

***Amplify Sprouted: A Community-Based Educational Tool for Gender-Affirming Care  
Evolved for the Prenatal/Preconception Genetic Counseling Specialty***

Master's of Genetic Counseling Graduate Thesis  
April 27th, 2022

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## **ABSTRACT**

Individuals who are transgender and/or gender diverse (TGD) face disparities in healthcare, including a lack of provider knowledge in transgender healthcare. In the genetic counseling profession, there is a lack of education on gender-affirming care in prenatal/preconception genetics, yet a desire by genetic counselors to be more inclusive of patients in this community. To address this need, we designed, implemented, and evaluated, in collaboration with TGD community members, a prenatal/preconception educational program, *Amplify Sprouted*, and clinical skill implementation workshop. This tool was based on the validated educational program, *Amplify*, and was expanded to include gender-affirming care information for the prenatal/preconception genetics. A total of 45 genetic counselors and students completed the 5-module educational tool, *Amplify Sprouted*, and a pre- and post-education assessment that asked about participant knowledge on gender-affirming care (25 multiple choice questions (MCQs)) and validated self-efficacy questions in providing care to TGD patients (N=35 MCQs). Results showed a statistically significant increase in knowledge for content in 3 of the 5 *Amplify Sprouted* modules and in overall knowledge with an average percent correct increase of 16% ( $p < 0.001$ ). There was also a statistically significant increase in all self-efficacy competencies with an overall average of 11.6% increase ( $p < 0.001$ ) in score. Genetic counseling specialty nor status (student vs genetic counselor) were significant predictors of knowledge or self-efficacy. A subset of genetic counselors (N=9) were then selected to participate in a workshop and focus group with TGD community members (N=8), allowing for collaborative clinical skill practice and discussion. Deductive analysis on data from verbal transcripts and a pre- and post-workshop assessment that asked about the utility of the workshop revealed seven themes surrounding patient-focused communication, TGD community involvement, expanding inclusive genetic counseling, and being an advocate for patients in all aspects. *Amplify Sprouted* was successful in increasing participant knowledge and self-efficacy, revealing the utility of the tool in genetic counseling. In addition, the workshop and focus groups successfully provided an opportunity to translate education and enhance clinical skills. Overall, our research found that gender-affirming care is not static; it is dynamic, ever-growing, and must be tailored to patients through open communication. As such, actions must be taken with communities to make gender-affirming changes, not acted upon communities because voices in the TGD community need to be Amplified.

## **INTRODUCTION:**

Transgender and/or gender diverse (TGD) individuals face significant disparities, specifically relating to health and healthcare. A recent study by Grant et al. surveyed 6,000 transgender individuals and found that 50% of respondents had to teach their medical provider about transgender healthcare and 33% of individuals delayed or did not try to get preventative healthcare due to fear of discrimination (Grant et al., 2011). In addition, TGD individuals face significant health barriers surrounding insurance coverage, mistreatment by medical providers, and provider discomfort in treating TGD patients and lack of knowledge in their treatment. Of the respondents from one survey, 31% reported that their health care providers did not know they were transgender (James et al., 2016).

Many TGD individuals have a desire to have children or may already have children. However, there are a number of barriers present for TGD individuals surrounding fertility and the possibility of preservation, conception of a child, pregnancy, and the post-partum period. At the same time, many groups of health care providers don't feel prepared to provide care to the TGD community. However, it should be noted that there is also a lack of resources and education on gender-inclusive and affirming care (Hoffkling et al. 2017; Ruderman et al. 2021). In the past few years, there has been a growing body of knowledge and publications surrounding perspectives on care from TGD patients in addition to genetic counselors identifying gaps in knowledge and care considerations for patients in this community (von Vaupel-Klein and Walsh, 2020; Ruderman et al., 2021; Rolle et al., 2021; Barnes et al., 2020). Recent work has been done to provide genetic counselors with education surrounding key knowledge and care considerations for TGD patients through webinars and presentations (Zayhowski et al. 2021; Dowshen et al., 2021).

In order to educate genetic counseling providers on various aspects of gender-affirming care with a specific focus on cancer genetic counseling, Huser et al. created a five-learning module educational tool called *Amplify*. The five modules in *Amplify* covered gender-affirming terminology and care information, tailoring a session to a TGD patient, and gender-affirmation considerations in cancer risk assessment. To evaluate the effectiveness of her educational tool, Huser et al. recruited genetic counseling students and genetic counselors to take the educational tool, *Amplify*. Participants in the study took pre- and post-education assessments that asked knowledge and self-efficacy-based questions in order to evaluate the tool's effectiveness. These assessments questioned knowledge on gender-affirming care and self-efficacy in providing clinical care components to TGD patients. Huser et al.'s research found the average pre-*Amplify* education knowledge score of genetic counselors to be 77.6% (SD = 11.2%) and the average post-*Amplify* education knowledge score to be 94.5% (SD = 4.5%), revealing a statistically significant improvement of 16.9% (SD = 11.6%;  $p < 0.001$ ). Statistically significant improvements were also observed in all self-efficacy measures (Huser et al., 2022). With these results, *Amplify* was shown to be a successful tool in preparing genetic counselors to provide gender-affirming care.

While there has been a number of publications on gender-affirming care in the cancer genetics specialty, there has been little research done in other specialties, like prenatal and preconception genetic counseling. However, one article recently published by Ruderman et al. did specifically explore this specialty. In this research, they found that prenatal and preconception genetic counselors were driven to using more gender-inclusive content both in their language as well as their written materials in the clinic space, like pedigrees and visual aids. They also found that genetic counselors faced challenges in providing inclusive care with the care team which spans other healthcare providers and laboratories. Many genetic counselors in this study noted feeling underprepared in providing inclusive and gender-affirming care to TGD patients. Additionally, participants also noted feeling fearful and frustrated for their transgender patients and/or partners in reproductive clinics (Ruderman et al., 2021). With these concerns, their work revealed the need for gender-affirming education on a variety of topics in the prenatal/preconception specialty. With the need for more training and information provided to genetic counselors, an educational resource was deemed necessary to create in the form of online learning modules, lecture content, and video testimonials with the goal of improving gender-affirming care. In addition to this online educational tool, an interactive workshop was also held with a subset of research participants and TGD community members. This was created in order to further participant education by facilitating an opportunity for gender-affirming clinical skill implementation. Research has shown that these forms of education were most desired by genetic counselors for gender-affirming care education (Sheehan et al., 2021). Overall, the goal for this research was to improve gender-affirming health care in genetic counseling through education and knowledge application

Therefore, with the success of the work done by Huser et al. and the need for additional education in the prenatal and preconception genetic counseling space, an educational tool called *Amplify Sprouted* was created by evolving *Amplify* in order to add to this knowledge base (Huser et al., 2022; Ruderman et al., 2021). With education in this space, we also anticipate the addition of updated, gender-affirming pedigree guidelines from the genetic counseling community for TGD individuals. To the best of our knowledge, a comprehensive educational tool and workshop series has not been created for genetic counseling providers in the prenatal/preconception genetics specialty. With this educational tool, *Amplify Sprouted*, adds knowledge on gender-inclusive care in genetic counseling and specifically in the prenatal/preconception space. With an additional opportunity to practice clinical skills, we anticipate a positive impact on participating genetic counselors and genetic counseling students with the goal of improving patient care for all individuals.

## **METHODS:**

### **Research Participants:**

Board certified genetic counselors and genetic counseling students were recruited through a variety of outlets for participation in this research. Members of the American Board of Genetic Counselors (ABGC), the Michigan Association of Genetic Counselors (MAGC), and the

National Society of Genetic Counselors (NSGC) were notified of eligibility for this research project through the organization's listserv or student research email notification. The research was also promoted through the podcast *DNA Today: A Genetics Podcast* released on January 14, 2022.

### **Community Advisory Board (CAB):**

In order to aid in the development of this work and the educational tool, *Amplify Sprouted*, a community advisory board (CAB) made up of diverse transgender and/or gender diverse (TGD) individuals was created. TGD individuals were recruited from a number of communication platforms including Twitter, Facebook, and Instagram through a tailored post that was promoted by LGBT Detroit, the University of Michigan Spectrum Center, and genetic counselors. Additionally, community members were recruited who had previously participated on the CAB for the project, *Amplify*, by Huser et al. A total of 10 TGD individuals participated in this project in various capacities and were diverse in their gender, age, disability status, racial and ethnic background, geographical location, sexual orientation, experience with fertility and family planning, and interactions with genetic counseling. Meetings were held with the CAB to discuss project development, the creation of *Amplify Sprouted* content, the preparation for the Community Engagement Workshop (CEW), and execution of the CEW with genetic counselor participants (see Appendix 1).

