Primary Care Providers’ Use of Genetic Services in the Southeast United States: Barriers, Facilitators, and Strategies

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Abstract
Introduction/Objectives: Collectively, genetic diseases are not that rare, and with increasing availability of genetics-informed healthcare management, primary care providers (PCPs) are more often asked to screen for or provide genetic services. Previous studies have identified barriers that impact PCPs’ ability to provide genetic services, including limited knowledge, training, and time/resources. This study set out to identify specific barriers limiting genetics service provision by PCPs within the Southeastern Regional Genetics Network (SERN) and resources that would help eliminate those barriers. Methods: PCPs were recruited through provider networks and invited to participate in semi-structured interviews, conducted via Zoom, recorded, and transcribed verbatim. Interview transcripts were independently coded by 2 coders using MAXQDA software. Thematic analysis was conducted. Results: Eleven interviews were conducted. Three predominant themes emerged from the data regarding factors impacting use of genetic services: system-wide factors, provider-specific factors, and patient factors. System-wide barriers included a lack of genetics providers and logistic challenges, which led to some PCPs coordinating referrals with other specialists or independently managing patients. Regarding provider-specific barriers, PCPs reported lack of genetics knowledge making referrals challenging. When possible, many PCPs contacted genetics providers for assistance. When not possible, some PCPs reached out to other colleagues or specialists for guidance. Patient-specific barriers included concerns or lack of information regarding genetics and unmet social needs. Many PCPs provided additional education regarding genetics appointments or testing benefits to their patients. Assistance from genetic counselors, electronic medical record systems that support referral to genetics, prior experience referring to genetics, established communication channels with genetics professionals, and highly motivated patients all facilitated improved collaboration with genetic services. Conclusions: PCPs face barriers at 3 different levels when engaging with genetic services: systems, providers, and patients. This study identified strategies that PCPs use to address these barriers, which are dependent on individual resources and practice settings. These strategies demonstrate resourcefulness in working to incorporate genetics into clinics operating at maximum capacity. By targeting barriers that uniquely impact providers, systems, and patients, as well as building upon strategies that PCPs are already using, medical providers can support PCPs to help with the provision of genetic services.

Keywords
primary care, genetic services, barriers, facilitators, Southeastern United States

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Introduction

Twenty-five million individuals in the United States (US) are estimated to have a “rare disease,” of which 80% have genetic etiologies.1 Other common genetic conditions include Cystic Fibrosis, Sickle-Cell Disease, Trisomy 21, along with the 5% to 10% of all cancers that are estimated to be due to inherited cancer predisposition.2,3 Cumulatively,
these rare conditions impact the lives and healthcare of a significant number of individuals in the US. When it comes to managing these patients, the availability of genetics professionals, including geneticists and Genetic Counselors (GCs), is far from sufficient. As of 2020, all 8 states in the Southeast Regional Genetics Network (SERN) region (AL, FL, GA, LA, MS, NC, SC, TN) have on average 4 GCs and 1 medical geneticist per 500,000 people. Because genetics professionals are generally responsible for managing patients with genetic conditions, limited availability can contribute to long appointment wait times and be a barrier to patient access.

Additional factors, such as social determinants of health, compound already limited access to genetics providers. Racial disparities are observed in the offering and uptake of genetic services, demonstrated in the differences in BRCA1/2 testing and knowledge in Black patients as compared to their White counterparts, which can lead to diminished impact of results, knowledge, and proactive interventions, such as risk-reducing surgeries, in historically underrepresented patient populations. Patients who live in rural areas may not have specialty medical care available nearby, including genetics services, and need to travel long distances to receive care. In the southern US, limited access to care is pervasive, with fewer GCs as compared to other regions, a population in generally poorer health, and reduced access to urban medical centers and prenatal care. In addition, patient concerns, lack of knowledge, and/or misinformation regarding genetic services can all act as barriers to care in rural and minority populations. All of these factors currently reflect limited access to genetic services which hinders the widespread delivery of personalized medicine.

