Genetic counseling student rotations in industry: How COVID-19 magnified the urgency for virtual learning options in diverse training settings

Aishwarya Arjunan1 | Merideth Sanders1 | Anthony Chen2 | Breanna Roscow2 | Jessica Ray1

1 Myriad Women’s Health, South San Francisco, California, USA
2 Myriad Genetics, Inc., Salt Lake City, Utah, USA

Correspondence
Aishwarya Arjunan, 180 Kimball Way, South San Francisco, CA 94080 USA.
Email: arjunan.aishwarya@gmail.com

Abstract
The COVID-19 pandemic created unprecedented challenges worldwide that required rapid adaptation and transformation across the entire healthcare system. Graduate medical training programs across all specialties have moved to rapidly adjust to the virtual landscape. This created a unique opportunity for genetic counselors who work in industry and within diagnostic laboratories to develop internship and rotation programs that can be offered virtually to meet the needs of genetic counseling training programs. Myriad Genetics, Inc., was contacted by numerous graduate programs in genetic counseling beginning in March 2020 requesting the opportunity for their students to participate in remote laboratory-based rotations. As a result of these requests, a working group of genetic counselors across Myriad came together to adapt existing experiences to fully remote formats and develop new remote-based opportunities for students. We describe our experience of expanding genetic counseling student rotations during the COVID-19 pandemic with the goal of providing examples of remote learning experiences that may be applicable to other diagnostic laboratory industry-based rotations for genetic counseling students. In 2020, a total of 59 second-year genetic counseling students, from 21 different genetic counseling training programs, participated in one of five different virtual experiences. Furthermore, two new rotation experiences were created to increase capacity and highlight diversity of industry roles. Genetic counselors in industry are uniquely positioned to provide both remote training opportunities for genetic counseling students and exposure to the variety of roles that genetic counselors can occupy. Increasing the exposure to these roles is important as the genetic counseling workforce continues to expand and diversify, and it is imperative among all programs to enable access to these opportunities.

Keywords
COVID-19, education, genetic counseling, genetic counseling rotations, training
1 | INTRODUCTION

At the inception of the profession, genetic counselors were by and largely employed in clinical roles involving direct patient care. As the field of genetic counseling has grown, the demographics of genetic counseling work environments have changed drastically over time, where now 25% of genetic counselors work in non-patient-facing roles, and of those, 62% work for a diagnostic laboratory, whether commercial, non-commercial, and/or academic (NSGC Professional Status Survey: Executive Summary, 2020).

Accreditation standards for the training of new genetic counselors have begun to evolve along with work environments. In its last revision to the standards of accreditation, the Accreditation Council for Genetic Counseling (ACGC) stated that genetic counseling training programs must demonstrate that field experiences be provided to students across diverse settings including ‘clinical, laboratory, research, industry and/or other environments’ (ACGC Standards of Accreditation, 2019a). However, the number of eligible supervisors and the adherence of standards to a traditional set of rotation types historically have been a barrier to the expansion of training programs and the genetic counseling workforce (Pan et al., 2016). Additionally, competencies that reflect the breadth of skills required by genetic counselors in industry settings are largely still not covered by traditional rotation requirements (Waltman et al., 2016). As the number of genetic counselors employed by diagnostic laboratories increases, an important question is whether genetic counseling programs are adequately training students for the current job market (Riconda et al., 2018).

The COVID-19 pandemic has created unprecedented challenges worldwide that have required rapid adaptation and change to healthcare delivery methods, which have been felt by healthcare professionals at all levels, including genetic counselors. The 2021 National Society of Genetic Counselors Professional Status Survey Special Report: Workforce Changes during the pandemic found that 85% of genetic counselor respondents who work in direct patient care worked remotely some or all the time during 2020, compared to only 20% in 2019 (NSGC Professional Status Survey Special Report, 2021).