### **Development of Amplify Sprouted:**

*Amplify Sprouted* was created based on the educational tool designed by Huser et al. called *Amplify* in addition to extensive literature information and expert insight from individuals in reproductive endocrinology, genetic counseling, and the TGD community. Huser's *Amplify* was developed to focus on gender-affirming care in the cancer genetics setting with modules that built upon each other, starting with terminology and moving to applying skills in a cancer genetics patient example. *Amplify Sprouted* was structured similarly so content built on top of each other, providing new information, skills, and considerations with each module. However, *Amplify Sprouted* is focused on the prenatal/preconception specialties of genetic counseling. *Amplify Sprouted*, in total, comprises five modules. Module 1, titled "Terminology, Population Disparities, and Communication" includes a comprehensive glossary of gender-affirming and inclusive terminology, considerations of pronouns, and communication methods as well as population disparities among TGD individuals. Module 2 is titled "Clinical Environment" and discusses ways to make the clinic space, documentation, medical record, and paperwork gender-inclusive and affirming. Module 3, titled "Past, Present, and Future Aspects of Gender Affirmation," encapsulates potential aspects of an individual's gender-affirmation process which may include psychological, social, hormonal, legal, and/or surgical affirmation. Module 4 is titled "Fertility and Family Planning" and discusses aspects of reproduction as it intertwines with gamete preservation, hormonal impacts of fertility and pregnancy, conception, and managing a pregnancy overall. Finally, Module 5, titled "Pulling it All Together- The Prenatal/Preconception

Genetic Counseling Session,” brings together various components of a genetic counseling session with the application of gender-affirming knowledge, tools, and care.

Each of these modules contains progressive exposure to information, interactive methods of learning new knowledge, embedded resources, links to Slack channels to promote discussion, practice quiz questions, and 29 videos of testimonial information from TGD community members that range from approximately 15 seconds to 2 minutes. These video testimonials were recorded and edited for *Amplify Sprouted* and provided by four diverse TGD community members. These individuals shared their personal experiences in the healthcare system and perspectives on gender-affirming care.

*Amplify Sprouted* was created using Articulate 360 – Rise which held all of the educational content. Once completed, *Amplify Sprouted* was exported as a SCORM 2004 file and subsequently uploaded into a Learning Management System on a Canvas page titled “Amplify Sprouted: Genetic Counseling Gender Affirming Care” through the University of Michigan (Huser et al., 2022). Through this Canvas page, participants were able to access the course and track their progress. The study team was also able to track which participants had accessed the course and the length of time they spent on the course page overall.

### **Development of Slack Community:**

A Slack page was created to promote engagement and interaction among *Amplify Sprouted* participants. Slack is a chat platform that allows a group of individuals to communicate online and share information and resources through different channels. Channels are different chat groups where there is a targeted discussion. The #clinical-environment channel focused on having participants consider changes they could implement in their clinic and discuss these considerations with others. #Educational-tool focused on different reactions individuals may have to *Amplify Sprouted* and new information they were learning. In the #general-discussion channel, there was a focus on key topics being discussed in the genetic counseling community and general considerations that should be addressed with gender-affirming care in the clinic. #Overcoming-stereotypes-biases prompted participants to think about stereotypes and biases they may hold, then engage with ways to work at overcoming them. The channel #preconception-case-example prompted participants to consider aspects of a case example presented in *Amplify Sprouted* and what they might be thinking about when counseling or preparing to counsel a TGD patient. These channels contained questions to consider and/or respond to, polls, and resources for further education and knowledge that were posted on a weekly basis.

### **Assessment Instrument Development:**

Five assessments were developed through the platform Qualtrics to obtain information relating to genetic counseling participants’ demographics, gender-affirming knowledge, comfort and self-efficacy. The first assessment was designed to obtain demographic data including genetic counselor status (certified, board-eligible, student), previous experience with Huser’s

*Amplify*, years of practice, specialty specifics, professional and personal interaction with the TGD community, graduate school training, and comfort working with TGD patients in general and in the prenatal/preconception setting. The assessment also asked questions relating to age, gender, sexual orientation, race, region of practice, and genetic counseling graduate school. This assessment was taken prior to participants participating in *Amplify Sprouted* and derived from the demographic assessment developed by Huser et al. with appropriate updates. Consent for this research by the participant was also obtained in this first assessment.

The second assessment taken by participants prior to *Amplify Sprouted*, called the Pre-*Amplify Sprouted* assessment, asked questions about participant knowledge, comfort, and self-efficacy. There were a total of 25 multiple choice questions (MCQs) based on content from each of the five modules within *Amplify Sprouted*, therefore, there were five questions asked per module. These questions were based on the same set of questions asked by Huser et al. with added updates and content alterations designated for the prenatal/preconception space. Within this assessment, there were also 35 questions asking about genetic counseling self-efficacy (GCSE) which asked participants, on a scale from 0-100, how they would rate their overall self-efficacy in providing genetic counseling to TGD patients. These questions were derived from the validated genetic counseling self-efficacy scale adapted by Caldwell et al. (2018) and Keller et al. (2020) in which the basis of these questions is from the clinical competencies designed by the American Council for Genetic Counseling (ACGC). Finally, the assessment asks about self-efficacy on a scale from 0-100 in providing genetic counseling to a patient who is TGD and their overall comfort in providing genetic counseling to TGD patients. The third assessment was developed to be taken by participants after moving through the educational tool *Amplify Sprouted*. This assessment is deemed the Post-*Amplify Sprouted* Assessment, therefore, the same questions were asked in the third assessment so that a comparison could be done with the Pre-*Amplify Sprouted* Assessment. This was done in order to compare changes in knowledge, comfort, and self-efficacy surrounding the educational tool, *Amplify Sprouted*.

The third and fourth assessments were taken by a subset of the participants (n=9). These individuals were involved in the CEW and focus group held with TGD community members. The third assessment, called the Pre-Workshop Assessment, was taken by participants prior to the CEW and asked about the participants' comfort level working with TGD patients, self-efficacy in providing genetic counseling to TGD patients, and what information they were hoping to learn from the TGD community members at the CEW. The fourth assessment, the Post-Workshop Assessment, once again, asked about comfort and self-efficacy in working with TGD patients in the genetic counseling setting in addition to questions about the CEW overall, its set up, and utility, the level of helpfulness of the modules as well as the three different communication components of the study, Slack, *Amplify Sprouted*, and the CEW.

### **Participant Procedures:**

Participants were recruited for and participated in the research study from December 2021-February 2022. If interested in participating in the study, participants completed the



demographic assessment followed by the Pre-*Amplify Sprouted* Assessment. Participants were given a randomized ID number after completing the initial survey. This ID number allowed for their subsequent assessment data to be connected. Participants were made aware that this randomized ID number could not be connected to their name or email. Participants were then granted access to *Amplify Sprouted* via an email that linked to the Canvas course page and Slack chat platform for discussion. The participants were given until February 21<sup>st</sup>, 2022 to complete all five modules of *Amplify Sprouted* as well as the Post-*Amplify Sprouted* assessment.

### **Community Engagement Workshop (CEW) and Focus Groups:**

A subset of genetic counselors (n=9) that participated in the *Amplify Sprouted* education were invited to and agreed to participate in a CEW and focus group with TGD community members (n=8) involved in this research. This event was held online over Zoom over a three-hour time period. This workshop and focus groups provided genetic counselors the opportunity to practice gender-affirming skills with feedback from TGD community members and have discussions surrounding their practice. For TGD community members, this provided the chance to give feedback to healthcare providers on their counseling and healthcare overall.

Two weeks prior to the CEW, a training was completed for the participating TGD community members. This training event was held to prepare the community members for the structure of the CEW and their role during the case scenario role plays. This also provided an opportunity for them to ask questions and clarify all materials prior to the event.

During the CEW, genetic counselors and community members were paired up to form groups of 2-4 individuals, with at least one community member and one genetic counselor, and complete a prenatal-focused role play. Each group was assigned an individual breakout room. The role plays were based on the following scenario: 'The 37-year-old patient is referred by their OBGYN for an increased risk for Down Syndrome/Trisomy 21 based on non-invasive prenatal screening and because they are of advanced parental age (commonly referred to as advanced maternal age). The patient wants to learn more about their risk and determine if their child has Down Syndrome or not so they know how to prepare for their birth.' For these role plays, in order to promote a gender-affirming scenario, the community member was able to play the pregnant individual themselves or act as the partner of the pregnant individual and appropriately provide the genetic counselor with medical information as they saw fit.

