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## The Undiagnosed Patient and The Diagnostic Odyssey: Current Genetic Counseling Practices and Perspectives

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The Undiagnosed Patient and the Diagnostic Odyssey:  
Current Genetic Counseling Practices and Perspectives

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Bachelor of Science  
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Submitted in Partial Fulfillment of the Requirements

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University of South Carolina

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## **Abstract**

Patients seen in genetics clinics often endure a diagnostic odyssey in their search for answers for their medical symptoms. This time is not only challenging for patients and their families, but also for the genetic counselors who are trying to help the patients. Previous research has shown that parents of children with undiagnosed medical disorders have specific goals and reasons for wanting to find a diagnosis, and there are many difficulties faced by these parents. Genetic counselors often serve as a prominent figure during the diagnostic odyssey, but little known research has assessed the current practices of and impact that the diagnostic odyssey has on genetic counselors. This study surveyed pediatric genetic counselors to assess their current practices and thoughts about the diagnostic odyssey. This was assessed utilizing a questionnaire, which included both multiple choice and short answer questions. We identified current genetic counseling practices including communication methods and resources provided to patients. Counselors reported a possible need to share the responsibility of communication with their patients and a lack of resources specific to patients on the diagnostic odyssey. Genetic counselors also reported feeling personally impacted by patients on the diagnostic odyssey, and described the positive and negative feelings they experience, in addition to strategies to cope with their frustrations. In conclusion, the diagnostic odyssey is a complex process for patients, and similarly challenging for the counselors who are involved in the patients' care. Genetic counselors have an opportunity to provide

additional support, resources, and hope to families during the diagnostic odyssey, although these roles may not be strictly defined in the counselors' responsibilities.

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## **Chapter 1: Background**

### **1.1 What is a Diagnosis?**

In medicine, and especially genetics, making a “diagnosis” can mean a variety of different things. Some disorders are readily identifiable and a diagnosis can be made shortly after symptoms present. However, certain patients with genetic disorders experience a prolonged period of time before receiving a diagnosis because their symptoms and features may not represent a commonly identifiable disorder or syndrome with a known etiology.

Physicians utilize a few different types of diagnoses in order to provide one name to encompass a patient’s symptoms. One type of diagnosis can be considered “descriptive” or clinical. This means that one name has been given for a grouping of features, but there may or may not be a known underlying reason for the disorder (Makela, Birch, Friedman, & Marra, 2009). One example of a disorder with only a descriptive diagnosis is autism. There is little known about the biological cause for autism, but researchers have created criteria that can be used to identify a patient as having autism (American Psychiatric Association, 2013). Descriptive diagnoses may also include an “etiological” or “molecular” diagnosis. These types of diagnoses have not only a name, but also a known molecular or biological cause. These disorders may have been more extensively researched and have an established natural history with prognostic information. It is possible to only have a molecular or etiological diagnosis, meaning that

genetic testing has been performed and a deleterious mutation has been identified, but healthcare professionals may not know the full effects of the mutation and may not be able to make predictions about the progression of symptoms. These disorders may only be identified by the genetic mutation and may not be recognizable to the general public by name because of the rarity of the finding (Makela et al., 2009). Finally, a patient without a clinical or molecular diagnosis may receive a “working” diagnosis, or a suggestion of a type of disorder that seems to be present but cannot be specifically identified (Lewis, Skirton, & Jones, 2010). This can be useful when a patient’s group of symptoms does not meet diagnostic criteria for a specific condition, or a specific molecular cause was not found or has not yet been discovered.

## **1.2 The Diagnostic Odyssey and Uncertainty**

Many patients seen in genetics clinics experience a diagnostic odyssey, or “the time between when a parent or provider first becomes concerned about a child’s development and a diagnosis is eventually reached” (Carmichael, Tsipis, Windmueller, Mandel, & Estrella, 2015, p. 326). For some patients, this odyssey does not have a concrete ending because neither a descriptive nor etiological diagnosis can be made. The amount of time spent on the odyssey can vary, possibly extending over a lifetime. It has been reported that up to 50% of all cases of intellectual disability do not have a known etiology and therefore, families continue an extended diagnostic odyssey (Daily, Ardinger, & Holmes, 2000). Additionally, Shashi et al. (2013) reported that “the rate of unidentified genetic conditions is conventionally thought to be 50% overall, [but] there are surprisingly few empirical data supporting this statistic” (p. 176).