The COVID-19 pandemic also impacted many healthcare professional training programs. On March 17, 2020, the Association of American Medical Colleges (AAMC) released guidance stating that medical students should be removed from clinical rotations that involved direct patient care (Weiner, 2020). ACGC also released its first guidance on COVID-19 to genetic counseling training programs on April 8, 2020, which, for the 2020–2021 academic year, eased restrictions on remote-based instructional delivery methods (ACGC Guidance for COVID-19 Related Changes, 2020). There are currently 51 accredited genetic counseling graduate programs in the United States and four in Canada (ACGC Program Directory, 2019b). Prior to the COVID-19 pandemic, several of these programs established and utilized virtual learning for all or part of their course curriculum. However, after the widespread shutdowns of universities across the United States, most genetic counseling training programs were forced to switch from in-person learning to virtual learning.

What is known about this topic

There is little information regarding how rotation sites for graduate programs in genetic counseling, including those in industry, have adapted to training students during the COVID-19 pandemic.

What this paper adds to the topic

This paper highlights one laboratory’s experience in offering additional rotation experiences to genetic counseling students during the COVID-19 pandemic and shows how industry is uniquely positioned to provide both remote training opportunities and increase exposure to the variety of roles genetic counselors can occupy.

Myriad Genetics, Inc. (Myriad), founded in 1991 and headquartered in Salt Lake City, UT, develops and offers molecular screening and diagnostic tests for a wide variety of indications, ranging from hereditary cancer, urologic cancer, prenatal screening, carrier screening, autoimmune disorders, mental health, and other diseases.

Myriad has offered genetic counseling student industry experiences since 2006, and due to the diversity of roles held by genetic counselors at Myriad, it has expanded trainee offerings across multiple departments within the company. Historically, the student rotations available through Myriad have been a mixture of in-person and remote experiences; however, beginning in March 2020, numerous requests were made from genetic counseling training programs for more remote laboratory-based rotations and experiences. As a result, a working group of genetic counselors across Myriad came together to adapt existing offerings to be remotely delivered and to develop new remote-based opportunities for students.

2 | ADAPTATION OF INTERNSHIP AND ROTATION OPPORTUNITIES

All internship and rotation experiences offered in 2020 (Table 1) were virtual and conducted through Zoom© (Zoom Video Communications, Inc.). Here, we define an internship to be largely a shadowing or educational experience with few or no assignments, whereas we define a rotation to include assignments and more hands-on interactive experiences.

At the establishment of the working group, the short-term goal was to best accommodate the needs of each program and the students with the resources available at the time. The structure and content of existing rotation options were adapted and expanded, and students from both the same and different programs were combined when possible. The long-term goal was to update and expand offerings with a remote component so that students from all accredited graduate programs would be able to participate and not only...
| Experience                  | Length (location of rotation) | Learning objectives                                                                 | Activities and assignments                                                                 |
|-----------------------------|-------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Internships                 |                               |                                                                                      |                                                                                              |
| Field-Based Internship\(^a\,^b\) | 3–4 days (Remote)             | • Describe the role of the RMS                                                       • Introduce students to the role of RMS and PE genetic counselors by shadowing healthcare provider and patient interactions |
|                             |                               | • Recognize what genetic counseling competencies are most utilized in the RMS role    | • Assignments: No assignments. Observational only. The Field-Based Internship is completed while students also participate in a full-time rotation outside of Myriad |
| Summer Internship\(^a\)     | 4 days (Onsite in Salt Lake City, offered remotely in 2020 and 2021) | • Describe the various types of roles that genetic counselors can fill in a laboratory • Meet with genetic counselors in varied roles throughout the company to learn about their background and job responsibilities |
|                             |                               | • Compare and contrast the responsibilities of an RMS versus a MIL                  | • Observe the PE and MIL genetic counseling team and interactions with internal and external stakeholders |
|                             |                               |                                                                                        | • Network with genetic counseling students from other programs                                |
|                             |                               |                                                                                        | • Assignments: Prior to the rotation, students are expected to read two articles on laboratory genetic counseling and ethical/professional challenges encountered by laboratory genetic counselors and document any examples of these they observe during the rotation |
| Rotations                   |                               |                                                                                      |                                                                                              |
| Medical Affairs Rotation\(^a\) | 3–14 weeks (Remote)           | • Identify the genetic counseling competencies used in RMS and PE roles              • Observe genetic counselors in the RMS and PE role use core genetic counseling skills to provide education and medical support to stakeholders in other departments and healthcare providers and patients |
|                             |                               | • Perform provider-education role plays for common laboratory scenarios              • Role-play provider-education scenarios addressing appropriate patient identification through the utilization of society guidelines, case reviews and patient identification plans |
|                             |                               | • Demonstrate understanding of external-facing clinical product considerations through written assignments and formal presentations | • Prepare to address common questions and concerns regarding the use of genetic tests and screens from genetics and non-genetics specialists |
|                             |                               |                                                                                        | • When time allows, students supplement their rotation with professional development activities and recordings. Topics include resume and cover letter reviews, presentation skills, concepts of adult learning, email-writing, and Insights Discovery\(^b\) |
|                             |                               |                                                                                        | • Assignments: For students completing the rotation at the beginning of their second year who may have little rotation and clinical experience, the assignments are more introductory, such as reviewing conditions included on an expanded carrier screening panel. Later in the year, assignments can include practicing responses to providers, journal club, and pitch presentations, which challenge students to learn more about the prenatal genetics and hereditary cancer landscapes. Students are asked to submit weekly written reflections on new and surprising learnings and their thoughts on why topics and activities are included in the syllabus in addition to an overall reflection at the end of the rotation |
| MIL Rotation\(^a\)          | 1–6 weeks (Onsite in Salt Lake City) | • Describe the role of an MIL and identify the genetic counseling competencies used in the MIL role | • Observe the MIL genetic counseling team and interactions with internal and external stakeholders |
|                             |                               | • Demonstrate understanding of external-facing clinical product considerations through written assignments and formal presentations | • Gain an understanding of support provided by Myriad to healthcare providers offering genetic testing to their patients |
|                             |                               | • Critically review scientific articles and apply findings to product improvement     | • Assignments: Depending on the length of the rotation, students may assist with chart review, craft email responses to providers, and/or review journal articles and present at a journal club |