Primary care providers (PCPs) are often referred to as “gatekeepers” because they see patients more directly and frequently than a specialist. With limited genetics provider availability, PCPs are increasingly utilized as a resource for identifying patients who would benefit from genetic services, coordinating subsequent referrals or testing in specialties including hereditary cancer, medical genetics, and pharmacogenomics, and even providing genetic services themselves. However, the evolving role and expectations of PCPs are unclear. In many cases, PCPs recognize the benefit of genetic services for their patients, but do not feel comfortable with ordering testing or placing referrals. This discomfort can be compounded by complex logistic processes, identifying the correct referral reason and destination, or the need to interpret genetic test results. In many cases, PCPs report needing clear guidance from clinical geneticists or GCs on when to refer.

Prior research has identified many barriers to PCPs’ ability to provide genetic services. Some of these barriers include limited genetics knowledge, lack of formal genetics training, lack of time/resources, and patient concerns. Despite identified barriers around insufficient PCP education, research suggests additional education does not always directly lead to improved genetic service provision. In some cases, provider education has increased comfort level or knowledge, but has not always corresponded to increased referrals or test ordering. While prior survey-based research demonstrated barriers to PCPs incorporating genetic services into their practice, limited information is available regarding PCPs’ perspectives of their role in providing genetic testing and their opinions regarding resources that would reduce barriers and empower PCPs. The purpose of the present study is to identify provider perspectives in the Southeastern US, using in-depth semi-structured interviews. This study aims to explore specific barriers limiting provision of genetics services by PCPs, especially those serving underrepresented patients, and to identify resources that would address those barriers.

**Methods**

Participants were recruited via an interest survey link and informational flyer, distributed via email through PCP organizations in the Southeast US, including state chapters of the American Academy of Pediatrics (AAP) and American Academy of Family Physicians (AAFP), as well as rural and community health networks. To be eligible, participants were required to be licensed PCPs, credentialed as a Medical Doctor, Doctor of Osteopathic Medicine, Nurse Practitioner, or Physician Assistant seeing at least 10 patients per week, and practicing primarily in a SERN state. Interview participants were selected from survey respondents using purposeful sampling for a representative sample in terms of participant location, race, ethnicity, experience with genetics, geographic and practice setting. Selected individuals were contacted by email or phone.

An interview guide was created by the authors (genetic counseling graduate student, licensed genetic counselor, scientist consultant, and licensed health psychologist). Interview guide development was based on the results of a targeted literature review and focused on topics relevant to the research questions, including PCPs’ experiences with genetic services, impact of patient or personal preferences on providing genetic services, previous education related to genetic services, and potential resources to positively impact genetic service provision.

Prior to conducting interviews, the interview guide was piloted with a PCP in South Carolina who did not participate in the study. Interview participants were provided with a $100 VISA gift card as appreciation of their time. This study was approved by the University Institutional Review Board.
Study interviews were conducted over Zoom from June 2021 to August 2021 and only the interviewer (ES) and participants were present for each session. Interview audio and video were recorded, and interviews were transcribed verbatim by ES. All interviews were independently coded in MAXQDA (v20.40.1) by ES and EJ. Deductive codes were generated based on prior literature, while inductive codes arose from the data during the coding process. Thick descriptions were generated for interview codes and thematic analysis was conducted. Factors that promote the provision of genetic service were considered facilitators, and factors that inhibit the provision of genetic services were considered barriers.

Results

Twenty individuals responded to the interest survey. Fifteen respondents were selected to participate in an interview and 11 completed a study interview, which lasted an average of 23 min (range: 12-31 min). Table 1 shows demographic information from interview participants. Eight participants were pediatricians and 3 worked in family/general practice. Most participants identified as White (7/11) and female (8/11). Seven participants were from North Carolina, 3 participants from Georgia and 1 from Alabama. Five participants reported serving a majority of non-White patients. Data saturation was reached after 8 interviews, at which point new inductive codes were no longer generated. An intercoder reliability of 0.71 was calculated with Cohen’s kappa and reached at 90% agreement.