The diagnostic odyssey is a time of uncertainty for patients and their families as they try to plan for the future and manage the apparent symptoms (Rosenthal, Biesecker, & Biesecker, 2001). The amount of uncertainty may also be influenced by the interaction with healthcare professionals who must discuss the unknowns of the condition (Jessop & Stein, 1985). Some parents of children without a diagnosis have described their experience as stressful due to the added care for the children and required medical appointments. Additionally, parents experienced other psychological problems, including emotional distress and burden, due to the difficulties of not having a diagnosis. These difficulties often originated from feelings of being out of control. (Lewis et al., 2010)

In addition to stress, uncertainty often takes away the sense of control for parents. Madeo, O'Brien, Bernhardt, and Biesecker, (2012) assessed this uncertainty and lack of control in parents with children having different medical conditions, some of whom were undiagnosed. Individuals who perceived less control over their child's undiagnosed condition reported less optimism and higher uncertainty. These individuals felt they did not have control over the disease, their future, and medical care. However, they did feel in control of some aspects of their child's condition, including information and decision making, advocacy, the child's comfort, and self-care. (Madeo et al., 2012)

### **1.3 Parental Value of a Diagnosis**

Several themes have been identified as parental benefits of having a diagnosis. These themes include having a label for the child's condition, being able to predict the course of the disorder and provide a prognosis, accepting and validating the parents' concerns, and having access to support networks (Carmichael et al., 2015; Lewis et al., 2010; Makela et al., 2009; & Rosenthal et al., 2001). In terms of support services, parents

identified support from other parents in a similar situation as a useful source; the match between parents is critical (Ainbinder et al., 1998). Unfortunately, it is difficult to identify parents in similar situations when there is not one unifying term to describe the situation.

A limited number of studies have assessed the perceptions of parents whose children do not have a diagnosis for their collection of symptoms. Interviews with parents of children with neuromuscular disorders found that, during the diagnostic odyssey, parents desired a diagnosis for validation, a prognosis in order to plan for the future, and access to specific support networks (Carmichael et al., 2015). Providing a label for the child's condition proved essential for obtaining services and support for the affected children. Interviews with parents whose children have multiple congenital anomalies revealed similar themes and motivations for obtaining a diagnosis for their child's medical condition (Rosenthal et al., 2001). In addition to having a "label" and prognosis for the condition, parents expressed concern for recurrence in future children and a need to know as much information as they could about the condition. Parents expressed understanding that having a particular diagnosis may not have a cure and may not change their current medical management, but recognized the importance for future medical research (Rosenthal et al., 2001).

A study conducted in the United Kingdom in 2010 (Lewis et al.) analyzed interviews with parents of children who had an undiagnosed condition and had been seen in a genetics clinic. Parents most often stated that they wanted a diagnosis for "help with care and treatment" and "to know about the future." In addition, parents discussed wanting a label to use with the public when discussing the cause for their child's

condition. Certain parents utilized “social diagnoses,” similar to the earlier discussed descriptive diagnoses, to generally explain their child’s medical problem to society. One parent commented that the idea of a “working” diagnosis might provide similar insight for the patient and their family as when having a descriptive diagnosis (Lenhard, Breitenbach, Ebert, Schindelhauer-Deutscher, & Henn, 2005). With a working diagnosis, the patient and their family may be able to access support groups and obtain services that might not otherwise be available without a diagnosis (Lenhard et al., 2005). Similarly, parents whose children have undergone molecular testing hoped to find an answer in order to help explain their child’s condition, better prepare for the future, and better manage their child’s care (Sapp et al., 2014).