(Continues)
| Experience                        | Length (location of rotation) | Learning objectives                                                                                                                                                                                                 | Activities and assignments                                                                                                                                                                                                 | Assignments: |
|----------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| University of Utah Rotation⁷     | 2 weeks (Onsite in Salt Lake City, offered remotely in 2020 and 2021) | • Describe the role of an MIL and identify the genetic counseling competencies used in the MIL role  
• Describe testing process and workflow of a genetic testing laboratory  
• Explain the variant classification process used at Myriad | • Observe the MIL genetic counseling team and interactions with internal and external stakeholders  
• Learn about the inner workings of a genetic testing laboratory, including sample flow, genetic testing technology, data review, and quality assurance measures, and participate in a laboratory tour  
• Participate in seminars on variant classification  
• Become familiar with types of genetic testing technology and present related information to their peers | Prior to the rotation, students are expected to read two articles on laboratory genetic counseling and ethical/professional challenges encountered by laboratory genetic counselors and document any examples of these they observe during the rotation. Students also present a 30-min talk on genetic testing technology and participate in group discussions |
| Clinical Development             | 4–6 weeks (Remote)           | • Distinguish between various internal and external genetic counselor roles within the clinical development department at Myriad  
• Design an advocacy awareness campaign with the patient advocacy and marketing team  
• Evaluate competitive landscape and formulate recommendations for product improvement | • Introduce students to the roles of product management, patient advocacy, provider engagement, and research and development  
• Work with patient advocacy and marketing team to design an advocacy awareness campaign  
• Learn about the carrier screening and non-invasive prenatal screening landscape and differences between offerings  
• Participate in weekly product team meetings to understand how various individuals work cross-functionally to maintain and update a product | Students are expected to participate in a weekly journal club, develop a laboratory comparison matrix to learn about all the various laboratories in the prenatal screening space, craft email responses to provider questions, and work with the rotation supervisor to develop a final project based on student interest that results in a presentation to the clinical development leadership team on findings |
| Clinical Genomics: Reproductive  | 4–6 weeks (Remote)           | • Distinguish between various internal and external genetic counselor roles within the clinical genomics department at Myriad  
• Explain and apply the variant classification process used at Myriad by the reproductive team  
• Critically evaluate borderline cases and key considerations for clinical reporting | • Expose students to the roles that genetic counselors play within variant curation, laboratory operations, and report review at a clinical diagnostic laboratory with a focus on prenatal screening and the Foresight product  
• Participate in Edge Case team meetings with curators and laboratory directors involving difficult/borderline curation cases  
• Learn the differences in curation of AD versus AR diseases, and in population screening versus diagnostic setting  
• Gain ability to recognize types of variants and tendency towards pathogenicity | Participate in Journal club, variant type matching quiz, classification practice, provider response practice, and a final clinical case project |
students from programs who proactively reached out. The working group discussed various topics and ideas for projects and assignments that could help students get a better understanding of the responsibilities one may have in a particular role.