Three primary themes emerged during data analysis regarding barriers and facilitators to genetic testing among Southeastern US PCPs. These were system-related, provider-specific, and patient-related barriers (Figure 1, Table 2).

| Table 1. (continued) |
|----------------------|
| Referral frequency (n=8) |
| Less than once every 12 months | 0 |
| Once every 6-12 months | 2 |
| Once every 3-5 months | 2 |
| Once every 1-2 months | 3 |
| More than once/month | 1 |
| Testing history (ordered genetic testing in the last 12 months) |
| Yes | 8 |
| No | 3 |

Testing frequency (n=8)

| Less than once every 12 months | 0 |
| Once every 6-12 months | 2 |
| Once every 3-5 months | 2 |
| Once every 1-2 months | 3 |
| More than once/month | 1 |

Clinic information

| Clinic location |
|-----------------|
| Rural | 1 |
| Suburban | 6 |
| Urban | 4 |

Closest genetics provider

| Same clinic | 0 |
| Same city | 6 |
| Different city, less than 30 miles | 4 |
| 30 or more miles away | 1 |

State

| North Carolina | 7 |
| Georgia | 3 |
| Alabama | 1 |

Patient race (estimated % of White patients)

| 0%-24% | 3 |
| 25%-49% | 2 |
| 50%-74% | 5 |
| 75%-100% | 1 |

Patient language (estimated % of patients speaking English as a Second Language)

| 0%-24% | 6 |
| 25%-49% | 4 |
| 50%-74% | 1 |
| 75%-100% | 0 |
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System Barriers and Facilitators

PCPs reported barriers to coordinating genetic services for patients that are factors of the larger healthcare system. Challenges included a lack of genetics providers leading to limited appointment availability and logistic challenges for the provider leading to referrals or tests being incorrectly placed or not placed (Figure 1). Regardless of geographic proximity to genetics providers, PCPs’ experienced challenges with sufficient appointment availability to refer

Figure 1. Barriers to genetics referral placements, in context of facilitators and strategies that can either promote or inhibit referrals.

Table 2. Selected Quotes Demonstrating Identified Facilitators Related to Systems, Providers, and Patients.

| System Facilitators | Provider Facilitators | Patient Facilitators |
|---------------------|-----------------------|----------------------|
| Assistance from Genetics Providers: “I just type it into my note and say refer to genetics and we usually pick a particular practice based on our preference. And then the nurses go ahead and call in and take care of the referral.” (S9) | Previous knowledge of indication or process: “Actually going through it, you know, like if you have referred, somebody before, you know that process and so that also helps as well.” (S5) | Patient seeking testing: “If it’s something families really want to do, then we’ll definitely make it happen. Also, some families already know that they have something that another person in the family tested positive for - with genetic testing and they...that’s what they want specifically, so we’re definitely more likely to pursue that.” (S4) |
| “Many times, it’s purely become the referral process where we will get information, clinical summary and my nurse or I will send it over there to the genetics department and they’ll tell us you need to order this or no, we want to make sure it’s done so we’ll order because we use a certain lab to do this etc.” (S3) | Contact with genetics professionals: “So a lot of our subspecialists have these e-communications where it’s sort of like a more formal curbside. You sort of have this... I have a patient I’m concerned about Marfans, what should I do? And it’s just a more formalized process where there’s they have like an in basket in the EHR and...they can bill for it and everything which is good for them. And it’s you know, in the EHR so people can see the documentation which is also helpful.” (S11) | |
| EMR Assistance: “We have a pretty good electronic system in place for referrals that works well.” (S4) | | |
patients. This was confounded by distance or specialty and often resulted in long wait times for appointments:

“It seems, at least in this area, to be a shortage of geneticists and appointment availability, and that’s really our main barrier.”

