

SPECIAL ISSUE

Analysis of the reported use of practice-based competencies by North American genetic counselors during the COVID-19 pandemic

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Abstract

Genetic counseling services changed due to the COVID-19 pandemic. Many genetic counselors (GCs) moved from in-person to telehealth services. Others were redeployed by choice or necessity, using their expertise to provide COVID-19 care and education. For some, their employment status changed due to budgetary constraints or decreasing referrals. This study surveyed North American GCs to assess the relative use of genetic counseling Practice-Based Competencies (PBCs) as a proxy for the skills used during the first wave of the pandemic, whether GCs were in their current role or in new or adjusted roles. A secondary aim was to determine whether GCs believe their training should be refocused in view of the workforce shifts posed by the pandemic. The survey comprised closed- and open-ended questions and was completed in full by 97 respondents. The study population was representative of the general genetic counseling workforce in terms of gender, race/ethnicity, age, and practice area when compared to the National Society of Genetic Counselors 2020 Professional Status Survey. Most participants (97.9%) indicated that the COVID-19 pandemic resulted in a change to their work, and 89.7% used at least one PBC at a different frequency than before the pandemic. The most significant change was the adaptation of genetic counseling skills for varied service delivery models: 83.5% of respondents indicated that their roles and responsibilities moved to a remote setting and/or utilized telehealth. The majority of participants felt competent using the PBCs during the pandemic. Major themes that emerged from the qualitative data were as follows: (a) adaptation of service delivery, (b) translation of genetic counseling skills, and (c) provision of psychosocial support. This study highlights practice changes for GCs due to the COVID-19 pandemic as well as the increased use of, and need for focused training in, varied service delivery models.

KEYWORDS

COVID-19, Genetic counseling, Genetics services, Practice-Based Competencies, Service delivery models

1 | INTRODUCTION

The COVID-19 pandemic continues to greatly impact the global economy and workforce. In particular, healthcare systems around the world have quickly adapted to utilize available resources and employees to address urgent care and personnel needs. Adaptations have included greater use of telehealth services (including both telephone and video-conferencing modalities), canceling non-essential visits, and deferring elective surgeries. In many hospitals, physicians with critical care training took on lead roles in COVID-19 intensive care units (ICUs), while other medical professionals provided support in the ICU or assisted with the pandemic response in other ways, such as employee screening or fulfilling administrative duties (Divito et al., 2020; Kumaraiah et al., 2020; Sarpong et al., 2020; Shipchandler et al., 2020).

Like their healthcare colleagues, many genetic counselors (GCs) have altered their service delivery, work environment, job type, or employment status during the pandemic. An immediate impact of local shutdowns and quarantine orders in the United States and Canada in spring 2020 was that numerous GCs needed to provide telehealth services to patients and clients and/or teach and supervise students remotely (McWalter, 2020; Norman et al., 2020; Shannon et al., 2020). Many GCs continued their regular job duties in home office settings and with different service delivery models. However, there are also reports of GCs who were redeployed to new roles outside of the field of genetic counseling, such as palliative care or COVID-19 research (Ahimaz et al., 2020; Luu, 2020). Less is known about these new roles or the ways in which GCs' unique and varied skills have been utilized to address emergent COVID-19 concerns.

Since its inception in the 1960s, the genetic counseling profession has adapted to a changing healthcare landscape. Though genetic counseling began solely as a clinical profession (Abacan et al., 2019), as of 2020, a large proportion of GCs now work in non-direct patient care settings. Based on the 2020 National Society of Genetic Counselors (NSGC) Professional Status Survey (PSS), 25% of GCs work in a non-direct patient care position, and 17% of GCs work for a commercial (non-academic) diagnostic laboratory ('NSGC Professional Status Survey: Reports', 2020). GCs in non-direct patient care roles may contribute to project management, marketing, sales, test development, research, variant curation, report writing, education, test utilization management, care coordination, customer service, and various other roles (Christian et al., 2012; McWalter et al., 2018; Waltman et al., 2016; Wool & Dudek, 2013; Zetzsche et al., 2014; Zierhut & Austin, 2011). As with the broader healthcare field, it is expected that the COVID-19 pandemic will continue to have lasting effects on the future development of the genetic counseling profession, skills utilized by GCs, and settings in which those skills may be applicable and impactful.

Though GCs utilize their skills to different extents depending on their role, Practice-Based Competencies (PBCs) were created by the Accreditation Council for Genetic Counseling (ACGC) to define the knowledge and skill set needed for successful practice as an entry-level GC, regardless of specialty or work setting (Doyle et al., 2016;

What is known about this topic

To date, there are no known publications on the impact of the COVID-19 pandemic on the use of Practice-Based Competencies (PBCs) by the genetic counseling workforce.

What this paper adds to the topic

The current paper adds quantitative and qualitative data on the use of the PBCs during the COVID-19 pandemic, including data to support updated training models to ensure workforce preparedness in a changed healthcare system.

Practice-Based Competencies for Genetic Counselors', 2019). The PBCs are divided into four domains: 'Domain I: Genetics Expertise and Analysis', 'Domain II: Interpersonal, Psychosocial and Counseling Skills', 'Domain III: Education', and 'Domain IV: Professional Development & Practice'. Past studies demonstrated that GCs have been able to successfully utilize the PBCs in emerging and/or non-direct patient care roles (Field et al., 2016). Highly transferable genetic counseling skills include communicating complex ideas, evaluating and appropriately responding to patient/client emotions, and demonstrating genetics expertise (Everett et al., 2014; McWalter et al., 2018; Rabideau et al., 2016).