Enhancements to existing experiences and the development of new offerings were designed to meet the following objectives: flexibility, accessibility, and exposure to diverse and varied educational interactions. Rotations and internships were structured to ensure that students: accrued adequate hours of learning experiences as requested by the participating training programs; could self-select topics of greatest interest to them; and would have increased knowledge of possible roles for genetic counselors in industry. All participating students had a general list of expectations to follow as described in Table 1. All students provided feedback on an ongoing basis and at the end of the internship and rotation. For rotations, the supervisors also completed student evaluations sent by the respective training programs.

3 | PROGRAM OUTCOMES

3.1 | Demographics

Between January 1, 2020 and December 31, 2020, a total of 59 second-year genetic counseling students, from 21 different genetic counseling training programs, participated in one of five different experiences at Myriad, and all delivered virtually beginning in April 2020 (Table S1). By comparison, a total of 39 second-year genetic counseling students from 14 different genetic counseling training programs participated in an internship or rotation in 2019.

### Table 1 (Continued)

| Experience                                      | Length (location of rotation) | Learning objectives                                                                 | Activities and assignments                                                                 |
|-------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Clinical Genomics: Hereditary Cancer<sup>b</sup> | 6 weeks (Remote)              | • Distinguish between various internal and external genetic counselor roles within the clinical genomics department at Myriad   | • Apply technical knowledge and understanding to testing technology, variant identification, and variant nomenclature |
|                                                 |                               | • Explain and apply the variant classification process used at Myriad by the hereditary cancer team | • Understand team approach to variant classification as well as role for different individuals and teams involved in classification |
|                                                 |                               | • Design and construct external messaging around variant classification and reclassification | • Review, Understand and Utilize appropriate resources and tools for variant interpretation |
| Patient Education Team (Observation)           | 1 week (Remote)               | • Identify the genetic counseling competencies used in the PE roles                 | • Population databases (i.e., gnomAD) |
|                                                 |                               | • Compare and contrast the roles and responsibilities of a PE genetic counselor in various specialties and settings | • PubMed |
|                                                 |                               | • Recognize differences between service delivery models in genetic counseling       | • Internal Myriad classification tools |
|                                                 |                               |                                                                                     | • Identify and evaluate literature and how it may inform variant classification |
|                                                 |                               |                                                                                     | • Construct messaging, letters, and report text to explain classification/reclassification |
|                                                 |                               |                                                                                     | • Assess evidence of cancer association with ‘new’ genes and propose reasons for including/not including on a hereditary cancer panel |
|                                                 |                               |                                                                                     | • Assignments: Review variant nomenclature and sequence traces, perform review of publication and facilitate discussion; perform pedigree analysis for segregation studies; draft letter or messaging explaining variant classification; perform gene review and discuss potential cancer association |
|                                                 |                               |                                                                                     | • Observe PE genetic counselors providing pre- and post-test prenatal, cancer, and neuroscience consultations to patients |
|                                                 |                               |                                                                                     | • Learn about similarities and differences in laboratory-provided patient education and clinical genetic counseling |
|                                                 |                               |                                                                                     | • Assignments: No assignments. Observational only |

Note: All students participating in an experience at Myriad were required to complete HIPAA training and Myriad’s Workforce Confidentiality Agreement prior to the scheduled start date. The students also reviewed and signed Student Participation Agreements. Students were expected to attend all scheduled didactic sessions, complete assignments by scheduled due dates, complete and present any assigned projects at the end of their rotation, effectively communicate with their supervisors, and peers, and provide feedback at the end of the rotation.