For PCPs who perceived a scarcity of genetics providers, some managed patients on their own for a longer period of time before referring, especially if they felt the need to reserve utilization of genetics providers for more dire cases:

“We definitely are more likely to manage things on our own... just to try to protect the geneticists and also try to protect families, [we] don’t want to make them drive or go somewhere that would be a big burden on them.”

In response, many PCPs reported providing genetic services directly to their patients. Other PCPs referred patients anyway, knowing the wait time for an appointment may be long. Another strategy was referring patients to other providers, either in the meantime or in place of genetics.

“Our practice doesn’t have a sort of a metabolic specialist, so that’s a little bit difficult, too. In addition to the wait time. So, I’m kind of thinking... should I send this kid to like DB [developmental behavioral] peds, for example, so they will get in a little bit sooner?”

Not having a genetics provider in the same electronic medical record (EMR) system could create barriers, even between geographically close providers. This finding of “network distance” was illuminated as some PCPs who were geographically close to a genetics provider were unable to successfully contact them or refer patients due to the PCP and genetics provider being in different hospital systems. Some PCPs reported ordering their own genetic testing, with the intent of placing a referral if the results were abnormal. Another barrier was logistic challenges associated with a complex EMR system. Some PCPs described EMR systems with many genetic tests listed, making it challenging to order a specific test. For these PCPs, some contacted the testing laboratory or a genetics provider for assistance, while others placed the test order with the hope that it was the correct test for the patient.

“Sometimes with the [hospital] system, it can be difficult to figure out which tests to order. So, sometimes, just having that guidance is helpful and I have called the lab before for that.”

Alternatively, some PCPs reported that certain aspects of their system were facilitators to providing genetic services (Table 2). Having a genetics provider to answer questions and ensure that the correct referral or test was ordered made it easier for PCPs to feel confident in ordering genetic referrals or testing:

“We will primarily consult genetics and they’ll tell us what to do, basically. And that has worked out because it is efficient for the patient.”

In some cases, communication between providers was in the form of a direct message, while other EMR systems had specific “curbside referral” or “ecommunication” options. Additionally, having an EMR system with a simple process for placing referrals or ordering testing was helpful to PCPs.

Providers were asked to recommend specific facilitators for the system-wide barriers they encountered. Changes to ordering processes, such as simplified processes for genetic testing through the EMR system, were recommended, especially for patients with frequently seen diagnoses:

“Or if there could be, like, an order set created where [the] order set could be called “new diagnosis trisomy 21”... if there is a set of labs for if we are, you know, confirming a diagnosis of trisomy 21, here are the things that we order.”

In addition, having more genetics providers, as well as building relationships with local genetics providers, would simplify the process:

“Maybe having your local genetics doctor come to just, like, talk to your practice and tell you, ‘this is our program, this is what we do, this is how you make a referral...’. That would definitely have to be, like, localized but that could be helpful as well, because that also helps you create a relationship with that department.”

Genetic testing results from laboratories with clear guidelines and implications, as well as genetic counseling information from the laboratory, was suggested to help PCPs interpret results, especially if the PCP seldom ordered testing.

Provider Barriers and Facilitators
At the provider level, PCPs reported lack of knowledge being a significant challenge to referrals. The following categories were most frequently identified as barriers: unsure where to refer, unsure what to refer patients for, unsure how to identify patients needing genetics services and how to place appropriate referrals, and unsure what patients will experience at a genetics appointment. In response to a lack of knowledge, many PCPs contacted genetics providers to seek assistance:

“I’m an academic pediatrician and there is a geneticist at our institution. I think that that’s easy because we can actually contact them [for help] if we need to.”
For those that were unable to contact a genetics provider, some chose to reach out to other colleagues or specialists for testing recommendations. In some cases, PCPs consulted a different specialist to confirm and combine a single genetics referral:

“Many times, I’ll have neurology, and we will interface, and then send the kid to genetics. I’ll have kids with short stature, failure to thrive, so we’re working with endocrine and then we will again partner/piggyback over to genetics.”