There is limited information available regarding how genetic counseling skills were, and continue to be, used during the COVID-19 pandemic. This study surveyed GCs who were working before and during the COVID-19 pandemic. The purpose of this study was to: 1) evaluate the relative frequency with which GCs used each of the 22 ACGC PBCs during the pandemic, whether they were in new roles or continuing in the same role they had prior to the pandemic, and 2) assess whether GCs felt that genetic counseling training should be updated or changed based on their experience working during the pandemic.

2 | METHODS

2.1 | Participants and procedures

The target population for the study was GCs in the United States and Canada. Participants were deemed eligible if they were employed in a genetic counseling position at the beginning of the pandemic (March 2020), trained at an ACGC-accredited genetic counseling program, and, as of March 2020, had at least one year of work experience as a GC.

An invitation to participate in the study was emailed through the NSGC Research Survey Program, the American Board of Genetic Counselors (ABGC), and the Canadian Association of Genetic Counsellors (CAGC) to their internal membership mailing lists in October and November 2020. The survey remained open for four

weeks following the initial posting. No reminder emails were sent. These mailing lists included approximately 5,000 GCs. The email contained a brief description of the study, study contact information, and a link to the consent form. Participants were allowed to begin answering survey questions only after they provided electronic consent to take part in the study.

2.2 | Instrumentation

This study employed a mixed-methods study approach using an online survey with multiple-choice and open-ended questions (Supplement S1). Prior to distribution, the survey was piloted on colleagues for clarity and flow. The survey was conducted via the SurveyMonkey platform (www.surveymonkey.com) and utilized a 38-item, retrospective questionnaire to assess GCs' experiences with changes in their roles and skill utilization during the COVID-19 pandemic. Initial questions and demographic questions in the survey assessed participant eligibility. Participants were excluded if they were a current genetic counseling master's student, had less than one year of genetic counseling work experience, and/or were retired or not employed at the beginning of the pandemic. In addition, participants were asked which genetic counseling program they attended, and the responses of those who did not train at an ACGC-accredited program or did not answer this question were removed prior to data analysis.

2.2.1 | Demographics

Demographic information was collected to assess representativeness of the study population to respondents of the NSGC 2020 PSS ('NSGC Professional Status Survey: Reports', 2020). Demographic data included age, sex, race, ethnicity, genetic counseling training program, year of graduation, and current area of practice. Participants provided information about their current role, including genetic counseling specialty, availability and accessibility of remote work, part-time or full-time position, years of experience, and type of employer.

2.2.2 | Quantitative assessments of competencies

Multiple-choice questions were used to assess the type of role, area of practice, employment setting, years of experience, and title/job duties the participant had prior to the pandemic, and whether professional positions and volunteer roles had changed as a result of the pandemic. Participants were asked to assess whether they used each ACGC PBC more, less, or at the same frequency during the first regional peak of COVID-19 cases in the pandemic, compared with their use of each PBC before the pandemic began. As there was variability in the peak of COVID-19 cases throughout various regions of North America, the participant was instructed to answer relative to

the time period during which they felt their employer's region initially experienced the greatest impact from COVID-19. Participants were also asked whether these changes in PBC use were a direct result of the pandemic and whether they felt competent using that particular PBC during the pandemic.

2.2.3 | Qualitative assessment of changes during the COVID-19 pandemic

Participants were asked a series of questions with free-text responses to gain further insight about the skills they used to adapt to practice changes caused by the pandemic. In addition, free-text questions assessed their views on whether adjustments should be made to genetic counseling training due to these adaptations.

2.3 | Data analysis

Quantitative data were analyzed using SurveyMonkey software (www.surveymonkey.com). Data analysis included descriptive statistics and inferential statistics. To facilitate comparisons between demographic groups, two-tailed Fisher's exact tests were performed. Fisher's exact test was utilized as opposed to the Chi-square test due to counts of zero for some answer choices as well as many expected values of less than five. To apply Fisher's exact test in contingency tables larger than 2x2, JMP® Pro (Version 15) and the Real Statistics Resource Pack software for Excel (Release 7.2, copyright 2013–2020, Charles Zaiontz, www.real-statistics.com) were used.

Qualitative data analysis was performed using an inductive content analysis approach. Two members of the research team (LW and LR) independently coded data to identify themes, and they met regularly to discuss emerging codes and to generate a codebook. A third researcher (MWH) reviewed a random sample of responses from ten participants to test and validate the codes. Coding discrepancies were resolved through discussion.

2.4 | Ethics approval

This study was approved by and conducted according to the ethical standards of the Emory University Institutional Review Board (study #00001450).

3 | RESULTS

3.1 | Demographics

The survey was sent to approximately 5,000 North American GCs. Approximately 1.9% ($n = 97$) completed all required questions of the survey. Data from 118 participants were excluded: 80 respondents answered initial eligibility and demographic questions but did not

complete the survey; an additional 38 participants did not meet one or more eligibility criteria, with the majority having less than one year of work experience as a genetic counselor.