Abbreviations: MIL, medical information liaison; PE, patient education; RMS, regional medical specialist.

<sup>a</sup>Denotes experience available prior to 2020.

<sup>b</sup>Denotes rotation developed prior to COVID-19 but was not available in 2020.
By updating and adapting existing offerings to virtual formats, additional 20 students were able to participate in one of the offered experiences in 2020 compared to 2019. This resulted in a 1.5-fold increase in both the number of students and the unique training programs participating in a rotation or internship experience at Myriad. More than 40 genetic counselors in a variety of roles across six departments at Myriad participated in these rotations and internships by providing lectures, coaching, or mentorship (Table S2).

An overarching goal across all internship and rotation experiences was for students to develop a broader understanding of the varied roles genetic counselors can assume in a diagnostic industry setting at Myriad Genetic Laboratories. Comprehensive descriptions and objectives for each of the experiences are detailed in Table 1. As a result of the COVID-19 pandemic, many of the business operations of the laboratory had already switched to remote work which allowed for us to include students more readily.

3.2 | Feedback

Reflection assignments, in addition to weekly or bi-weekly check-ins with supervisors and final rotation evaluations, allowed genetic counselors overseeing the various rotations and internships to not only hear feedback throughout the rotation but also to better understand how students were processing what they were learning. During the process of implementing pandemic-necessitated changes to these experiences, other necessary changes in the curriculum were also made. These included the updating of previous recordings, increasing prenatal screening content, increasing the variety of assignments, and the addition of projects.

Five general areas of feedback were observed and noted from the student evaluations, reflection statements, and one-on-one conversations (Table 2). They include requests for more case-based learning and real-time observations, breaks between sessions, scheduling of lectures and meetings, and requests for additional networking opportunities. Students also provided comments on how the industry experience provided value. These areas of feedback primarily emerged from the Summer Internship and Medical Affairs Rotation based on the number of students who completed these experiences compared with the number of students who completed the other three experiences in 2020. The development and addition of the one-week PE internship addressed the multiple requests for more case-based learnings and real-time observations. Similarly, the feedback to better distribute presentations and calls for the Medical Affairs Rotation resulted in changes where students were given access to pre-recorded calls to watch at their convenience. Students were then asked to schedule one-on-one conversations with individuals when their schedule permitted. The ask for networking opportunities led to the incorporation of an ice-breaking activity into the summer internship and to the overlapping of students from multiple training programs whenever possible in the Medical Affairs Rotation. All students reflected that they valued the opportunity to learn more about roles in industry and how genetic counseling skills are transferable.

The feedback gathered through these experiences was also considered while developing the additional observation and rotations.

3.3 | Newly developed experiences

While the short-term goal was to adapt existing rotations to accommodate additional students as needs arose from genetic counseling training programs during the COVID-19 pandemic, we also identified opportunities for expansion and inclusion of more permanent virtual rotations. Two additional virtual rotations in clinical development and reproductive clinical genomics were created along with a one-week virtual patient education (PE) team experience (Table 1). An example syllabus for the reproductive clinical genomics rotation can be found in the Appendix S1. With the development of these additional rotations, Myriad now offers six multi-week rotations, two internships, and a one-week observation experience (Table 1).

4 | NEXT STEPS

The experience described here illustrates how genetic counselors working in laboratories are well situated to help to address the need for remote-based laboratory rotations and experiences not only during the COVID-19 pandemic but also in a post-pandemic era in which genetic counseling roles and opportunities continue to expand and grow.

4.1 | Practice implications

The demand for genetic counseling and genetic counselors has increased over the last decade and is projected to grow 21% over the next decade (Bureau of Labor Statistics, US Department of Labor, 2019). The variety of roles held by genetic counselors has also increased in this era of precision health. In 2010, only 17% of genetic counselors reported working in a non-clinical setting compared to 25% in 2020 (NSGC Professional Status Survey: Executive Summary, 2010, 2020). The genetic counselor skill set is highly valued in industry settings where genetic counselors have a variety of roles including but not limited to product development, sales, variant curation, report writing, research, payer markets, marketing, and telegenetics. Therefore, it is important that genetic counseling trainees are exposed to a variety of different rotations and experiences so that they are well prepared to enter the workforce.