There were two role plays to be completed. The first role play was medical history (30 minutes) and was completed by one genetic counselor and one community member. The genetic counselor was instructed to practice taking a gender-affirming medical history. Once complete, the genetic counselor was instructed to present the information to the other genetic counselor, if present, and practice continued gender-affirming skills. The group was then instructed to discuss the role play including what went well, what was challenging, and what are areas of needed improvement. The second role play was completed with another genetic counselor and community member. It is important to note that if a group of two was present, both individuals completed the second role play. If there was a group of three, the same community member

played in the second role play. The second role play was family history (45 minutes). The same format was completed including carrying out the role play, presenting the case, and discussing the role play.

After the role plays were completed, all genetic counselors and TGD community members were brought back to the main Zoom room from their breakout rooms to complete the focus groups. The focus group with the genetic counselors and community members as well as the genetic counselor only focus groups were recorded and the transcripts were used for qualitative analysis. Qualitative analysis was only completed on the transcripts from the genetic counselors. The first focus group was held with the genetic counselors and TGD community members (40 minutes). To begin this discussion, a poll was posted with the following question: “What came up for you all during the role plays? What discussions did they lead you to have?” Following this poll, four topics were prompted for discussion including next steps for gender-affirming care and applying knowledge in practice, what community members want genetic counselors to take away from the CEW, ways of learning and inquiring about patient pronouns, and genetic testing documentation which may or may not ask for and/or use sex versus gender.

The second focus group divided the genetic counselors from the community members (20 minutes). Only the genetic counseling focus group was recorded for qualitative data analysis using participant transcripts. The topics discussed in the focus group included what was helpful in the CEW, how the genetic counselors see themselves moving forward in this work, the term advanced maternal age and its use in the prenatal/preconception setting, and the value of the community members in the CEW. After this event, the genetic counselors participating completed the Post-Workshop Assessment.

### **Quantitative Data Analysis**

Quantitative analysis was completed using SPSS software with assistance from the University of Michigan Consulting for Statistics, Computing and Analytics Research (CSCAR). Descriptive analysis was completed in order to summarize the demographic data of the research participants as well as review participant interaction with the online LMS Canvas page for *Amplify Sprouted*. Overall comfort and self-efficacy of participants in providing care to TGD patients was analyzed through descriptive analysis.

A series of thirteen paired samples T-tests were completed to analyze the mean difference in knowledge and self-efficacy from the Pre-*Amplify Sprouted* assessment and Post-*Amplify Sprouted* assessment. To understand the change in overall knowledge questions from the five *Amplify Sprouted* modules (25 questions total, five questions per module), the number and percentage of correct answers for each section of the survey were calculated as well as an overall number and percentage of correct answers. A mean and standard deviation were calculated for the five modules and overall. In analyzing self-efficacy in six clinical competency categories (35 questions total), a mean value was determined for each of the self-efficacy competencies as well as overall. A mean and standard deviation were calculated for the six competency categories and

overall. A Bonferroni Correction of  $p < 0.0038$  ( $p\text{-value} = 0.05/13$ ) was used for significance to control for Type 1 Error. This p-value correction was only used for T-tests that involved analyzing all of the data meaning all 45 participants were included in the analysis. This p-value correction was not used when considering subgroups or outcomes with incomplete data. This is because the subgroup analyses did not have enough statistical power to determine significance. Participants were also asked specifically about their overall self-efficacy in providing genetic counseling to TGD patients, and a paired samples T-test was used to analyze time point comparisons. Analysis for overall self-efficacy was only completed on the 9 participants that participated both in *Amplify Sprouted* and the workshop and focus group, therefore, the p-value correction was not used for this T-test analysis

Linear regression analysis was used to determine the impact of genetic counseling specialty and status (practicing genetic counselor or student) on predicting knowledge and self-efficacy surrounding *Amplify Sprouted*.

### **Qualitative Data Analysis**

Qualitative data was collected from the nine ( $n=9$ ) workshop participants, all of whom are certified genetic counselors. This data was collected from the pre- and post-workshop assessments which included individual written responses as well as transcripts from the whole group discussion and genetic counselor focus group discussions from the CEW. Three members of the research team reviewed the data and, using deductive analysis, pulled out key ideas from the content along with representative quotes. These key themes and quotes from each of the four sets of data were compiled by the principal investigator into a separate document to be compared. The themes were then grouped by similarity and consolidated into seven overarching themes.

### **Institutional Review Board:**

This research study, “Amplify Sprouted: A Community-Based Educational Tool for Gender-Affirming Care Evolved for the Prenatal/Preconception Genetic Counseling Specialty,” was approved for exemption by the University of Michigan Institutional Review Board HUM00209061.

## **RESULTS:**

### **Demographic Information:**

A total of 73 individuals completed the initial survey and Pre-*Amplify Sprouted* assessment in order to be signed up for the *Amplify Sprouted* Canvas course site and Slack discussion page. 45 individuals completed the educational tool, *Amplify Sprouted*, and the Post-*Amplify Sprouted* assessment. 26/45 participants were certified genetic counselors and 19/45 were genetic counseling students. No board-eligible genetic counselors completed the Post-*Amplify Sprouted* assessment. 5/45 individuals previously completed *Amplify* (Huser et al. 2022) and were included in the analysis of all 45 participants. 9/45 individuals were asked to and

willing to participate in the subsequent workshop and focus groups. These 9 individuals were all certified genetic counselors that had not previously completed *Amplify*.

A majority of the participants were certified genetic counselors (n=26/45, 57.8%) with cisgender women (n=40/45, 88.9%) also depicting a majority of participants. Most participants were heterosexual (n=27/45, 60%), white (n=36/45, 80%), and ages 25-34 (n=26/45, 57.8%). The mean number of years in practice for those who are genetic counselors was 6.40 years (SD=6.33, min=1 year, max=27 years). The largest number of participants were practicing in geographical Region 4 (includes: AR, IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, OK, SD, WI, Ontario). Half of the participating genetic counselors (n=13/26, 50%) were involved in the prenatal and/or preconception genetic counseling specialty. In addition, half of the genetic counselors saw more than 30 patients per month, on average (n=13/26, 50%). Additional information can be found in Table 1.

### **Prior Experience with Individuals who are TGD:**

Information regarding participants' personal and professional association with the TGD community was also obtained. 15 of the 45 participants noted that they have had a patient disclose to them that they are a member of the TGD community (33.3%), however, only 1 participant (n=1/45, 2.2%) works specifically in a clinic that serves TGD individuals. In asking about education related to TGD care considerations, 17 of 45 participants (37.8%) had received some education during graduate school with 8 of those 17 individuals (47.06%) having education during graduate school where TGD individuals were involved in developing and/or administering the education. Overall, 44.4% (n=20/45) participants identified as an active ally in the TGD community. Demographic statistics can be found in Table 1. Table 2 outlines the years of clinical experience of the participating genetic counselors. The mean number of years of clinical practice among this cohort was 6.4 years (standard deviation = 6.3, minimum = 1 year, maximum = 27 years).

### **Amplify Sprouted User Interaction:**

Participant interactions on the *Amplify Sprouted* LMS Canvas course site were recorded. Participants spent an average of approximately 277 minutes in the *Amplify Sprouted* course (minimum = 23 minutes, maximum = 1967 minutes, standard deviation = 329 minutes). Participant views of the *Amplify Sprouted* course page were also recorded which was determined to be an average of 8 page views per participant (minimum = 2, maximum = 19, standard deviation = 5). Interaction data can be found in Table 3.

### **Knowledge of Gender-Affirming Care:**

Through a series of 25 questions on knowledge of gender-affirming care derived from each of the 5 modules in *Amplify Sprouted*, paired T-test analysis was completed on the change in percent of questions correct before and after taking *Amplify Sprouted*. Based on the mean difference between percent correct in knowledge questions, there was a statistically significant

( $p < 0.0038$ , based on a Bonferroni Correction) difference in percent correct of knowledge questions in modules 2, 3, 4, and overall knowledge, each with two-sided  $p$  values of  $< 0.001$  (SD = 14.5%, 20.2%, 27.6%, respectively). Modules 1 and 5 were not statistically significant in their mean difference between pre- and post-*Amplify Sprouted* knowledge questions correct with a  $p = 0.005$  (SD = 13.2%) and  $p = 0.037$  (SD = 19.5%), respectively. This data is displayed in Table 4a. Subsequently, the mean percent of questions correct for each module and overall before and after taking *Amplify Sprouted* is displayed in Table 4b. The most notable change in knowledge was in module 4 where the mean percent correct was 55.1% and increased to 95.1% correct.