To determine whether sampling was representative of the North American genetic counseling workforce, participants' demographic and employment information were compared with the 2020 PSS from NSGC (Supplement S2). Respondents were representative of the larger genetic counseling field in terms of position type, remote status, and primary practice area. The top three reported primary practice areas in this study were adult cancer, pediatrics, and prenatal, which were also the top three primary practice areas according to the 2020 PSS. There was a statistically significant difference ($p = .004$) in the proportion of respondents in direct patient care roles versus non-direct patient care roles versus mixed roles, with respondents in this study reporting a lower percentage of non-direct patient care roles as compared to the PSS. In addition, there was a statistically significant difference ($p = .01$) between the spread of reported employer types in this study and the 2020 PSS, although the top four employer types were the same for both surveys.

Most participants were female (94.8%, $n = 92$), white (92.8%, $n = 90$), and under age 40 (age range 24–61). There were no statistically significant differences regarding sex or race/ethnicity between participants of this study and participants in the 2020 PSS. In addition, in this study as well as the 2020 PSS, the majority of respondents reported ten or fewer years of experience.

3.2 | Professional changes during the pandemic

A vast majority of participants (97.9%, $n = 95$) responded that the pandemic had resulted in a change to their professional roles and responsibilities, their professional volunteer roles and responsibilities, and/or the way they performed their job (Figure 1). Additionally, the majority of participants (83.5%, $n = 81$) responded that their job duties moved to a remote setting and/or utilized telehealth. About half of respondents (49.5%, $n = 48$) reported that their roles and responsibilities changed somewhat. The questionnaire provided examples of 'changed somewhat', including changes to types of referrals or wait times for non-urgent patients. Fewer participants (7.2%, $n = 7$) indicated that their roles and responsibilities completely changed, such as being assigned to a different role within the same institution or changing jobs to a different institution. Six of the seven individuals who endorsed a complete change of role or responsibilities specifically mentioned the pandemic as a contributory factor in their response. Some of the reported new roles included the following: helping with the COVID-19 testing process, conducting COVID-19-related research, serving as a screener for patients entering the hospital, discussing the pandemic with patients, and/or creating pandemic-related education materials for patients. Only one respondent disclosed that they took an additional job. Twenty people responded to questions regarding professional volunteer positions; of those, nine (45.0%) reported that their professional volunteer roles and responsibilities changed due to the pandemic.

Two participants (2.1%) noted no change to their role, and those participants also noted no changes in their use of PBCs due to the COVID-19 pandemic. Those two participants had both been at their role for at least three years at the start of the pandemic (March 2020), both work for commercial diagnostic laboratories, and both worked all or partially remote as of March 2020.

3.3 | Self-reported competency using the ACGC PBCs during the pandemic

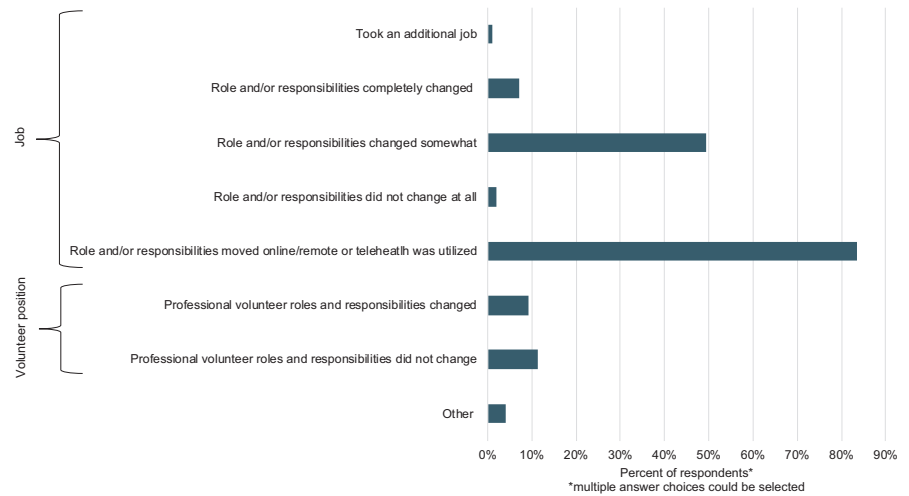
Across all PBCs for all four domains, at least 69% ($n \geq 67$) of respondents felt 'very competent' or 'competent' using each competency during the pandemic (Supplement S3). For 18 out of the 22 PBCs, over 85% ($n \geq 83$) of respondents felt 'very competent' or 'competent'. Overall, there were eight total 'not at all competent' responses out of 2,081 total responses (0.38%) when participants were asked to rate how competent they felt performing each of the PBCs during the pandemic.

3.4 | Change in use of ACGC PBCs during the pandemic

For most of the PBCs, over half ($n \geq 49$) of respondents indicated no change in their use of the PBC during the initial peak of the COVID-19 pandemic (Figure 2). Most participants (89.7%, $n = 87$) indicated that they used at least one PBC at a greater or lesser frequency due to the pandemic. For all PBCs except one, there was no clear pattern of reported use (some respondents reported using a particular PBC more due to the pandemic, while other respondents reported using that PBC less due to the pandemic). However, no respondent indicated they were using the PBC 'Assessing individuals' and their relatives' probability of conditions with a genetic component or carrier status based on their pedigree, test result(s), and other pertinent information' more often during the pandemic than they had been before the pandemic.