A 2018 study showed that many genetic counselors who had supervised genetic counseling trainees in their past clinical roles were not supervising students in their current industry positions (McWalter et al., 2018). Historically, some genetic testing laboratories, including Myriad, offered rotations and internships to local genetic counseling programs in a variety of formats (McWalter et al., 2018). However, with the increase in genetic counseling programs throughout North America and the need for remote-based
ARJUNAN et al.

The described adaptations of Myriad’s rotations will hopefully increase access to more in-depth industry rotations and internships than have previously been available to training programs not located near commercial diagnostic laboratories. It is possible that students who would have otherwise been unable to travel for in-person rotations, despite the pandemic—for scheduling or financial reasons that would have made such a trip infeasible—were able to participate in one of many of the rotations Myriad offered in 2020.

Adapting to a virtual format allowed us to more easily adjust to students’ varying schedules and have multiple students shadow one genetic counselor at a time. The revisions also now allow for rotation components to be more interchangeable between the various experiences.

In addition to furthering students’ training in the field of genetic counseling, these types of experiences can help students to assess

| TABLE 2 | Student feedback |
|---------|------------------|
| Areas of feedback | Quotes |
| Requests for more case-based learning/real-time observations | ‘More examples of cases that were encountered, conversations that are had with health care practitioners and being able to observe more of what is done daily would have helped’. (Medical Affairs Rotation) |
| | ‘While I feel that I gained an understanding of the roles and responsibilities of the genetic counselors at Myriad, and even had an assignment that addressed provider questions, I feel that I would have benefitted from gaining exposure to an actual consult. The rotation did not offer the opportunity to observe a call between a clinic/provider and Myriad, which I really would have enjoyed’. (Medical Affairs Rotation) |
| | ‘It was a nice split between observations and presentations, but I probably would have enjoyed a little more observation time’. (Summer Internship) |
| Breaks | ‘I think small, built-in breaks between each session would have been appreciated. As you know it’s quite a long time to sit back-to-back in front of our screens’. (Summer Internship) |
| | ‘I think for other online internships, I would build in more breaks in the schedule (even 5 min breaks) because we ended up not having many, if any, breaks at all since each session was an hour and we needed to get through a lot’. (Summer Internship) |
| Scheduling | ‘It would have been more helpful to have a routine or just a couple days with a lot of meetings’. (Medical Affairs Rotation) |
| | ‘I think it would have been more beneficial to break it [viewing of recordings] over more of the rotation’. (Medical Affairs Rotation) |
| | ‘Planning of meetings to work with Myriad schedules made it very difficult as a student to create a schedule with all of the other commitments that we have’. (Medical Affairs Rotation) |
| Networking opportunities | ‘… to incorporate some structured activity for the students to get to know each other, since I was sad I didn’t have a big chance to connect with everyone when this was virtual!’ (Summer Internship) |
| | ‘I certainly liked the Codenames activity (wishing that more of us all could have attended it). I think trying a 2nd social period would have been nice (even though with many people spread across time-zones this is challenging)’. (Summer Internship) |
| | ‘Something that I would have liked more of is interaction with the [students from another training program]. This is very unique and, to my knowledge, none of my classmates have been able to interact with [students from other training programs] through rotations’. (Medical Affairs Rotation) |
| Industry experience provides value | ‘I think that regardless of if you are considering industry or not, as a student, this is a good opportunity to learn as much as you can about the profession and where GCs are working. Even if you never end up in industry, it is a very valuable learning experience. As much as I learned about genetic counselling opportunities and industry operations, I also learned a lot about myself and how I want to think about my own career.’ (Medical Affairs Rotation) |
| | ‘I learned about jobs I didn’t know existed and got a decent feel for what working in industry may be like, something we don’t get a lot of in training.’ (Summer Internship) |
| | ‘Learning about all the different roles that GCs play at Myriad was really eye-opening for me and seeing what some of the day-to-day work looks like really offers a perspective that I haven’t been getting in my training… I learned more about laboratory GCs in this week than I think I’ll ever gain from my two-year program. It’s definitely a great supplement to my GC training’. (Summer Internship) |