Further analysis was completed specifically on participants who are genetic counselors as well as students to see if similar trends were present. As found in Table 4c and 4d, the two groups follow similar trends in their mean knowledge difference before and after taking *Amplify Sprouted*. Due to the small sample size and need to control for Type 1 Error through a Bonferroni Correction, we cannot determine significance; however, we would hypothesize a similar trend in significance given more power.

### **Self-Efficacy in Clinical Care Competencies:**

Similar to analysis of the mean percent difference in knowledge, analysis was also completed on the 35 self-efficacy questions derived from 7 clinical competencies that participants answered before and after *Amplify Sprouted*. Based on paired T-test analysis of the average self-efficacy scores before and after the educational tool, all 7 competencies had a statistically significant increase (based on the Bonferroni Correction of  $P < 0.0038$ ) in the mean self-efficacy of participants with each at  $p < 0.001$  (SD = 14.7, 15.9, 16.1, 9.8, 15.2, 12.7, 12.8, respectively). In addition to the self-efficacy in the 7 competencies, the mean for every individual participant from each clinical competency was averaged for a pre- and post-*Amplify Sprouted* score and used to find an overall self-efficacy score. The mean difference in self-efficacy was also statistically significant with  $P < 0.001$  (SD = 11.7). This data can be seen in Table 5a.

Similar trends were seen for paired T-test analysis on students and genetic counselors individually; however, statistical significance cannot be determined at this time due to a lack of power. This data can be found in Table 5c and 5d.

### **Impact of Specialty and Standing on Knowledge and Self-Efficacy:**

Linear regression analysis was completed to understand if genetic counseling specialty or genetic counseling status (certified genetic counselors vs. genetic counseling student) was significantly predictive of knowledge or self-efficacy. Analysis found that genetic counseling specialty was not predictive of knowledge or self-efficacy based on this groups of study participants ( $p = 0.194$  and  $p = 0.722$ , respectively). Additionally linear regression analysis found that being a student versus a genetic counselor was also not predictive of knowledge or self-efficacy ( $p = 0.772$  and  $p = 0.251$ , respectively). This data can be found in Table 6a-d.

### **Overall Comfort in Working with Individuals who are TGD:**

Participants were asked about their overall comfort level in working with patients who are TGD. All 45 participants were asked about their comfort level before and after taking *Amplify Sprouted*. The 9 participants who moved forward with the workshop and focus groups were also asked about their comfort before and after this clinical skills event. The participants answered this question through Likert style responses with the option of ‘extremely comfortable’, ‘somewhat comfortable’, ‘neither comfortable nor uncomfortable’, ‘somewhat uncomfortable’, and ‘extremely uncomfortable’.

Our analysis of the 45 participants found that prior to *Amplify Sprouted*, 11 participants (24.4%) stated they were ‘extremely comfortable’ and 23 participants (51.1%) noted they were ‘somewhat comfortable’ in working with patients who are TGD. After *Amplify Sprouted*, this shifted to 14 participants (31.1%) feeling ‘extremely comfortable’ and 28 participants (62.2%) feeling ‘somewhat comfortable’, revealing an overall increase in both categories. These results can be found in Table 8a.

A focused analysis on the 9 participants who completed both *Amplify Sprouted* and the workshop and focus group series was done as well. Looking at the overall comfort levels for these participants, prior to *Amplify Sprouted*, 5 participants (55.6%) felt ‘extremely comfortable’, 3 participants (33.3%) felt ‘somewhat comfortable’, and 1 participant (11.1%) felt ‘neither comfortable nor uncomfortable’. Interestingly, while there was an increase in the overall group in their comfortability, with these 9 participants, after completing *Amplify Sprouted*, 1 participant (11.1%) felt ‘extremely comfortable’ and 8 participants (88.9%) felt ‘somewhat comfortable’. Prior to the workshop, we saw an additional change in comfortability overall with 2 participants (22.2%) feeling ‘extremely comfortable’ and 7 participants (77.8%) felt ‘somewhat comfortable’. In the end after the workshop and focus groups, 5 participants (55.6%) felt ‘extremely comfortable’, 4 participants (44.4%) felt ‘somewhat comfortable’ which was similar to where participants started. These results can be reviewed in Table 8a and 8b.

### **Overall Self-Efficacy in Working with Individuals who are TGD:**

In addition to overall comfort, participants were asked specifically about their overall self-efficacy in providing genetic counseling to TGD patients. This question is separate from the overall self-efficacy calculated from the 7 individual clinical competencies answered by participants. This self-efficacy question was asked to all participants (N=45) before and after taking *Amplify Sprouted* as well as before and after the workshop and focus groups for the 9 participants who completed that section. Note that not all participants answered this question, resulting in a lower N than 45 and 9 participants, respectively.

Of all the participants who took *Amplify Sprouted*, their pre-education self-efficacy was a mean of 60.74 (SD = 19.466) on a scale of 0-100 and was a mean of 80.43 (12.769). For those who took *Amplify Sprouted* and participated in the workshop and focus groups, we saw a change in mean from 72.5 (SD = 13.6) to 87.33 (SD = 11.3) before taking *Amplify Sprouted* and after the workshop and focus groups, respectively. This data can be found in Table 9a and b. With a paired

T-test analysis for the group of 9 individuals involved in both components, a significance value of  $p < 0.001$  was determined from overall self-efficacy before *Amplify Sprouted* and after the workshop and focus groups. Due to the lack of power with 9 participants, we cannot determine statistical significance, however, this analysis indicates that both *Amplify Sprouted* and the workshop/focus group series are needed to show a statistically significant increase in self-efficacy. This data can be reviewed in Table 9c.

### **Workshop and Focus Group Themes:**

Through qualitative analysis of the focus group transcripts and pre- and post-Workshop assessments, a series of seven themes were identified. These themes were coded to be the core messages from the research participants through the discussions they had with the TGD community members and in their individual assessment reflections.

#### *Theme 1: Inclusive and Tailored Communication*

Genetic counselors discussed ways they want to make their language, both in providing information and asking for information from the patient, more inclusive and gender-affirming while also tailoring their session to the patient.

*“I am looking forward to more consistently applying this information in contracting with my pronouns, language during family history taking, and knowing new resources for any TGD patients in the future.”*

#### *Theme 2: Importance of Open Communication with Patients*

Participants cited the need for communication to be ongoing and transparent with patients as their preferences, needs, and comfort levels with care and language may evolve as broader language, terms, and provider actions also evolve over time.

*“When I discuss organ specific care and screening recommendations, whether it resonates and empowers them and what else I can do to provide gender affirming care.”*

#### *Theme 3: Being an Advocate for Patients in All Aspects*

A prominent theme from the genetic counselors was the need to be an advocate for patients both in the session and beyond. A number of participants identified potential roles in working with insurance to be gender-affirming as well as with test requisition forms, test reports, within individual clinics, and in the health care system overall, showing how advocacy goes beyond direct patient communication.

*“I'm looking forward to reviewing the notes I took, reflecting on and implementing what I learned. Particularly as it relates to being an ally for the TGD community in advocating for systemic changes.”*

#### *Theme 4: Knowledge and Education in the Genetic Counseling Community*

Participants noted being driven to learn and grow their knowledge in gender-affirming care, yet recognized that this mentality is not necessarily present throughout the entire genetic counseling community. This brought up the need to educate colleagues and the widespread community, including genetic counseling students. In addition, students, as future genetic counselors, were also noted to be critical individuals to educate and have discussions with in order to promote gender-inclusive care at an early stage.

*“I think that a lot of the genetic counselors here are very invested in this work, but I know that many of our genetic counseling peers are not, and so I, I see my next step is continuing to invite and educate, as best I can, my genetic counseling colleagues who are not necessarily seeking out the fantastic opportunities, like this one, to learn more.”*

#### *Theme 5: Improving the Genetic Counseling Clinical Environment and Overall Impact*

Genetic counselors discussed the importance of recognizing non-inclusive components and spaces in their clinic that may be harming their patients, including paperwork, forms, and test reports. They discussed how for anyone who is in the TGD community, they may currently have a system in place which excludes and creates barriers for individuals, potentially harming them and minimizing a possible trusting relationship.