The top five PBCs used **more** during the pandemic were: 1) Understand how to adapt genetic counseling skills for varied service delivery models (II.12); 2) Employ active listening and interviewing skills to identify, assess, and empathically respond to stated and emerging concerns (II.9); 3) Establish and maintain professional interdisciplinary relationships in both team and one-on-one settings, and recognize one's role in the larger healthcare system (IV.22); 4) Demonstrate a self-reflective, evidence-based, and current approach to genetic counseling practice (IV.20); and 5) Advocate for individuals, families, communities, and the genetic counseling profession (IV.19). The top five PBCs used **less** during the pandemic were: 1) Understand the methods, roles, and responsibilities of the process of clinical supervision of trainees (IV.21); 2) Establish and maintain professional interdisciplinary relationships in both team and one-on-one settings, and recognize one's role in the larger healthcare system (IV.22); 3) Effectively educate clients about

FIGURE 1 Self-reported job, role, or responsibility changes due to the COVID-19 pandemic



a wide range of genetics and genomics information based on their needs, their characteristics and the circumstances of the encounter (III.14); 4) Effectively give a presentation on genetics, genomics, and genetic counseling issues (III.16); and 5) Integrate knowledge of psychosocial aspects of conditions with a genetic component to promote client well-being (I.2).

The PBC 'Establish and maintain professional interdisciplinary relationships in both team and one-on-one settings, and recognize one's role in the larger healthcare system' appears in both top five lists. While 20.6% ($n = 20$) of respondents reported that they used this PBC more during the pandemic, 24.7% ($n = 24$) indicated that they used this PBC less during the pandemic. There was no statistically significant difference ($p = .17$) in usage of this PBC between GCs who were remote or partially remote prior to the pandemic and GCs who were not working remotely prior to the pandemic. However, there was a statistically significant difference ($p = .02$) in usage of this PBC between GCs in direct patient care roles and those in mixed or non-direct patient care roles (Supplement S4). A greater percentage of GCs in mixed or non-direct patient care roles indicated that they were using this PBC more due to the pandemic. There was no statistically significant difference ($p = .63$) in usage of this PBC between GCs in the top three reported specialty areas (adult cancer, pediatrics, and prenatal).

3.5 | Adapting genetic counseling skills for varied service delivery models

The PBC that had the most substantial change in use prior to the pandemic to the initial peak of the pandemic was 'Understand how to adapt genetic counseling skills for varied service delivery models'. Most respondents (66.0%, $n = 64$) indicated that they used the skill more due to the pandemic (Figure 3). For this PBC, there was no statistically significant difference ($p = .13$) in change in use during the pandemic between GCs who were remote or partially remote prior to the pandemic and GCs who were not working remotely prior to the pandemic. There was a statistically significant difference

($p < .001$) in PBC use between GCs in direct patient care ($n = 57$) and GCs in mixed or non-direct patient care roles ($n = 40$). Of GCs in direct patient care roles, 80.7% ($n = 46$) reported that they used this PBC more during the pandemic, versus 45.0% ($n = 18$) of GCs in mixed or non-direct patient care roles. There was no statistically significant difference ($p = .14$) in usage of this PBC between GCs in the top three reported specialty areas (adult cancer, pediatrics, and prenatal).

3.6 | Identified need for additional skills

When asked about skill use beyond the PBCs, 28.9% ($n = 28$) of participants indicated that there were additional skills not addressed by the PBCs that they used as a result of the COVID-19 pandemic. In addition, 38.1% ($n = 37$) of respondents indicated that there were PBCs or additional skills that need to be emphasized more or less during graduate training and genetic counseling practice as a result of their experience during the pandemic.

3.7 | Thematic analysis

Of the 97 respondents, 97.9% ($n = 95$) completed at least one of the four open-ended questions assessing use of PBCs. Qualitative analysis of participants' responses identified three overarching themes (Table 1): adaptation of service delivery, translation of genetic counseling skills, and provision of psychosocial support.

3.7.1 | Service delivery

Participants commented on the ways in which they have adapted the provision of genetic counseling, often switching from in-person to phone or video settings. Many participants reflected on the use of video-conferencing platforms, applications, and websites that they