Most studies that interviewed parents of children with undiagnosed medical conditions found that parents wanted more support options and thought there was a lack of support when no diagnosis was found (Carmichael et al., 2015; Lewis et al., 2010; Rosenthal et al., 2001). One support organization has been identified as focusing specifically on undiagnosed patients, titled “Syndromes Without A Name (SWAN).” This group was organized in 2004 in the United States to provide support and information to families who were affected by an unknown medical syndrome (SWAN USA, 2014). SWAN also directs families to potential clinical trials and studies that may help them find a diagnosis for their child’s condition. Previous studies involving parents of undiagnosed children indicated that these parents felt a lack of support and may not have been aware of nation-wide support groups such as SWAN. There may also be local organizations that serve as “special needs groups” that may provide support to families and aid in

navigating state services, but these are not specific to a particular diagnosis or lack thereof.

#### **1.4 Incorporation of New Technologies and Discoveries into Practice**

Strides are continuing to be made in genetic research and testing to be able to provide more information about genetic disorders and increase diagnostic yield. As new technologies have been developed, practice guidelines have changed to reflect the most effective use of these developments. For example, in 2010, chromosomal microarray became a first-tier test for patients with developmental delay, intellectual disability, autism spectrum disorders, and multiple congenital anomalies (Miller et al., 2010). Since the development of the microarray test, Next Generation sequencing has become another technological development that has improved the overall utility of genetic testing. Next Generation sequencing allows for rapid sequencing of single and multiple genes at a reduced cost compared to traditional Sanger sequencing (Mardis, 2008). The innovation of Next Generation sequencing has allowed for continued discovery of novel genes, providing etiologies for previously undiagnosed medical conditions. Next Generation sequencing is currently being used in Whole Exome Sequencing (WES), sequencing nearly all of the coding exons within the genome, and Whole Genome Sequencing (WGS), which includes the additional non-coding regions of the genome (Yang et al., 2014). As new tests are developed and become more accessible, there is a growing opportunity to incorporate technological advances into clinical use to identify a genetic etiology for a patient's medical condition.

Genetics professionals must continue to adapt with the ever-developing landscape of genetic technology. Lazaridis et al. (2014) reported one example of an institutional

approach to new genetic technology that came from the Mayo Clinic. They have created an Individualized Medicine Clinic to incorporate genomic technological advances into everyday clinical practice. One of the services offered by this clinic is WES for patients during their diagnostic odyssey. This service includes determining if the patient would benefit from WES, having an extensive genomic counseling session, and interpreting the results from sequencing by a review board. The clinic utilizes a “Genomic Odyssey Board” to interpret the results and make recommendations to the referring physician. After a year of offering this service, the researchers determined that patients need an extended conversation with a genetic counselor in order to grasp the abilities of genomic testing. However, no diagnostic rates from this year of service were provided (Lazaridis et al., 2014).

In recent years, more genetics clinics are ordering WES for their patients with complex medical conditions and various laboratories that offer this testing are starting to report their diagnostic rates and findings from WES. Yang et al. (2014) reported a molecular diagnostic rate of 25.2% from Baylor College’s first 2,000 exomes sequenced, similar to Ambry Genetics’ first 500 exomes sequenced, which resulted in a 30% molecular diagnostic rate (Farwell et al., 2014). Lee et al. (2014) reported a molecular diagnostic rate of 26% at the University of California, Los Angeles, and Sawyer et al. (2015) reported a diagnostic rate of 23-34% using WES for the Canadian group called Finding of Rare Disease Genes (FORGE). The previously listed studies reported higher diagnostic rates when three family members contributed DNA for sequencing, specifically the patient and two first-degree relatives. Many WES tests identified novel genes or variants that were predicted to be pathogenic or likely pathogenic. In addition to

finding new genes, many of the genes that were found to have damaging mutations were discovered in the last few years and may not be included yet in single gene or panel tests (Farwell et al., 2014; Lee et al., 2014; Yang et al., 2014).

While these studies have shown a benefit to utilizing WES as a diagnostic tool in genetics clinics, they also have shown that this technology is often not the final chapter in a patient's diagnostic odyssey. These studies demonstrated that WES is able to find a disease-causing mutation in around 25-30% of patients, leaving up to 75% of genetics patients to continue on their diagnostic odyssey. While WGS is possible as well, it is not utilized as frequently and results in a greater amount of data that requires analysis and interpretation. One of the downsides of genomic medicine is that there are a greater number of results of variants of uncertain significance that may or may not be causal of the patient's condition and this can complicate an already stressful situation (Rosell et al., 2016).