Facilitators which made it easier for PCPs to place referrals to genetics providers included previous knowledge of diagnosis or process and established relationships with genetics professionals for guidance when PCPs had questions (Table 2). Commonly seen indications and easy referral entry processes were helpful in the process of referring patients:

“Actually, going through it, you know, if you have referred, somebody before, you know that process and so that also helps as well.” (S5)

PCPs also suggested resources to address provider-specific barriers. Guidelines for referral/testing would be helpful in identifying patients, especially for providers who are less familiar with genetics due to time elapsed since medical school or who infrequently see cases with genetic components:

“It would be good to have some tools to guide us who to refer to. . . . Other than maybe BRCA testing and colorectal, there’s no clarity on lot of other issues.”

Many PCPs reported that some type of assistance system for correctly coordinating genetic referrals or testing would be helpful, whether an “informal curbside” with a genetics professional or a standard order set for commonly-seen diagnoses:

“I think it would be really great to have a sort of like a Telehealth consultation to a geneticist or a genetic counselor where you as the primary care provider could be like ‘hey, I saw this patient, or I saw this family and there’s this like constellation of symptoms and I’m wondering if this would be something that should be like seen in genetics’. That’s the question that I’m often thinking about.”

Access to further education via continuing medical education (CME) or at conferences also was suggested. PCPs who rarely saw patients with genetic conditions (such as rotations through newborn nursery or occasional oncology patients) stated that they did not have enough repetition to be familiar with genetics recommendations and could benefit from reminders or guidelines. PCPs also were interested in resources to help facilitate communication with patients, from patient education materials to guidelines on how to explain complex topics.

**Patient Barriers and Facilitators**

Finally, PCPs reported factors at the patient level that impact their ability to provide genetic services, including social needs, specific patient concerns, and/or lack of information regarding genetics. PCPs identified patient concerns regarding genetics, including hesitancy due to a general lack of information about the genetics appointment processes and the possible benefits of testing:

“I think sometimes, sometimes there may be a miscommunication or not enough communication about what genetics can do potentially. So maybe they don’t see the importance of having that visit, because they’re not quite sure what the visit will do.”

In response, many providers offered additional education. Some PCPs shared information about the structure or purpose of genetics appointments; however, if PCPs themselves are unaware of appointment specifics, this may have been more difficult:

“We give them that rough idea [of what happens when you go to a genetics appointment], but I still don’t know exactly how it happens for different conditions.”

In other cases, PCPs provided information about the value of genetics services. Some PCPs present the information to their patients and let the patient make the decision regarding the referral. This was more common if the medical situation was not acute. If PCPs felt that the testing was medically necessary, they were more directive in their recommendation.

Other patient-related barriers were language and education, distance to providers, financial and insurance concerns, and patients getting “lost” while on the waitlist for genetics appointments. In cases where distance and provider scarcity were prominent concerns, some PCPs were more likely to manage patients’ care on their own, rather than having them travel a long distance or endure a long waitlist if they perceived other patients’ needs to be more dire:

“Some patients come from three, four hours away and it takes me a little bit more to refer to see genetics. . . . I want their resources saved for people that really need to see them. We manage a lot more, because there is a sparsity of pediatric specialists and a lot of us in primary care want to preserve them.”