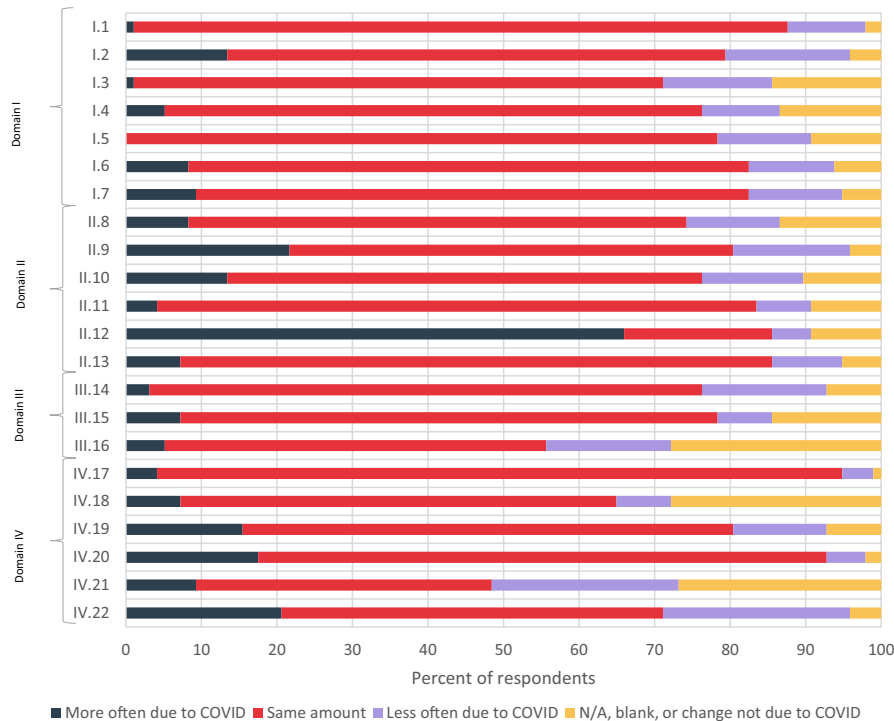


FIGURE 2 Responses to the question *How did your use of the following ACGC PBCs change during the initial peak of COVID-19 in your employer's region?* The Accreditation Council for Genetic Counseling (ACGC) Practice-Based Competencies (PBCs) are as follows: **Domain I: Genetics Expertise and Analysis:** I.1 Demonstrate and utilize a depth and breadth of understanding and knowledge of genetics and genomics core concepts and principles; I.2 Integrate knowledge of psychosocial aspects of conditions with a genetic component to promote client well-being; I.3 Construct relevant, targeted, and comprehensive personal and family histories and pedigrees; I.4 Identify, assess, order, facilitate, and integrate genetic/genomic testing options in genetic counseling practice (including molecular and non-molecular testing that directly impacts assessment of inherited risk); I.5 Assess individuals' and their relatives' probability of conditions with a genetic component or carrier status based on their pedigree, test result(s), and other pertinent information; I.6 Demonstrate the skills necessary to successfully manage a genetic counseling case; I.7 Critically assess genetic/genomic, medical, and social science literature and information; **Domain II: Interpersonal, Psychosocial, and Counseling Skills:** II.8 Establish a mutually agreed upon genetic counseling agenda with the client; II.9 Employ active listening and interviewing skills to identify, assess, and empathically respond to stated and emerging concerns; II.10 Use a range of genetic counseling skills and models to facilitate informed decision-making and adaptation to genetic risks or conditions; II.11 Promote client-centered, informed, non-coercive, and value-based decision-making; II.12 Understand how to adapt genetic counseling skills for varied service delivery models; II.13 Apply genetic counseling skills in a culturally responsive and respectful manner to all clients; **Domain III: Education:** III.14 Effectively educate clients about a wide range of genetics and genomics information based on their needs, their characteristics, and the circumstances of the encounter; III.15 Write concise and understandable clinical and scientific information for audiences of varying educational backgrounds; III.16 Effectively give a presentation on genetics, genomics, and genetic counseling issues; **Domain IV: Professional Development & Practice:** IV.17 Act in accordance with the ethical, legal, and philosophical principles and values of the genetic counseling profession and the policies of one's institution or organization; IV.18 Demonstrate understanding of the research process; IV.19 Advocate for individuals, families, communities, and the genetic counseling profession; IV.20 Demonstrate a self-reflective, evidenced-based, and current approach to genetic counseling practice; IV.21 Understand the methods, roles, and responsibilities of the process of clinical supervision of trainees; IV.22 Establish and maintain professional interdisciplinary relationships in both team and one-on-one settings, and recognize one's role in the larger healthcare system. *Note.* PBCs from 'Practice-Based Competencies for Genetic Counselors', 2019

had not used prior to the pandemic. These virtual platforms were also used to provide supervision and teaching for genetic counseling students. Respondents described the acquisition of telehealth skills to educate clients, such as using more descriptive analogies, rather than visual diagrams. One participant shared:

While implementing this new service delivery model, I had to adapt/change the way I counseled certain indications understanding that I would not have access to visual aids or nonverbal cues from my patients.

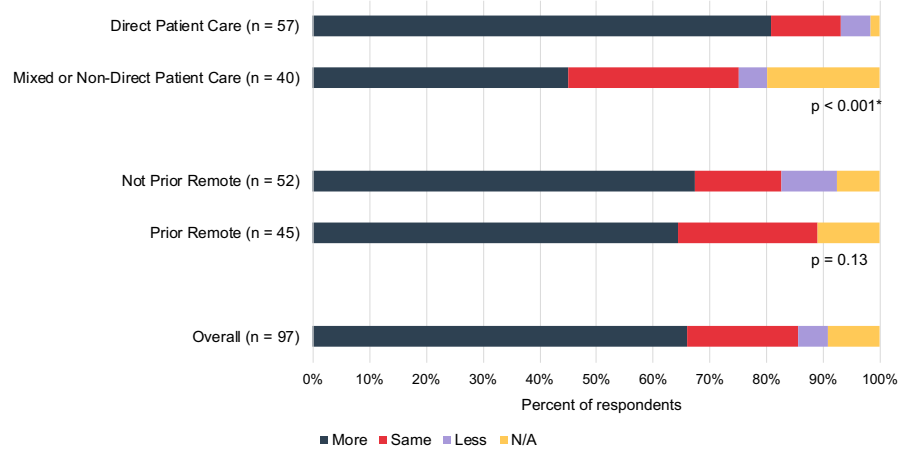
- Participant 23

In addition, participants predicted that there would be lasting service delivery changes in the profession as a result of the pandemic. As one participant noted:

I don't think the competencies need to be changed/emphasized, but I do think students will need to have more experience with telehealth models. Although clinics will ultimately move back to in-person models (if they haven't already), it is extremely likely clinics will continue to use some telehealth modalities moving forward.