training due to COVID-19, it was important to examine our current offerings and explore how we could develop alternative rotations and internships to meet the growing student and remote opportunity demand. Laboratories and other commercial entities are uniquely positioned to bridge the clinical and industry worlds and offer a wealth of learning opportunities to students, not only regarding the various responsibilities of a laboratory genetic counselor, but also regarding the numerous roles that a genetic counselor can fill in any organization. As one student mentioned, ‘I learned more about laboratory GCs in this week than I think I’ll ever gain from my two-year program. It’s definitely a great supplement to my GC training’.

The COVID-19 pandemic is forcing widespread exploration of virtual formats and as a result, has further normalized remote learning and training. Many adaptations to the training of genetic counselors over the last year are likely to be long-lasting.
early on whether this is a type of role they may wish to pursue in the future. Industry experiences during training will also make students stronger applicants for these types of positions at any time during their careers. In the post-internship survey, one student stated, ‘I learned about jobs I didn’t know existed and got a decent feel for what working in industry may be like, something we don’t get a lot of in training’. Even if genetic counselors never pursue a role in industry at any time during their careers, these experiences allow for insight into the roles of future colleagues and a wealth of professional development opportunities. Another student shared, ‘I think that regardless of if you are considering industry or not, as a student, this is a good opportunity to learn as much as you can about the profession and where GCs are working. Even if you never end up in industry, it is a very valuable learning experience. As much as I learned about genetic counselling opportunities and industry operations, I also learned a lot about myself and how I want to think about my own career’.

The goal of the rotations and internships described here was to provide genetic counseling students with practical genetic counseling career experience in a safe and intellectually stimulating remote environment that would enhance and supplement their classroom. The continued development and expansion of rotation experiences in the laboratory and industry setting will help students be more prepared to enter these roles and support future employment in the field. We share our experience in hopes that other laboratories and industry partners are also able to create similar rotations or expand their current offerings for genetic counseling trainees and in the future, even prospective genetic counseling students.

4.2 | Limitations

Although we collected feedback from students on their engagement and satisfaction with the 2020 rotations and internships, it was not collected in a manner that allows comparison with feedback from previous years. However, surveys across years have consistently shown a high level of satisfaction from students regardless of the specific experience they participated in. Additional data are necessary to determine whether virtual rotations and internships are non-inferior to in-person rotations in terms of satisfaction, engagement, and content quality. Moreover, many of the opportunities for students were largely observational, thus making it more difficult to assess a student’s skills or growth over the course of their experience. Depending on the specific rotation or internship or the time of year, either longer or dedicated experiences wherein students can entirely focus on an elective laboratory rotation, or additional framework for students to take on more responsibilities of the laboratory genetic counselor over the course of the experience would allow students to be evaluated in accordance with typical standards set forth by the ACGC for training programs. Additionally, it was noted that student evaluation forms provided by training programs were rarely adapted for a non-clinical rotation and asked supervisors to evaluate many areas that were only applicable to a clinical rotation. As such, it is important that training programs and industry rotation settings work collaboratively to both develop and refine learning objectives of the rotations and learning experiences and ensure that students can be properly evaluated based on the objectives of the rotation.

5 | CONCLUSION

There is a need in genetic counseling training for students to have more exposure to diverse roles. The COVID-19 pandemic has demonstrated genetic counseling training programs can incorporate virtual and remote-based options as a means for providing such training. Genetic counselors in industry are uniquely positioned to provide both remote training opportunities for genetic counseling students and exposure to the variety of roles that genetic counselors can occupy. Increasing exposure to these roles is important as the genetic counseling workforce continues to expand and diversify, and there is an imperative among all programs to enable access to these opportunities.

AUTHOR CONTRIBUTIONS

AA conceived the idea, assisted with data review and interpretation, and lead writing, editing, and preparation of the manuscript. MS also helped conceive the idea, assisted with data review and interpretation, as well as writing, editing, and preparing the manuscript. AC, BR, and JR were critical in assisting with data review and interpretation, writing, editing, and preparing the manuscript. AA, MS, and AC confirm that they had full access to all the data and take responsibility for the integrity of the data and the accuracy of the data review and interpretation. 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.