Of the 25-30% of patients who are receiving molecular diagnoses, there may still be little known about the prognosis of the condition. In this way, a finding from WES may not provide the information that may benefit a patient and their family. In a study published by Makela et al. (2009), patients expressed that a descriptive diagnosis may be more beneficial than a genetic diagnosis. Often times, a descriptive diagnosis provides information based on the natural history of the disorder as seen from many clinical cases of the same diagnostic features. Although these disorders may not have a known genetic etiology, they may have established support groups and specialists who know the disorder well and are able to provide the prognostic information that patients seem to be pursuing.

There has been limited research that explores parents' opinions about the process of WES. More recently, Rosell et al. (2016) reported perceptions of parents after concluding the WES process for their undiagnosed child. Many of these parents had the experience of identifying a definite or likely cause for their child's medical symptoms, while few had the experience of identifying a VUS or no diagnosis at all from WES. Parents expressed varying views regarding their expectations and concerns about WES, but most expressed hope in finding an answer and being able to connect with other families with the same genetic diagnosis. Parents were also able to recall the details of the testing itself and understood the different results, and many felt that the definite or likely diagnoses were beneficial in terms of improving their child's medical management, understanding their child and the condition, and increasing their hope for the future (Rosell et al., 2016).

### **1.5 Genetic Counselors' Role in the Diagnostic Odyssey**

As has been mentioned above, genetic counselors play a prominent role in assisting families with their diagnostic odyssey. According to the National Society of Genetic Counselors (NSGC) website:

Genetic counseling is a process of helping people understand and adapt to the medical, psychological and familial implications of genetic contributions to disease. This process integrates:

- Interpretation of family and medical histories to assess the chance of disease occurrence or recurrence.
- Education about inheritance, testing, management, prevention, resources and research.

- Counseling to promote informed choices and adaptation to the risk or condition. (National Society of Genetic Counselors, 2015)

When a patient does not have a diagnosis, this process may be altered. For instance, without a molecular diagnosis, the counselors may be limited in their ability to provide information about recurrence in future pregnancies or for occurrence in other family members. They may experience limitations in educating the patient about inheritance of the disorder or providing disease-specific resources. Finally, the lack of information may impact the counselors' ability to promote adaptation to the condition because they have limited information about the prognosis or natural history.

Although challenges exist to the genetic counseling process when a diagnosis is unknown, genetic counselors can implement other strategies in order to achieve the goals of a session. In Lipinski, Lipinski, Biesecker, and Biesecker, (2006), parents of children in genetics clinics were interviewed to identify helpful qualities of a genetic counselor and to identify suggestions to improve the genetic counseling session. Parents who felt that the genetic counselor was helpful seemed to benefit from interventions that helped them gain a sense of control over their situation. When there was greater uncertainty, the parents found the genetic counselor less helpful. Parents suggested that counselors provide more information and resources but parents also understood there may not be much information available. Therefore, the authors concluded that addressing the lack of information is an important strategy for genetic counselors. It could also be helpful for the counselor to ask the parents what they need regarding the condition. The parents emphasized that the providers should remain available and they wanted to be informed

when new information became available to the genetics professionals (Lipinski et al., 2006).

Genetic counselors can also assist parents with identifying factors over which they do have control in situations of medical uncertainty. These factors may include providing effective coping strategies, encouraging advocacy for their child, and giving control in making decisions regarding the child's medical care (Madeo et al., 2012). Some coping strategies that parents have identified as being beneficial include creating future images, seeking social support, and identifying positive aspects, all of which genetic counselors are able to do (Graungaard & Skov, 2007). In addition to these specific strategies, pediatric genetic counselors often play a larger role in the diagnostic odyssey. At the Individualized Medicine Clinic at the Mayo Clinic, genetic counselors often became the patient's main point of contact (Lazaridis et al., 2014). Therefore, the relationship between the patient, their family, and pediatric genetic counselors is critical throughout the diagnostic odyssey.