- Participant 8

FIGURE 3 Data visualization of the differences between usage of the Practice-Based Competency (PBC) 'Understand how to adapt genetic counseling skills for varied service delivery models' during the pandemic. Note. *significance at $p < .05$



3.7.2 | Translation of skills

Participants described situations in which their genetic counseling skills were translated into new contexts. Some GCs were assigned to new roles such as: project management, creating science communication materials, advocating for safe infection control measures with patients, or direct involvement in COVID-19 testing and research. Participants also indicated an increased responsibility for administrative tasks, such as scheduling, sample transport assistance, and managerial roles. Participants reflected that skills used in these new roles were similar to those used in more familiar genetic counseling contexts. Other respondents reflected on more unique pandemic roles, such as the support of inpatient care and palliative care. For example, one participant shared:

We had to repurpose many of our Domain II skills as the health system asked us to step in and support our Palliative care group working with COVID patients and their families. We had two team members deployed to Palliative care and, as their supervisor, I was involved in orientation and onboarding to their new area. It was very interesting to see how effectively we could repurpose our skillset to work outside of our traditional setting to meet the needs of these patients' family members.

- Participant 75

3.7.3 | Provision of psychosocial support

The theme of psychosocial support was illuminated in three contexts: self, colleagues, and patients. Participants reflected on attendance to personal self-care and the need for resilience due to stressors caused by the pandemic. Some GCs commented on the need to provide additional support to colleagues. Finally, respondents reflected on a need to further improve the provision of psychosocial and counseling support to patients when sessions were conducted virtually.

One participant commented:

There is more in-depth psychosocial counseling now. Understanding basic living needs is important and we didn't ask those questions before. Also, we have a glimpse into the in home dynamics with other family members present to get a better understanding of how the home works and what needs might be.

- Participant 30

4 | DISCUSSION

This study demonstrated that the vast majority of surveyed GCs experienced some type of change in their professional or volunteer capacities, while a few were even redeployed into totally new roles or took on an additional job. Even with these changes, the majority of respondents reported using their core genetic counseling skills and felt competent or very competent using the established ACGC PBCs in their changed roles. This demonstrates the generalizability of genetic counseling skills and the adaptability of practicing GCs in a variety of settings. For all PBCs except one, some respondents indicated that they were utilizing a given PBC more often during the pandemic, while other respondents indicated that they were utilizing that PBC less often during the pandemic. This suggests that GCs adapted their skill set in unique and possibly position-specific ways during the COVID-19 pandemic.

In addition, these data emphasize the need for continued focus on new technologies and adaptation of the PBCs as the field evolves. The genetic counseling profession has expanded into roles that did not exist as recently as a decade ago (Uhlmann et al., 2020). GCs continue to find ways to use their skills and perform at the top of scope. As many of the free-text responses highlighted, GCs can continue to develop their competencies by working in different settings, such as project management and science communication beyond medical genetics, while also learning new technologies and models to promote flexibility of the genetic counseling skill set in the future. This study suggests that the PBCs capture fundamental skills that

TABLE 1 Participant quotes from the thematic analysis

Theme	Sub-theme	Illustrative quotes
Service delivery	Telehealth skills	'The ability to verbally draw pictures when not able to in person' - Participant 12 'While implementing this new service delivery model, I had to adapt/change the way I counseled certain indications understanding that I would not have access to visual aids or nonverbal cues from my patients'—Participant 23
	New technology	'Doximity app video chatting and communicating with colleagues and staff through multiple modes of communication like MS Teams, Zoom and text. I am using my personal cell phone and number to conduct business calls, which is something I did not do before the pandemic'—Participant 47 'Learning how to navigate all the technology that we needed to download, install, learn, etc to be able to work remotely and see patients remotely. And also how to help patients and families also learn how to problem solve the technology'—Participant 76
	Education	'Did take on some coordination of trainees from multiple clinical programs due to clinical COVID restrictions on the number of trainees per patient'—Participant 11 'Students need to be taught how to use video or telehealth apps and not fear doing it themselves'—Participant 47
Translation of skills	Project management	'I am involved in a non-patient facing research project. Since we're all working remotely my role has changed slightly to include more admin/project management tasks'—Participant 49
	Science communication	'If you removed the word genetic or genomic from a lot of these skills - they were used during this time. E.g. critically assess genetic/genomic, medical and social science literature and information - if it had been critically assess medical and social science literature and information, that is something I have been doing a lot of and feel quite competent. It is just that I am assessing infectious disease and FDA information rather than genetic information. Or effectively give a presentation on genetics, genomics and genetic counseling issues - I am giving less genetic presentation, but am doing a ton of COVID-19 testing lectures and training'—Participant 59 'We were previously counseling all patients via telehealth so my primary role did not change, but I was added to a COVID team developing education materials for different types of COVID tests'—Participant 62
	Palliative care	'We had to repurpose many of our Domain II skills as the health system asked us to step in and support our Palliative care group working with COVID patients and their families. We had two team members deployed to Palliative care and, as their supervisor, I was involved in orientation and onboarding to their new area. It was very interesting to see how effectively we could repurpose our skillset to work outside of our traditional setting to meet the needs of these patients' family members'—Participant 75
	Inpatient skills	'Inpatient work tied in well with my role switch. Training related to inpatient work is expanding, and would be a good area to include in education of GCs'—Participant 24
	Advocacy	'I think that COVID has highlighted the importance of self-reflective practice (PBC V.20), and advocating for yourself, your clients and your communities'—Participant 33 'It was very emotionally challenging. I found myself having to advocate for patients/visitors on a daily basis'—Participant 97
	COVID-19 testing, research	'Laboratory and research roles began to focus more on COVID and virology testing than traditional genetic testing'—Participant 15 'There were no initial changes other than less volume. As time went on, my role changed more substantially and to focus more on COVID-19 specific tasks (testing sites and COVID-19 test results)'—Participant 7 'I was asked to help coordinate and train the onsite clinical and non-clinical staff at the sites on how to use the sample collection software and collect a nasal sample using our FDA approved collection device. My experience teaching clinicians about genetic testing made this an easy transition for me and I really enjoy helping people understand how something works'—Participant 59