*“It's a difference of intellectual conceptualization of barriers of care versus hearing this non-inclusive form is now causing complications and appeals that are unnecessary and I can be a better ally to help support”*

#### *Theme 6: Importance of Learning From and Working with the TGD Community*

Participants highlighted the value of getting to interact with and learn from individuals in the TGD community, citing it to be an invaluable experience and safe space created for important dialogue and questions to be asked.

*“So I think just having the opportunity to ask questions of people directly after getting off the didactic information - that's definitely the most helpful, especially because professionally we've been having these conversations, but we don't have anyone who is transgender or gender diverse or out in those groups. So there's been things that have come up that I really have had questions about - are we thinking about this right at all? ... They need someone to fight for them in a sense.”*

#### *Theme 7: Impact of Gendered Marketing and Societal Norms on Patients and the Medical Setting*



Genetic counselors noted a greater impact of society's feminisation of pregnancy and birth, noting a negative impact on providing care to individuals in the TGD community as well as those not in this community. Through society's impact, they discussed recognizing gendered marketing and gender-reveal parties, examining the impact they may have on a variety of individuals.

*"It is important to deconstruct pregnancy and femininity from many different sides, particularly for trans and gender diverse individuals, but also knowing that, that the fact that pregnancy has become very gendered is harmful to society as a whole."*

## **DISCUSSION:**

This study was developed in order to provide genetic counselors and genetic counseling students with education on gender-affirming care considerations and opportunity for skill implementation with the goal of increasing gender-affirming care in genetic counseling. In this study, only 37.8% (n=17/45) of participants indicated that they definitely received education on TGD care considerations in graduate school with only 8/17 participants (47.06%) indicating that an individual who is TGD was knowingly involved in the education. Therefore, if participants don't seek out this information individually during or after graduate training, they may not feel as capable or knowledgeable of gender-affirming considerations and care which are important for the goal of providing equitable genetic counseling to patients. In addition to understanding the prior exposure to gender-affirming education, it is also important to consider the interactions that participants have had with patients in the TGD community. Only a third of our participants have had a patient disclose that they are TGD, however, research shows that it is not uncommon for individuals to not tell any or very few of their medical providers that they are TGD (James et al., 2016). Therefore, while some participants have knowingly counseled a patient in the TGD community, there are likely other patients that they have worked with who have not disclosed this information. This emphasizes the need for education on gender-affirming care which can be applied to clinical settings in order to be inclusive of all identities, regardless of whether or not this information is known about a patient.

While this work focused on the prenatal/preconception genetic counseling specialty, half of the practicing genetic counselors worked in a specialty outside of prenatal and/or preconception genetics. Therefore, it is also important to note that specialty of practice, prenatal/preconception versus other, was not a significant predictor of knowledge or self-efficacy. Additionally, modules 1-3 focused on overarching education that can be applied to all genetic counseling specialties and healthcare providers in general. Therefore, whether someone has knowingly counseled a patient who is TGD or not or whether they practice in prenatal or preconception genetic counseling, this education is still valuable and helpful in educating genetic counseling professionals.

Specifically thinking about the education portion of this research, within the *Amplify Sprouted* assessment for knowledge, we saw a statistically significant ( $p < 0.0038$ ) increase in knowledge in Modules 2, 3, 4, and overall, with the most drastic mean difference in percent in

Module 4, Fertility and Family Planning. This drastic difference in percent correct may be due to the lack of education overall in gender-affirming care, specifically in an area with less published research. Regarding Modules 1 and 5, it's possible that a statistically significant increase in mean percent correct was not seen due to prior knowledge and familiarity with the topic area. Module 1 focuses on terminology, communication components, and disparities in the TGD community. As a result, this baseline information may have been more familiar to participants, especially if they specifically are seeking information and resources on this topic outside of *Amplify Sprouted*. Similarly, Module 5 focuses on a genetic counseling case scenario with aspects of gender-affirming care implemented. Genetic counseling professionals would be more familiar with this section's general content, potentially explaining why a significant increase in knowledge was not seen. However, despite not all modules having a significant mean percent difference, all six core clinical competencies revealed a statistically significant increase in self-efficacy. Therefore, despite not all of the knowledge data being significant, the increase in self-efficacy reveals the utility in *Amplify Sprouted* for clinical practice. Additionally, since only half of the genetic counselors currently practice in the prenatal and/or preconception genetic counseling specialty, yet we see significant differences before and after *Amplify Sprouted*, we can see that this educational tool is effective for all genetic counselors and not just those working in that specific specialty.

It is also important to recognize that language within the TGD community evolves over time as more inclusive and affirming terms are created, discussed, and used, which in turn means that the genetic counseling community must listen to and amplify the voices in this community. For example, the term 'transgender and/or non-binary' was discussed with and used to address this gender diverse community. However, with *Amplify Sprouted*, the term 'transgender and/or gender diverse,' based on feedback from the community members, was determined to be a more updated and inclusive term, recognizing that this term will likely evolve again in the future. Similarly, as more research is done in the space of gender, affirming healthcare, aspects of gender-affirmation and its impact on fertility and pregnancy, this knowledge must also evolve in the genetic counseling community. For example, there is still little research on the long term impact of gender-affirming hormones on fertility ("What You Need to Know About Feminizing Hormone Therapy," n.d.; "What You Need to Know About Masculinizing Hormone Therapy," n.d.). These components emphasize the need to continue to update and evolve the content in *Amplify Sprouted*.

When thinking about the qualitative data from the subset of genetic counselors (n=9) that participated in the workshop and focus groups, each of the themes address a component of continued communication and education growth moving forward. Additionally, the themes also involve addressing a variety of levels including patients, individuals in the TGD community, genetic counseling colleagues, and genetic counseling students. Participant response from the workshop emphasized the utility of the workshop outside of *Amplify Sprouted* alone as well as the continued practicing and discussions that need to still be had in a variety of communities. Additionally, participants noted the importance of and appreciation for working with members of

the TGD community, revealing the utility of the workshop and focus groups both in practicing skills while also getting real time feedback, input, and discussion questions answered. Therefore, not only did participants showcase the success of implementing clinical skills with their increased knowledge and self-efficacy, but also emphasized the importance of working with and learning from a community to be a better advocate in a genetic counseling appointment and beyond.

### **Study Limitations:**

While we had a number of highly motivated individuals complete *Amplify Sprouted*, there were still 73 total individuals that signed up for the educational tool, 28 of those individuals did not complete the post-*Amplify Sprouted* assessment. As a result of only having 45 individuals complete the post assessment, therefore having less statistical power, we were unable to determine statistical significance of knowledge and self-efficacy differences among subsets of the 45 individuals (genetic counselors vs. students, previously completed *Amplify*, participated in the workshop). Of those that completed the post-assessment, and therefore, completed *Amplify Sprouted*, they may be a more highly motivated group of individuals in seeking knowledge on gender-affirming care due to the time commitment involved with completing the education (mean time = 276.6 minutes). This may also explain a higher baseline knowledge and level of self-efficacy among the participants. However, we believe it is important to keep *Amplify Sprouted* accessible to all genetic counseling professionals, regardless of their motivation, in hopes of continuing and broadening the discussion of gender-affirming care in the genetic counseling community. Overall, a larger sample size in the future may provide a broader representation of the knowledge and self-efficacy for genetic counseling providers.

Additionally, while we were able to measure knowledge, self-efficacy, and comfort changes based on *Amplify Sprouted* and the workshop and focus group series, we were not able to assess the clinical implementation of learned knowledge and skills. While participants indicated various actions they wanted to implement moving forward, we were not able to learn this information at this time. Additionally, we were not able to assess any patient outcomes for individuals who saw a genetic counselor and are in the TGD community. Assessing patient outcomes would have provided a more in-depth insight into the success of *Amplify Sprouted* and the workshop and focus groups.

### **Practice Implications:**

The findings from this research study have the potential to positively impact gender-affirming care in genetic counseling. Stakeholders involved in promoting and providing genetic counseling education through online learning and skill implementation models, this study will aid in the development of further tools and workshops that will focus on appropriate delivery, content, and implementation with the aid of TGD community members. Continuing to work with and learn from members of the TGD community will promote a positive relationship that allows for continued growth and evolution in gender-affirming care.

### **Research Recommendations:**

With the success of *Amplify Sprouted* individually and in conjunction, it would be beneficial to expand *Amplify Sprouted* to all genetic counselors and genetic counseling students. If genetic counseling students gain this knowledge during their graduate training, it would be interesting to conduct further research on the possible success of applying gender-affirming skills at an earlier career stage.