Due to this primary role that genetic counselors play in the diagnostic odyssey, they were selected as the main subjects for this study. We aimed to establish the clinical and personal impact of the diagnostic odyssey on pediatric genetic counselors. We investigated the information and resources that genetic counselors offer to their patients who are on a diagnostic odyssey. Also of interest were the counselor's preferences for a molecular or descriptive diagnosis and their utilization of new technologies for clinical patients. We compared genetic counselor's offerings to parents' reports of needs and desired resources.

We hypothesized the following: first, that genetic counselors are utilizing similar strategies in their current practice for all patients, including those without a diagnosis; second, that counselors would agree with themes previously reported by parents in the literature, including the challenges of not having a diagnosis and the limited availability of resources and support options; third, that pediatric genetic counselors would identify strategies and resources that have seemed beneficial to parents of children on a diagnostic odyssey; and finally, that patients on a diagnostic odyssey would have a personal impact on genetic counselors.

A questionnaire was sent to pediatric genetic counselors through the NSGC electronic mailing list. The questionnaire consisted of multiple choice, open-ended, and Likert Scale questions created by the researchers and adapted from themes expressed in the literature. The participants remained anonymous; no identifying information was collected on the survey. There was no immediate benefit to the survey participants, but we hope to provide future suggestions that may be beneficial in genetics clinics.

## **Chapter 2: The Undiagnosed Patient and the Diagnostic Odyssey: Current Genetic Counseling Practices and Perspectives<sup>1</sup>**

### **2.1 Abstract**

Patients seen in genetics clinics often endure a diagnostic odyssey in their search for answers for their medical symptoms. This time is not only challenging for patients and their families, but also for the genetic counselors who are trying to help the patients. Previous research has shown that parents of children with undiagnosed medical disorders have specific goals and reasons for wanting to find a diagnosis, and there are many difficulties faced by these parents. Genetic counselors often serve as a prominent figure during the diagnostic odyssey, but little known research has assessed the current practices of and impact that the diagnostic odyssey has on genetic counselors. This study surveyed pediatric genetic counselors to assess their current practices and thoughts about the diagnostic odyssey. This was assessed utilizing a questionnaire, which included both multiple choice and short answer questions. We identified current genetic counseling practices including communication methods and resources provided to patients. Counselors reported a possible need to share the responsibility of communication with their patients and a lack of resources specific to patients on the diagnostic odyssey. Genetic counselors also reported feeling personally impacted by patients on the diagnostic odyssey, and described the positive and negative feelings they experience, in

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<sup>1</sup>Wardyn, A., Jordon, E., Corning, K., & Carmichael, N. To be submitted to *Journal of Genetic Counseling*

addition to strategies to cope with their frustrations. In conclusion, the diagnostic odyssey is a complex process for patients, and similarly challenging for the counselors who are involved in the patients' care. Genetic counselors have an opportunity to provide additional support, resources, and hope to families during the diagnostic odyssey, although these roles may not be strictly defined in the counselors' responsibilities.

## **2.2 Introduction**

Many patients seen in genetics clinics experience a diagnostic odyssey, or “the time between when a parent or provider first becomes concerned about a child’s development and a diagnosis is eventually reached” (Carmichael et al., 2015, p. 326). The diagnostic odyssey is a time of uncertainty for patients and their families as they try to plan for the future and manage the apparent symptoms (Rosenthal et al., 2001). Parents benefit from having a diagnosis in several ways, including having a label for the child’s condition, being able to predict the course of the disorder and provide a prognosis, acceptance and validation of the parents’ concerns, and having access to support networks (Carmichael et al., 2015; Lewis et al., 2010; Makela et al., 2009; Rosenthal et al., 2001). Genetic counselors play a prominent role in assisting families with their diagnostic odyssey by helping them feel more in control of their situation and helping them cope with the uncertainty of not having a diagnosis (Lipinski et al., 2006; Madeo et al., 2012).

Continuing strides in genetic research and testing increase the information available to families. Improved testing not only increases our knowledge of genetic disorders, but also increases diagnostic yield. Geneticists in pediatric clinics are more often ordering chromosomal microarray and whole exome sequencing (WES) for their

patients with complex medical conditions in order to identify a genetic diagnosis. These tests are non-specific and often unveil new or unexpected diagnoses. Studies show that WES is able to find a disease-causing mutation in around 25-30% of patients, leaving up to 75% of genetics patients who still must continue on their diagnostic odyssey (Farwell et al., 2014; Lee et al., 2014; Yang et al., 2014). Of those who receive a molecular diagnosis, many may not have extensive prognosis and natural history research available to provide the type of information that parents are seeking (Makela et al., 2009).