Theme	Sub-theme	Illustrative quotes
Provision of psychosocial support	Counseling skills	<p>'There is more in-depth psychosocial counseling now. Understanding basic living needs is important and we didn't ask those questions before. Also, we have a glimpse into the in home dynamics with other family members present to get a better understanding of how the home works and what needs might be'—Participant 30</p> <p>'I believe that psychosocial skills should be emphasized more. As our clients (and everyone else in the world) are experiencing an unprecedented amount of stress and anxiety due to COVID-related issues (including but not limited to worry about illness, economic concerns, etc), our psychosocial skills are more important than ever'—Participant 33</p> <p>'I expressed empathy toward patients who were having a personal crisis (ie cancer diagnosis) while the world was focused on a broader crisis (ie pandemic). This was difficult for patients emotionally because those who may have been available for support were not. This was also difficult medically as treatments were delayed'—Participant 42</p>
	Self-care and resiliency	<p>'Self care and self empathy were important skills to develop during the pandemic'—Participant 1</p> <p>'Can I count my resiliency as a skill? Although I realize how lucky I was to have the furlough time with the increased unemployment benefits...it was a really tough 3 months where I wasn't allowed to do anything related to work. I found a therapist and when I returned in August, I came back at 0.8 FTE so that I could continue to do some of the volunteer and other activities I had rediscovered during my furlough time'—Participant 39</p>

can be applied broadly, even during a global pandemic. However, the fact that certain PBCs were used more during the pandemic suggests that the genetic counseling profession should continually re-evaluate the relative emphasis of each PBC in training and/or continuing education overtime. In particular, it may be beneficial to evaluate NSGC/CAGC educational initiatives and training program curricula to see where additional opportunities for remote training can be incorporated, even after the pandemic no longer necessitates a shift to completely remote service delivery.

The majority of respondents indicated that they were working remotely and/or using telehealth during the initial pandemic peak in their employer's region. In addition, the majority of respondents felt they were *'adapting genetic counseling skills for varied service delivery models'* more often during the pandemic than before. The trend toward remote work as a result of the pandemic will likely have a lasting impact on healthcare, as the majority of professions that could work remotely transferred to and remained remote throughout the pandemic (Bergstrom et al., 2020; Contreras et al., 2020). The transition to remote work in the genetic counseling profession is supported by multiple studies that revealed no significant outcome difference between in-person genetic counseling and telehealth genetic counseling. (Bracke et al., 2020; Bradbury et al., 2016; Hilgart et al., 2012). In addition, although there are challenges to the implementation of new service delivery models (Khan et al., 2020), offering telemedicine services can reduce barriers to care for patients in remote areas, individuals with limited transportation options, or those with physical disabilities that make travel challenging (Boothe et al., 2020; Cohen et al., 2016; Hilgart et al., 2012; Valdez et al., 2020). Inclusion of additional methods for learning about alternative service delivery models will remain imperative for the profession even after the pandemic ends, which was emphasized by some of the participants

in their free response answers. Although 2019 ACGC accreditation standards already state that student participatory cases and field experiences need to utilize more than one service delivery mode ('Standards of Accreditation for Graduate Programs in Genetic Counseling', 2019), the study data suggest that additional emphasis during training may be needed. Furthermore, supplemental training should be made available to practicing GCs who may not have had the benefit of such training when they were students.

Studies conducted prior to the COVID-19 pandemic demonstrated that patients generally report high satisfaction with virtual genetic counseling visits (Buchanan et al., 2015; Zilliacus et al., 2011). However, some GCs have expressed concern in the past regarding their ability to provide sufficient psychosocial counseling virtually (Zierhut et al., 2018). Some participants in the present study noted challenges regarding the provision of psychosocial support while providing telehealth during the pandemic, including adapting to counseling without nonverbal cues and addressing patients' psychosocial concerns unrelated to genetics. However, for all PBCs in Domain II ('Interpersonal, Psychosocial, and Counseling Skills'), the majority of participants felt competent or very competent using the skill during the pandemic. It remains to be seen whether there will be any lasting impacts on the provision of psychosocial counseling in light of experiences during the pandemic. Nevertheless, given the likelihood of continued remote service delivery even after the pandemic, clinical supervision of students in a remote setting should be an increased focus for training, and practicing GCs may need additional preparation to feel equally as effective at using telehealth methods as with in-person counseling models.