Additionally, while our data revealed changes in knowledge, self-efficacy, and comfort surrounding the education and clinical skill implementation, it would be insightful to learn more about the skills and knowledge actually used with patients in the clinic and the success of the interaction. Further research on how clinical practice and interactions with patients and providers may have changed would be effective in understanding a deeper impact of this work and its benefits.

### **CONCLUSION:**

This research was successful in evolving and implementing an educational tool for gender-affirming care, and specifically in prenatal/preconception genetic counseling, that amplified the voices and perspectives of individuals in the TGD community. This tool research was also successful in increasing participant knowledge and self-efficacy surrounding inclusive care, revealing the utility of the tool in genetic counseling. There is an established need for education in prenatal/preconception genetic counseling, however, it has been lacking. With *Amplify Sprouted*, there is hope that patient care can be improved and be inclusive for all patients.

In addition to *Amplify Sprouted*, the CEW and focus groups were successful in providing an experience to aid participants in translating education and enhancing clinical skills for patient care. Based on the key themes, participants concluded that gender-affirming care is not static; it is dynamic, ever-growing, and must be tailored to patients through open communication. Additionally, actions must be taken with communities to make gender-affirming changes, not acted upon communities as individuals in the TGD community are the voices that need to be Amplified.

### **ACKNOWLEDGMENTS:**

Funding for this research was provided by the Michigan Association of Genetic Counselors, National Society of Genetic Counselors Prenatal Special Interest Group, National Society of Genetic Counselors Research Special Interest Group, National Society of Genetic Counselors Cancer Special Interest Group, and the Rackham Graduate Student Research Grant. This research was completed to fulfill the graduate requirements for a Master's of Science in Genetic Counseling at the University of Michigan.

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### **TABLES AND FIGURES:**

**Table 1** Summary of the demographic data from the research participants in addition to their exposure to individuals in the TGD community, aspects of their clinical work, and previous exposure to *Amplify*.

Variable		n	%
Genetic Counselor Status			
	Certified genetic counselor	26	57.8
	Student	19	42.2
Gender			
	Cisgender man	3	6.7
	Cisgender woman	40	88.9
	Nonbinary	1	2.2
	Prefer not to say	1	2.2
Sexual Orientation			
	Heterosexual	27	60
	Homosexual	2	4.4
	Bisexual	7	15.6
	Queer	5	11.1
	Prefer to self-describe	2	4.4
	Prefer not to say	2	4.4
Race and Ethnicity			
	Asian	3	6.7
	Asian Indian	1	2.2
	Middle Eastern or North African	1	2.2

	White	36	80
	Prefer not to say	1	2.2
	Mixed Asian and White	2	4.4
	Mixed Black or African American and White	1	2.2
Age (years)			
	18-24	11	24.4
	25-34	26	57.8
	35-44	5	11.1
	45-54	3	6.7
Region of Practice			
	Region 1: CT, MA, ME, NH, RI, VT, CN Maritime Provinces	5	11.1
	Region 2: DC, DE, MD, NJ, NY, PA, VA, WV, PR, VI, Quebec	7	15.6
	Region 3: AL, FL, GA, KY, LA, MS, NC, SC, TN	3	6.7
	Region 4: AR, IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, OK, SD, WI, Ontario	14	31.1
	Region 5: AZ, CO, MT, NM, TX, UT, WY, Alberta, Manitoba, Saskatchewan	7	15.6
	Region 6: AK, CA, HI, ID, NV, OR, WA, British Columbia	8	17.8
Genetic counseling specialty (genetic counselors only, n=26)			
	Prenatal and/or preconception	13	50
	Other	13	50
Patients seen per month (genetic counselors only, n=26)			
	Fewer than 5 patients	3	11.538
	5-15 patients	4	15.384

	16-30 patients	6	23.077
	More than 30 patients	13	50
A patient has disclosed to you that they are a member of the TGD community			
	Yes	15	33.3
	Maybe	2	4.4
	No	28	62.2
Work specifically in a clinic serving patients from the TGD community			
	Yes	1	2.2
	Maybe	1	2.2
	No	43	95.6
Received education on TGD care considerations during graduate school			
	Yes	17	37.8
	Maybe	7	15.6
	No	21	46.7
Members of the TGD community were involved in developing and/or administering TGD care consideration education during graduate school			
	Yes	8	47.06
	Maybe	5	29.41
	No	4	23.53
How participants are connected with the TGD community			
	I am apart of this community	0	0
	I am an active ally in this community	20	44.4
	I have multiple loved ones in this community	13	28.9
	I have one loved one in this community	7	15.6
	Other	3	6.7



Participated in the follow-up workshop and focus groups			
	<i>Amplify Sprouted</i> and workshop/focus groups	9	20
	<i>Amplify Sprouted</i> only	36	0.8
Previous participation in <i>Amplify</i>			
	No	40	88.9
	Yes	5	11.1

**Table 2** Descriptive analysis of the number of years of genetic counseling experience from the participants who are certified genetic counselors.

Years of Genetic Counseling Experience (genetic counselors only)			
	N		26
	Mean		6.4038
	Median		4.5
	Std. Deviation		6.32775
	Minimum		1
	Maximum		27
	Percentiles	25	1.5
		50	4.5
		75	9.5

**Table 3** Summary of the time spent and number of views participants had on the Canvas page for *Amplify Sprouted*.

Descriptive Statistics: Activity Time on <i>Amplify Sprouted</i>						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
Time (minutes)	45	1944.15	22.6	1966.75	276.6156	328.5360
Valid N (listwise)	45					
Descriptive Statistics: Number of Views on <i>Amplify Sprouted</i>						

	N	Range	Minimum	Maximum	Mean	Std. Deviation
<i>Amplify Sprouted Views</i>	45	17	2	19	7.6889	4.5067
Valid N (listwise)	45					

**Table 4a** This table summarizes the paired samples T-tests performed on the percent difference of knowledge questions correct before and after all participants completed *Amplify Sprouted*. Significant values are based on  $p < 0.0038$ . Each module includes five related questions and the overall knowledge includes all 25 questions together.

Paired Samples Test: All Amplify Sprouted Participants (n=45)										
		Paired Differences							Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
					Lower	Upper				
Pre vs Post Module	Module 1: Terminology, Population Disparities, and Communication	5.77778	13.22685	1.97174	1.80399	9.75156	2.930	44	.003	.005
Pre vs Post Module	Module 2: Clinical Environment	11.11111	14.49486	2.16077	6.75637	15.46585	5.142	44	<.001	<.001
Pre vs Post Module	Module 3: Past, Present, and Future Aspects of Gender Affirmation	18.66667	20.18100	3.00841	12.60362	24.72971	6.205	44	<.001	<.001
Pre vs Post Module	Module 4: Fertility and Family Planning	40.00000	27.63397	4.11943	31.69784	48.30216	9.710	44	<.001	<.001
Pre vs Post Module	Module 5: Putting it All Together – The Prenatal/Preconception Genetic Counseling Session	6.22222	19.45728	2.90052	.37661	12.06784	2.145	44	.019	.037
Pre vs Post Amplify Sprouted	Overall Knowledge	16.00000	11.05359	1.64777	12.67913	19.32087	9.710	44	<.001	<.001

**Table 4b** The paired samples statistics summarizes the pre- and post-*Amplify Sprouted* percent of knowledge questions correct for all 45 participants. Each module includes five related questions and the overall knowledge includes all 25 questions together.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Module 1	Post-Amplify Sprouted	96.4444	45	7.73292	1.15275
	Pre-Amplify Sprouted	90.6667	45	12.50454	1.86407
Module 2	Post-Amplify Sprouted	98.6667	45	5.04525	.75210
	Pre-Amplify Sprouted	87.5556	45	13.67738	2.03890
Module 3	Post-Amplify Sprouted	96.4444	45	7.73292	1.15275
	Pre-Amplify Sprouted	77.7778	45	20.54805	3.06312
Module 4	Post-Amplify Sprouted	95.1111	45	9.68181	1.44328
	Pre-Amplify Sprouted	55.1111	45	26.68181	3.97749
Module 5	Post-Amplify Sprouted	88.8889	45	14.49486	2.16077
	Pre-Amplify Sprouted	82.6667	45	17.88854	2.66667
Overall Knowledge	Post-Amplify Sprouted	95.1111	45	4.66234	.69502
	Pre-Amplify Sprouted	79.1111	45	10.26517	1.53024

**Table 4c** This table summarizes the paired samples T-tests performed on the percent difference of knowledge questions correct before and after participants who are genetic counselors completed *Amplify Sprouted*. Significant values are based on  $p < 0.0038$ . Each module includes five related questions and the overall knowledge includes all 25 questions together. Each module includes five related questions and the overall knowledge includes all 25 questions together.