This desire to “protect specialists” and prioritize referrals for more severe cases was not limited to genetics but could also apply to other specialties.
Facilitators at the patient level included patient interest in genetic services. In situations where patients expressed a specific concern or interest for genetics, PCPs were able to provide genetic services with less difficulty (Table 2). Providers also suggested resources to assist patients, including designated clinical support and structure to ensure that patients are aware of and attend genetics appointments, especially for those clinics with long waitlists. PCPs working with underserved patients expressed a specific need for structural changes that would increase access for their patients. PCPs described examples of genetics referrals being canceled if a patient did not have transportation to the appointment or was unable to schedule the appointment due to a language barrier. This suggested the need for additional genetic administrative support to ensure patient success in attending an appointment after a referral was placed. Increased access to GCs, through telehealth or bilingual providers, would also help PCPs and patients: “If there were more genetic counselors who were bilingual for my patient population, I think that would be amazing. Or always making sure there’s, like, really good interpreter services because I don’t think these are conversations to be had without those” (S2).

Discussion

This study demonstrates that PCPs face barriers at the system, provider, and patient levels when engaging with genetic services (Figure 2). Many of these barriers, especially lack of knowledge and need for guidelines, have been demonstrated in previous literature and were upheld in this study population.11,17,19,23,24 Through interviews, some PCPs identified strategies they were able to use to address these barriers, often influenced by a provider’s particular resources and practice settings. Some strategies included reaching out to genetics providers, other specialists, or colleagues for assistance in facilitating the referral or testing process. These strategies demonstrate resourcefulness and show PCPs are working to incorporate genetics into already-full clinics. PCPs with limited access to genetics providers, especially those separated by distance or different EMR systems, were required to be especially innovative.

One key finding of this study was the existence of “network distance.” PCPs working in a hospital or EMR system without an in-system genetics provider found it very difficult to access genetics services, even if they were located geographically nearby. This barrier of “network distance,” rather than geographic distance, shows the importance of PCPs being able to connect with genetic professionals. Network distance can have detrimental implications for PCPs both in urban and rural settings, as well as other healthcare providers and patients not participating in the same EMR systems as their local genetics providers. Since most GCs and geneticists work in academic centers, that leaves a significant gap for PCPs who work in other settings, including community and private practice.25

Another finding from this study was that some PCPs triage patients if they felt that access to genetics providers needed to be “saved” as a resource for more critical cases. This is consistent with the ethos of “doing without” described in the practice of providers with limited access to specialty services.26,27 While this finding demonstrates the resourcefulness and well-roundedness of PCPs, especially those working in areas without accessible genetics providers, it highlights significant inequities in access to healthcare. Many individuals and providers in rural areas have limited access to genetics providers who are often localized to urban and academic settings. These inequities also are seen when comparing health outcomes, including mortality, based on racial and geographic differences. Patients from minority backgrounds and patients located in the Southern US are less likely to have access to genetic services than their counterparts.28,29 Providers without access to a local geneticist or GC would likely benefit from guidance when managing possible genetics cases, which would ultimately improve the health benefits to their patients. Increased access to genetics providers using telemedicine has been suggested as one solution. Other solutions may include increasing the number of genetics providers (especially in rural areas), adapting service models to provide additional support for local providers, and increased access to education about clinical genetics, particularly for rare diseases.27

Because PCPs often receive limited genetics training as part of their very complex medical education, and because genetics is a constantly and rapidly evolving field, contact with genetics providers is one way to bridge the knowledge disconnect.
gap. For PCPs who lack both knowledge regarding genetic testing and access to guidance on appropriate testing, they may have to seek assistance from other professionals or resort to other options, including independently ordering testing without guidance. Unfortunately, errors in genetic testing ordering can lead to inappropriate tests, increased costs to patients and healthcare systems, diagnostic delays, and misinformed medical recommendations. Review, while review of ordered genetic tests by genetics providers has been shown to mitigate many of these adverse outcomes.30,31 Additional pre-testing guidance from genetics providers could help ensure that the appropriate tests are ordered and benefits to patients are maximized. In an age where PCPs are being asked to play a larger role in the implementation of genomic medicine, access to and support from genetics providers is imperative.