ACKNOWLEDGEMENTS

We would like to acknowledge and thank all of the genetic counselors within Myriad that volunteered their time and participate in the various rotation experiences.

COMPLIANCE WITH ETHICAL STANDARDS

CONFLICT OF INTEREST

All authors (AA, MS, AC, BR, and JR) are or were employees of Myriad Genetics, a commercial genetic testing laboratory.

HUMAN STUDIES AND INFORMED CONSENT

Internal Review Board review approval was not necessary for this as it did not include research involving human subjects.

ANIMAL STUDIES

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

The authors confirm that the data supporting the findings of this report are available within the article and its supplementary materials; raw data files and qualitative data can be provided from the authors upon request.

ORCID

Aishwarya Arjunan https://orcid.org/0000-0002-7863-2388

REFERENCES

Accreditation Council for Genetic Counseling (2019a). Standards of accreditation for graduate programs in genetic counselling (pp. 22). https://www.gceducation.org/standards-of-accreditation/

Accreditation Council for Genetic Counseling (2019b). Program directory. https://www.gceducation.org/program-directory/

Accreditation Council for Genetic Counseling (2020). Guidance for COVID-19 related changes. https://www.gceducation.org/guidance-for-covid-19-related-changes/

Bureau of Labor Statistics, US Department of Labor (2019). Occupational Outlook Handbook, Genetic Counselors. http://www.bls.gov/ooh/healthcare/genetic-counselors.htm

McWalter, K., Cho, M. T., Hart, T., Nusbaum, R., Sebold, C., Knapke, S., Klein, R., Friedman, B., Willaert, R., Singleton, A., Williams, L., Butler, E., & Juusola, J. (2018). Genetic counseling in industry settings: Opportunities in the era of precision health. American Journal of Medical Genetics Part C: Seminars in Medical Genetics, 178(1), 46–53. https://doi.org/10.1002/ajmg.c.31606

National Society of Genetic Counselors (2010). 2010 Professional Status Survey: Work environment. https://www.nsgc.org/p/cm/ld/fid=68

National Society of Genetic Counselors (2020). 2020 Professional Status Survey: Work environment. https://www.nsgc.org/p/cm/ld/fid=68

National Society of Genetic Counselors (2021). 2021 Professional Status Survey: Special report: Workforce changes during the pandemic. https://www.nsgc.org/Policy-Research-and-Publications/Professional-Status-Survey

Pan, V., Yashar, B. M., Pothast, R., & Wicklund, C. (2016). Expanding the genetic counseling workforce: Program directors’ views on increasing the size of genetic counseling graduate programs. Genetics in Medicine, 18, 842–849. https://doi.org/10.1038/gim.2015.179

Riconda, D., Grubs, R. E., Campion, M. W., & Cragun, D. (2018). Genetic counselor training for the next generation: Where do we go from here? American Journal of Medical Genetics. Part C, Seminars in Medical Genetics, 178(1), 38–45. https://doi.org/10.1002/ajmg.c.31598

Waltman, L., Runke, C., Balcom, J., Riley, J. D., Lilley, M., Christian, S., Zetzsche, L., & Goodenberger, M. K. L. (2016). Further defining the role of the laboratory genetic counselor. Journal of Genetic Counseling, 25, 786–798. https://doi.org/10.1007/s10897-015-9927-4

Weiner, S. (2020). No classrooms, no clinics: Medical education during a pandemic. Association of American Medical Colleges. https://www.aamc.org/news-insights/no-classrooms-no-clinics-medical-education-during-pandemic

SUPPORTING INFORMATION

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

How to cite this article: Arjunan, A., Sanders, M., Chen, A., Roscow, B., & Ray, J. (2021). Genetic counseling student rotations in industry: How COVID-19 magnified the urgency for virtual learning options in diverse training settings. Journal of Genetic Counseling, 30, 1316–1324. https://doi.org/10.1002/jgc4.1500