Paired Samples Test: Genetic Counselors only (n=26)											
		Mean	Std. Deviation	Std. Error Mean	Paired Differences		t	df	Significance		
					95% Confidence Interval of the Difference				One-Sided p	Two-Sided p	
					Lower	Upper					
Pre vs Post Module	Module 1: Terminology, Population Disparities, and Communication	5.38462	13.33590	2.61538	-.00187	10.77110	2.059	25	.025	.050	
Pre vs Post Module	Module 2: Clinical Environment	13.07692	14.90483	2.92308	7.05673	19.09711	4.474	25	<.001	<.001	
Pre vs Post Module	Module 3: Past, Present, and Future Aspects of Gender Affirmation	20.00000	16.97056	3.32820	13.14544	26.85456	6.009	25	<.001	<.001	
Pre vs Post Module	Module 4: Fertility and Family Planning	38.46154	27.66837	5.42621	27.28604	49.63703	7.088	25	<.001	<.001	
Pre vs Post Module	Module 5: Putting it All Together – The Prenatal/Preconception Genetic Counseling Session	5.38462	19.23138	3.77158	-2.38311	13.15234	1.428	25	.083	.166	
Pre vs Post Amplify Sprouted	Overall Knowledge	16.30769	11.75336	2.30502	11.56041	21.05498	7.075	25	<.001	<.001	

**Table 4d** This table summarizes the paired samples T-tests performed on the percent difference of knowledge questions correct before and after participants who are genetic counseling students completed *Amplify Sprouted*. Significant values are based on  $p < 0.0038$ . Each module includes five related questions and the overall knowledge includes all 25 questions together.

Paired Samples Test: Genetic Counseling Students only (n=19)										
		Mean	Std. Deviation	Std. Error Mean	Paired Differences		t	df	Significance	
					95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pre vs Post Module	Module 1: Terminology, Population Disparities, and Communication	6.31579	13.42077	3.07893	-.15281	12.78439	2.051	18	.028	.055
Pre vs Post Module	Module 2: Clinical Environment	8.42105	13.84965	3.17733	1.74573	15.09637	2.650	18	.008	.016
Pre vs Post Module	Module 3: Past, Present, and Future Aspects of Gender Affirmation	16.84211	24.27908	5.57000	5.13996	28.54425	3.024	18	.004	.007
Pre vs Post Module	Module 4: Fertility and Family Planning	42.10526	28.20145	6.46986	28.51260	55.69793	6.508	18	<.001	<.001
Pre vs Post Module	Module 5: Putting it All Together – The Prenatal/Preconception Genetic Counseling Session	7.36842	20.23257	4.64167	-2.38336	17.12021	1.587	18	.065	.130
Pre vs Post Amplify Sprouted	Overall Knowledge	15.57895	10.31889	2.36732	10.60540	20.55249	6.581	18	<.001	<.001

**Table 5a** This table summarizes the paired samples T-tests performed on the difference in self-efficacy ratings before and after all participants completed *Amplify Sprouted*. Significant values are based on  $p < 0.0038$ . Self-efficacy scores were based on a scale of 0-100. Each section includes 3-7 questions that align with that clinical competency and the overall self-efficacy includes all 35 questions together. Variable degrees of freedom indicate that not all participants answered the assessment questions.

Paired Samples Test: Self-Efficacy, All Amplify Sprouted Participants (N=45)										
		Mean	Std. Deviation	Std. Error Mean	Paired Differences		t	df	Significance	
					95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pre vs Post	Information Gathering	11.16667	14.68439	2.26585	6.59069	15.74265	4.928	41	<.001	<.001
Pre vs Post	Genetic Testing	13.46357	15.88559	2.42253	8.57470	18.35243	5.558	42	<.001	<.001
Pre vs Post	Case Management	15.36825	16.05185	2.47685	10.36615	20.37036	6.205	41	<.001	<.001
Pre vs Post	Genetic Counseling Process	7.45000	9.83218	1.51714	4.38608	10.51392	4.911	41	<.001	<.001
Pre vs Post	Psychosocial Counseling	11.56247	15.16101	2.33939	6.83797	16.28697	4.943	41	<.001	<.001
Pre vs Post	Communication	10.16156	12.72059	1.96283	6.19755	14.12558	5.177	41	<.001	<.001
Pre vs Post	Overall Self-Efficacy	11.61148	12.08160	1.86423	7.84659	15.37637	6.229	41	<.001	<.001

**Table 5b** The paired samples statistics summarizes the pre- and post-*Amplify Sprouted* self-efficacy values for all participants. Self-efficacy scores were based on a scale of 0-100.

		Paired Samples Statistics			
		Mean	N	Std. Deviation	Std. Error Mean
Information Gathering	Post-Amplify Sprouted	88.6151	42	9.36945	1.44574
	Pre-Amplify Sprouted	77.4484	42	16.10865	2.48562
Genetic Testing	Post-Amplify Sprouted	89.9197	43	8.07862	1.23198
	Pre-Amplify Sprouted	76.4561	43	17.11591	2.61015
Case Management	Post-Amplify Sprouted	86.4389	42	9.58061	1.47832
	Pre-Amplify Sprouted	71.0706	42	18.12105	2.79614
Genetic Counseling Process	Post-Amplify Sprouted	92.2190	42	6.55719	1.01180
	Pre-Amplify Sprouted	84.7690	42	12.53406	1.93405
Psychosocial Counseling	Post-Amplify Sprouted	86.3747	42	9.97214	1.53873
	Pre-Amplify Sprouted	74.8122	42	18.34960	2.83140
Communication	Post-Amplify Sprouted	88.7438	42	8.26791	1.27577
	Pre-Amplify Sprouted	78.5822	42	15.52206	2.39511
Overall Self-Efficacy	Post-Amplify Sprouted	88.6770	42	7.66967	1.18346
	Pre-Amplify Sprouted	77.0655	42	14.13315	2.18079

**Table 5c** This table summarizes the paired samples T-tests performed on the difference in self-efficacy ratings before and after genetic counselors completed *Amplify Sprouted*. Significant values are based on  $p < 0.0038$ . Self-efficacy scores were based on a scale of 0-100. Each section includes 3-7 questions that align with that clinical competency and the overall self-efficacy includes all 35 questions together. Variable degrees of freedom indicate that not all participants answered the assessment questions.

Paired Samples Test: Self-Efficacy, Genetic Counselors only (N=26)										
		Paired Differences					Significance			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
					Lower	Upper				
Pre vs Post	Information Gathering	10.58667	17.56997	3.51399	3.33414	17.83920	3.013	24	.003	.006
Pre vs Post	Genetic Testing	9.02857	14.17628	2.78020	3.30265	14.75449	3.247	25	.002	.003
Pre vs Post	Case Management	12.68400	14.85575	2.97115	6.55185	18.81615	4.269	24	<.001	<.001
Pre vs Post	Genetic Counseling Process	5.20400	10.28350	2.05670	.95918	9.44882	2.530	24	.009	.018
Pre vs Post	Psychosocial Counseling	8.09143	13.87149	2.77430	2.36556	13.81730	2.917	24	.004	.008
Pre vs Post	Communication	7.72000	11.00953	2.20191	3.17549	12.26451	3.506	24	<.001	.002
Pre vs Post	Overall Self-Efficacy	8.99519	11.71634	2.34327	4.15892	13.83145	3.839	24	<.001	<.001

**Table 5d** This table summarizes the paired samples T-tests performed on the difference in self-efficacy ratings before and after genetic counseling students completed *Amplify Sprouted*. Significant values are based on  $p < 0.0038$ . Self-efficacy scores were based on a scale of 0-100. Each section includes 3-7 questions that align with that clinical competency and the overall

self-efficacy includes all 35 questions together. Variable degrees of freedom indicate that not all participants answered the assessment questions.