Quantitative and qualitative responses indicated that GCs adapted their interdisciplinary relationships in response to the pandemic. While those in direct patient care roles reported using the

PBC 'Establish and maintain professional interdisciplinary relationships in both team and one-on-one settings, and recognize one's role in the larger healthcare system' less, those in non-direct and mixed roles increased the use of this PBC during the pandemic. It is possible that GCs in non-direct or mixed roles may have had prior experience in establishing interdisciplinary relationships within their team or organization when roles and responsibilities were less defined and were able to draw upon that experience during the pandemic. For example, Rabideau et al. (2016) describe how GCs working in start-ups often have to establish their role in a setting with less structure and more fluidity than a traditional hospital or clinic setting. This suggests the need for additional support in the collaboration between disciplines in centers that primarily rely on in-person interactions, perhaps through increased use of communication technologies. Similarly, GCs shared that the pandemic greatly impacted their psychosocial assessments and interventions, both with their patients and with their colleagues. During a time in which nearly all aspects of daily life have radically changed, and many families are struggling with basic necessities, the support offered by GCs has broadened significantly beyond genetics.

Of note, a significant proportion of qualitative responses to the question, 'Please describe the changes to your role and/or responsibilities due to COVID in more detail', indicated that many GCs are taking on additional administrative tasks: people management, appointment scheduling, sample collection, and other clerical duties. This may be attributed to several factors, including layoffs and furloughs of administrative staff, the need to coordinate remote sample collection and return, and the updated set of tasks inherent to a virtual service delivery model. However, administrative skills were not noted in response to the question, 'Which competencies or skills do you think need to be included and/or emphasized more, and why?' This potentially indicates a recognition of the fact that these new responsibilities are expected to be temporary and are not a part of the core genetic counseling role.

4.1 | Study limitations and future directions

Limitations of this study include the low response rate (1.9%) and relatively small sample size ($n = 97$), which limits the generalizability of the findings beyond the study sample. The demographics of study respondents were similar to those reported in the 2020 PSS with regard to gender, race, remote status, and top practice areas; however, there were some differences in role type and employer setting. This study had a higher percentage of GCs in direct patient care roles than the PSS. It is possible that those in direct patient care roles were more likely to think this study was relevant to their practice. The PSS had a 49.6% response rate in 2020 ('NSGC Professional Status Survey: Reports', 2020) and also may not exactly reflect the demographics of the North American genetic counseling population that this survey attempted to sample. In addition, this study had an unusually high drop off rate. All 80 participants who

started but did not complete the survey dropped off at the start of the table in Section 2: Quantitative assessment of competencies (Supplement S1), which may have been due to the length of the table including all 22 PBCs.

This study was meant to provide a baseline understanding of the changes in genetic counseling practice and use of the PBCs due to the COVID-19 pandemic while the pandemic was ongoing. Participants were asked to think retrospectively about their experience during the initial peak of the pandemic, but when the study was conducted, the pandemic was continuing to worsen, and it continues to have an effect on genetic counseling practice over a year after it began. In addition, individuals who experienced changes to their role or responsibilities may have been more likely to complete the survey. Future studies can repeat this survey to gain a longitudinal analysis of practice and competency changes over time. It would be valuable to explore genetic counseling training program adjustments in response to the pandemic, as well as to further investigate the reasons behind the reported changes to GC roles and PBC use.

4.2 | Practice implications

The increased use of telehealth service delivery models during the pandemic demonstrates the importance of ensuring genetic counseling students, and practicing professionals are competent in using a variety of service delivery models and new technologies. Given that the vast majority of respondents indicated that they moved into a remote work setting during the pandemic, it is conceivable that GCs will continue to work remotely when possible in the future. As such, increasing opportunities to train in the use of telehealth technologies and in how to modify pertinent aspects of genetic counseling (e.g., psychosocial assessment without nonverbal cues) would be beneficial moving forward.

5 | CONCLUSION

This study investigated changes in use of the ACGC PBCs and changes in professional or volunteer genetic counseling roles during the COVID-19 pandemic. Findings demonstrate that significant changes did occur, with 97.9% of participants endorsing some form of change to their role specifically due to the pandemic. Nevertheless, GCs continued to feel competent in their use of the PBCs, showing resilience when faced with a changing environment. The most significant change was the expanded use of telehealth or remote work. Participants suggested a need for additional training around new technologies and adapting genetic counseling skills for varied service delivery models. This study highlights the importance of continuing to provide and potentially expanding opportunities for training in telehealth, varied service delivery, and the related technologies for both students and practicing GCs.

AUTHOR CONTRIBUTIONS

All authors confirm that they had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors made significant contributions to the conception and design of this study. Sarah Witherington was responsible for the acquisition of data. All authors contributed to the drafting of the manuscript, as well as the analysis and interpretation of the data. All of the authors gave final approval of this version to be published and agree 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.

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COMPLIANCE WITH ETHICAL STANDARDS

CONFLICT OF INTEREST

Naomi E. Wagner is a full-time employee of and owns stock in Invitae Corporation. Sarah Witherington is a full-time employee of BioReference Laboratories. Larissa Waldman declares that she has no conflicts of interest. Lauren Ryan is a full-time employee of GRAIL, Inc. and owns stock in GRAIL, Inc. and Color Health, Inc. Melanie W. Hardy and Sarah Witherington were the chairs of the Laboratory/Industry Special Interest Group of NSGC at the time of this study, though they did not participate in the decision to fund this study.

HUMAN STUDIES AND INFORMED CONSENT

This study was reviewed and granted an exemption by the Emory University Institutional Review Board (IRB #00001450). All applicable international, national, and/or institutional guidelines were followed. Informed consent was obtained for individuals electronically.

ANIMAL STUDIES

No non-human animal studies were carried out by the authors for this article.

DATA SHARING AND DATA ACCESSIBILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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