For PCPs who are within the same system as genetics providers, contact via EMR messaging or email may be beneficial. PCPs who could speak with a genetics professional to confirm the appropriateness of a referral or to learn what tests should be ordered reported more confidence in their referrals and testing practices. However, this requires the time and effort of genetics providers to answer these questions, in addition to their clinical duties. An electronic consult service to formalize and structure this process may streamline interactions between PCPs and genetics providers. Having designated and compensated time for genetics professionals to devote to answering questions about referrals and testing could meet the needs of PCPs without putting undue burden on genetics providers. A Canadian health system utilized an eConsult service for genetics professionals and found that 30% of unnecessary or inappropriate referrals were avoided after consultation with a genetics provider.32 The eConsult service allowed PCPs to message genetics providers through a secure portal. Genetics providers could then confirm if a referral was necessary and recommend tests to order or information to collect. These communications occurred prior to a patient being referred, reducing undue administrative burden on the genetics clinic. The PCPs who utilized the system reported very high rates of satisfaction and stated that the genetics provider provided helpful information to either confirm a planned course of action or to support a new course of action.

A commonly suggested resource for PCPs was access to education via CME or conferences, as well as presentations by local genetics providers. PCPs requested topics such as recent updates to testing recommendations, what to do when a specific condition is suspected, and guidelines for management of specific genetic conditions. Prior studies identified similar desires for guidance regarding genetics, but while educational interventions can lead to increased confidence, they do not always result in changes in practice.20 It is possible that PCPs need information tailored to their specific patient populations and common indications. Another proposed resource was guidelines for testing or referrals, which has been identified in previous literature.18 In some cases, guidelines are available and need to be made more accessible; however, other indications do not have existing or up-to-date guidelines. In either case, clear and available guidelines for genetic referrals and testing are a desired resource to direct PCPs in their referral-making decisions.

Recognizing strategies that PCPs are using in managing patients with genetics needs in their clinic can help by providing opportunities to build upon skills and processes that are already being engaged. This study identified barriers that inhibit the provision of genetic services at 3 different levels and interventions should be targeted to address challenges within each specific area. To better integrate genetic services into primary care, system-wide adaptations such as changes to EMR systems, developing “ecommunication” pathways, and implementing telehealth genetic counseling have been suggested. Strategic changes such as increased accessibility to referral or testing guidelines for PCPs and additional education and administrative support to ensure that patients have knowledge about and access to genetics appointments would also target specific barriers. Coordinated efforts across these different levels have the most promise toward eliminating area-specific barriers and creating widespread access to genetic services through PCPs.

This study took a qualitative approach to an area of research that was previously mostly explored through quantitative research. In doing so, we obtained well-rounded perspectives of PCPs on the topic of genetics in primary care. Our study population included providers from multiple states and multiple clinical settings, as well as representing different provider and patient backgrounds. However, there were several limitations to this study. The population of this study did not accurately represent the ethnic diversity of the geographic region in question. Furthermore, upon data evaluation, additional interview questions such as asking if a PCP had genetics providers located in the same EMR system, rather than extrapolating based on participant answers, could have been useful for further data analysis.

Future research could investigate the potential impact of telemedicine on increasing access to genetics providers, especially as telemedicine is becoming a widely-used delivery model in response to the COVID-19 pandemic.33,34 Additionally, the targeted analysis of specific strategies utilized by PCPs, such as referring to other specialists or independently managing patients, as well as analyzing the efficacy of interventions, could be used to assess how PCP referral practices are modified with additional support.

As additional genetics resources for PCPs are developed, it is important to consider not only the barriers that are faced, but also the impact on systems, providers, and patients. By capitalizing on the strategies that PCPs are already using, genetics providers can stand alongside PCPs to help them provide genetic services within the framework of their practice. Other resources are necessary to address barriers affecting systems and patients. Empowering PCPs
and health systems to integrate genetics services can help provide care for those patients who may not reach genetics providers, but who stand to benefit from the knowledge of genetic services.

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

Supplemental Material
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