Paired Samples Test: Self-Efficacy, Students only (N=19)										
		Paired Differences							Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
					Lower	Upper				
Pre vs Post	Information Gathering	12.01961	9.39154	2.27778	7.19092	16.84829	5.277	16	<.001	<.001
Pre vs Post	Genetic Testing	20.24650	16.35748	3.96727	11.83626	28.65674	5.103	16	<.001	<.001
Pre vs Post	Case Management	19.31569	17.36099	4.21066	10.38949	28.24188	4.587	16	<.001	<.001
Pre vs Post	Genetic Counseling Processing	10.75294	8.34402	2.02372	6.46284	15.04304	5.313	16	<.001	<.001
Pre vs Post	Psychosocial Counseling	16.66695	15.93328	3.86439	8.47481	24.85908	4.313	16	<.001	<.001
Pre vs Post	Communication	13.75210	14.48517	3.51317	6.30451	21.19969	3.914	16	<.001	.001
Pre vs Post	Overall Self-Efficacy	15.45896	11.90390	2.88712	9.33854	21.57939	5.354	16	<.001	<.001

**Table 6a** A linear regression analysis was conducted to determine if participants' specialty was predictive of knowledge. The significance value was calculated to be  $p=0.194$ .

Coefficients Linear Regression Analysis: Specialty/Knowledge <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	103.444	9.256		11.176	<.001	84.297	122.590
	Pre-Amplify Sprouted Percent Knowledge Questions Correct	-1.128	.122	-.940	-9.241	<.001	-1.381	-.876
	Genetic Counseling Specialty	3.141	2.345	.136	1.339	.194	-1.711	7.993

a. Dependent Variable: Percent difference between Pre- and Post- Amplify Sprouted

**Table 6b** A linear regression analysis was conducted to determine if participants' specialty was predictive of self-efficacy. The significance value was calculated to be  $p=0.722$ .

Coefficients Linear Regression Analysis: Self-Efficacy/Specialty <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	61.528	7.534		8.167	<.001	45.903	77.152
	Pre-Amplify Sprouted Percent Questions Correct	-.656	.091	-.839	-7.204	<.001	-.844	-.467
	Genetic Counseling Specialty	-.963	2.675	-.042	-.360	.722	-6.512	4.585

a. Dependent Variable: Percent difference between Pre- and Post-Amplify Sprouted

**Table 6c** A linear regression analysis was conducted to determine if participants' role as a genetic counselor versus student was predictive of knowledge. The significance value was calculated to be  $p=0.772$ .

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	92.966	5.668		16.403	<.001	81.529	104.404
	Pre-Amplify Sprouted Percent Knowledge Questions Correct	-.978	.070	-.908	-13.961	<.001	-1.119	-.836
	Genetic Counseling Students and Genetic Counselors	.210	.720	.019	.291	.772	-1.243	1.662

a. Dependent Variable: Percent difference between Pre- and Post-Amplify Sprouted

**Table 6d** A linear regression analysis was conducted to determine if participants' role as a genetic counselor versus student was predictive of self-efficacy (scale of 0-100). The significance value was calculated to be  $p=0.772$ .

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	63.380	6.489		9.768	<.001	50.256	76.505
	Pre-Amplify Sprouted Self-Efficacy	-.701	.075	-.820	-9.405	<.001	-.851	-.550
	Genetic counseling students and genetic counselors	1.234	1.060	.102	1.165	.251	-.909	3.378

a. Dependent Variable: Difference between Pre- vs Post-Amplify Sprouted Self-Efficacy

**Table 8a** This table summarizes the level of comfort felt by participants before and after completing *Amplify Sprouted*, revealing the number of participants in each answered category. No participants indicated feeling 'extremely uncomfortable.'

Comfort: <i>Amplify Sprouted</i> Participants (n=45)		Pre- <i>Amplify Sprouted</i> Comfort		Post- <i>Amplify Sprouted</i> Comfort	
		Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
Valid	Extremely comfortable	11	24.4	14	31.1
	Somewhat comfortable	23	51.1	28	62.2

	Neither comfortable nor uncomfortable	10	22.2	2	4.4
	Somewhat uncomfortable	1	2.2	1	2.2
	Total	45	100	45	100

**Table 8b** This table summarizes the level of comfort felt by the 9 education and workshop/focus group participants before and after completing *Amplify Sprouted* and before and after the workshop and focus groups. No participants indicated feeling ‘somewhat uncomfortable’ or ‘extremely uncomfortable.’

Comfort: Workshop Participants (n=9)		Pre- <i>Amplify Sprouted</i> Comfort		Post- <i>Amplify Sprouted</i> Comfort		Pre-Workshop Comfort		Post-Workshop Comfort	
		Frequency (n)	Percent (%)	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
	Extremely comfortable	5	55.6	1	11.1	2	22.2	5	55.6
	Somewhat comfortable	3	33.3	8	88.9	7	77.8	4	44.4
	Neither comfortable nor uncomfortable	1	11.1						
	Total	9		9		9		9	

**Table 9a** This table looks at the overall self-efficacy of participants in providing gender-affirming care to patients who are TGD, on a scale of 0-100. Note that not all participants answered this question, indicating a lower ‘N’ value than 45.

Self-Efficacy: All Participants, Pre- and Post- <i>Amplify Sprouted</i>	N	Minimum	Maximum	Mean	Std. Deviation
Pre- <i>Amplify Sprouted</i> Self-Efficacy	39	28	95	60.74	19.466
Post- <i>Amplify Sprouted</i> Self-Efficacy	44	35	100	80.43	12.769
Valid N (listwise)	38				



**Table 9b** This table looks at the overall self-efficacy on a scale of 0-100 of the nine participants who participated in *Amplify Sprouted* and the workshop/focus groups in providing gender-affirming care to patients who are TGD. Note that not all participants answered this question, indicating a lower ‘N’ value.

Self-Efficacy: Workshop/Focus Group Participants, Pre- and Post- <i>Amplify Sprouted</i> and Workshop/Focus Group					
	N	Minimum	Maximum	Mean	Std. Deviation
Pre- <i>Amplify Sprouted</i> Self-Efficacy	8	40	80	72.5	13.628
Post- <i>Amplify Sprouted</i> Self-Efficacy	9	66	100	83	10.989
Pre-Workshop/Focus Group Self-Efficacy	8	75	92	82.38	5.449
Post-Workshop/Focus Group Self-Efficacy	9	60	96	87.33	11.303
Valid N (listwise)	7				

**Table 9c** Paired samples T-tests were performed to compare self-efficacy among the 9 *Amplify Sprouted* and workshop/focus group participants from before and after *Amplify Sprouted* (pair 1), after *Amplify Sprouted* and before the workshop/focus group (pair 2), before and after the workshop/focus group (pair 3), and before *Amplify Sprouted* and after the workshop/focus group (pair 4). While significant differences can not be solidified due to the low statistical power present, it trends toward statistically significant improvement in self-efficacy in pair 4.

**Paired Samples Test: Overall Self-Efficacy (N=9)**

		Paired Differences				t	df	Significance		
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			One-Sided p	Two-Sided p	
					Lower					Upper
Pair 1	Pre vs Post Amplify Sprouted	9.625	12.455	4.403	-.788	20.038	2.186	7	.033	.065
Pair 2	Post Amplify Sprouted vs Pre Workshop/Focus Group	-2.250	8.276	2.926	-9.169	4.669	-.769	7	.234	.467
Pair 3	Pre vs Post Workshop/Focus Group	8.375	7.308	2.584	2.265	14.485	3.241	7	.007	.014
Pair 4	Pre Amplify Sprouted vs Post Workshop/Focus Group	15.750	3.196	1.130	13.078	18.422	13.939	7	<.001	<.001

**APPENDIX:**

**Appendix 1** Community advisory board meeting dates and agenda items for discussion.

<b>DATE</b>	<b>AGENDA ITEMS</b>
9/26/2021	Introduction to the research and goals, <i>Amplify Sprouted</i> , what is asked of participating TGD community members, and compensation
10/17/2021 - 10/18/2021	Video testimonials were completed for <i>Amplify Sprouted</i>
10/24/2021	Review of <i>Amplify Sprouted</i> Modules 1-3
11/14/2021	Review of <i>Amplify Sprouted</i> Modules 4 and 5 as well as knowledge assessment questions
2/5/2022	Training for the workshop and focus groups
4/3/2022	Research progress and data review, discussion of future directions and spaces to continue gender-affirming work

**Appendix 2** Workshop and focus group training outline for the CAB.

<b>CAB WORKSHOP + FOCUS GROUP TRAINING: AGENDA ITEMS</b>
Review the role of a genetic counselor and what they do during a session
Discuss the goal of the research and the overall project plan
Review the goal of the workshop and the benefits for participants and CAB

The timeline of the workshop and focus groups
Case scenario and the role of the CAB member during the role plays
Review of key topics related to the case scenario: Down Syndrome/Trisomy 21, non-invasive prenatal screening, advanced maternal age
Considerations for giving feedback to genetic counselors