiting Student Electives (VSEs), could be a method to increase access to abortion training opportunities; however, amongst the study participants, utilization of abortion-related VSEs was low. Additionally, the availability of these training opportunities could be complicated by a program's ability to accommodate additional students from other states (Pasha et al., 2023). Ultimately, further exploration of these

alternative training methods could help pave the way for expanded access to clinical abortion training.

4.3 | Future research

Further studies should aim to specifically examine genetic counselor exposure to abortion topics outside of graduate education and clarify which external exposures may have the greatest impact on selfefficacy to address pregnancy termination in a prenatal session. Our analysis suggests that individuals from restrictive states were more likely to conduct an independent search online to learn more about abortion topics compared to individuals from protective states. It is unclear whether this finding is due to a lack of opportunity to engage in other forms of education in these states or if other variables may be contributing. It is possible that individuals may turn towards independent internet searches if they are hesitant to bring up the topic of pregnancy termination to colleagues in the workplace or if there is a lack of institutional guidance regarding abortion policies. For example, in the qualitative Koenig et al.'s study, one genetic counselor stated that they had to proactively seek information about their state's abortion laws and the implications, given a lack of information from their institution.

Additionally, further studies should aim to assess how genetic counseling programs in restrictive states are incorporating opportunities to provide students with practice counseling the option of termination. According to our analysis, there were no significant differences in reported exposures to this topic amongst participants from restrictive and protective states; however, a larger sample size may elucidate additional findings. Abortion curricula and teaching modalities for these topics in genetic counseling graduate programs have likely changed over time, particularly post Dobbs decision. Laws and state classifications by the Guttmacher Institute have also changed since the time of this study's analysis, so further and continuous research is required to reevaluate this study's findings. Lastly, since this study measured self-efficacy, it is possible that the true efficacy of the genetic counselors in this sample may differ from the self-reported evaluation of their skills and performance. Therefore, future studies should aim to measure prenatal genetic counselors' efficacy to counsel about termination, utilizing other modalities of evaluation.

5 | CONCLUSION

The prenatal genetic counselors sampled in this study demonstrated high self-efficacy to address the prenatal case scenario involving termination, regardless of location of genetic counseling graduate program or current practice. Most participants in this study also indicated their genetic counseling graduate programs covered information about abortion procedures, legislation, and counseling the option of termination. However, graduate programs that do not already provide "hands on" learning opportunities (e.g., mock cases, etc.) for students to practice counseling the option of pregnancy termination, should consider incorporating these experiences into their curricula. Inclusion of these educational opportunities may help promote students' self-efficacy to address these topics in future prenatal counseling sessions. Given the continuously evolving nature of abortion legislation in the United States, further research is necessary to examine the variables that can influence genetic counseling practice in the context of state-level and federal reproductive policies.

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AUTHOR CONTRIBUTIONS

Brianna J. Gentile conceptualized the study. All authors contributed to the study design and participant recruitment. Brianna J. Gentile developed the Qualtrics survey and conducted the data analysis with input from Christina G. S. Palmer, Rebecca LeShay Araujo, Jessica Kianmahd Shamshoni, and Carole H. Browner. Brianna J. Gentile wrote the first draft of the manuscript. All authors critically revised the manuscript for intellectual content. Brianna J. Gentile confirms that she had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. All authors gave final approval of this version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

ACKNOWLEDGMENTS

This study was completed in fulfillment of the requirements for the first author's Master of Science in Genetic Counseling degree from UCLA.

CONFLICT OF INTEREST STATEMENT

Authors Brianna J. Gentile, Rebecca LeShay Araujo, Jessica Kianmahd Shamshoni, Carole H. Browner, and Christina G. S. Palmer declare that there are no conflicts of interest to report.

DATA AVAILABILITY STATEMENT

Research data are not shared.

ETHICS STATEMENT

Human studies and informed consent: Informed consent was obtained from all participants included in the study through the research information sheet, integrated into the Qualtrics survey. The UCLA Office of Human Subjects Research Protection Program approved all aspects of this study (Protocol IRB#23-001677). All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Gentile, B. J., Araujo, R. L., Shamshoni, J. K., Browner, C. H., & Palmer, C. G. S. (2025). Evaluation of prenatal genetic counselors' abortion education and training as variables associated with self-efficacy. *Journal of Genetic Counseling*, *34*, e2019. https://doi.org/10.1002/jgc4.2019