Little research has been conducted to assess the feelings and experiences of genetics patients who have not obtained a diagnosis, and no research to our knowledge has been conducted to assess the feelings and experiences of the healthcare professionals involved with these families. This population may make up a significant portion of the patients seen in clinics, and there are currently no guidelines or recommendations for counseling patients who do not receive a diagnosis. However, previous studies (Carmichael et al., 2015; Lewis et al., 2010; Rosenthal et al., 2001) have shown that parents of these patients do want and need similar resources and information for their child during the diagnostic odyssey.

Genetic counselors were the focus of this study because they play a primary role in the assessment of patients in genetics clinics and often become the point of contact for the patient through the genomic process and diagnostic odyssey (Lazaridis et al., 2014). We aimed to establish the clinical and personal impact of the diagnostic odyssey on pediatric genetic counselors. We investigated the information and resources that genetic counselors offer to their patients who are on a diagnostic odyssey. Also of interest were the counselor's preferences for a molecular or descriptive diagnosis and their utilization

of new technologies for clinical patients. We compared the genetic counselor's offerings to parents' reports of needs and desired resources.

We hypothesized the following: first, that genetic counselors are utilizing similar strategies in their current practice for all patients, including those without a diagnosis; second, that counselors would agree with themes previously reported by parents in the literature, including the challenges of not having a diagnosis and the limited availability of resources and support options; third, that pediatric genetic counselors would identify strategies and resources that have seemed beneficial to parents of children on a diagnostic odyssey; and finally, that patients on a diagnostic odyssey would have a personal impact on genetic counselors.

### **2.3 Materials and Methods**

An invitation to take part in our survey was sent via email to genetic counselors who are current members of the NSGC (see Appendix A). The selection process for participation was based on individuals who identified themselves as pediatric genetic counselors. The email was sent through the NSGC electronic mailing list on Wednesday July 22, 2015 and again on Tuesday September 1, 2015.

The inclusion criteria were as follows:

- currently practicing as a genetic counselor and currently counseling at least 30% clinical pediatric cases;
- counseling at least 10% undiagnosed patients.

The exclusion criteria were as follows:

- genetics professionals other than genetic counselors;

- currently practicing genetic counselors who see less than 40% clinical pediatric cases;
- and/or have less than 10% undiagnosed patients.

Participants were first asked to read the Participant Introductory Letter (see Appendix B) and then could continue to take our online questionnaire (see Appendix C). The questionnaire assessed the current practices of pediatric genetic counselors when seeing a patient who is on a diagnostic odyssey. We provided the following definition of a diagnosis and the diagnostic odyssey:

Providers working in pediatric genetics clinics may make diagnoses in a number of different ways, such as based on clinical symptoms or genetic testing. For the purposes of this survey, we are focusing on patients on a diagnostic odyssey. These patients have a collection of symptoms that the medical team believes to be related, but a single unifying cause or descriptive label has not been identified. The patients may be collectively referred to as “undiagnosed”.

The questionnaire consisted of items including demographic information, Likert Scale questions, multiple choice questions, and open-ended questions (see Appendix C). The participants remained completely anonymous; no identifying information was collected on the survey. There was no immediate benefit to the survey participants, but we hope to provide future suggestions that may be beneficial in counseling pediatric genetics patients. There was also no risk to participants of completing the survey. This research study was approved by the Institutional Review Board, Office of Research Compliance, of the University of South Carolina in June, 2015.

We expected to determine the goals of genetic counselors when working with this population as well as the impact that these patients have on the counselor. We also aimed to compare themes among pediatric genetic counselors to those seen among parents of children without a diagnosis described in the literature. To address these research goals, we used descriptive statistical analysis using Microsoft Office Excel software. The majority of survey items resulted in categorical information and therefore percentages and frequencies were calculated, in addition to utilizing the Chi-Square Test for Independence to analyze associations between categorical variables.

For the responses collected from open-ended questions, we used grounded theory methods to analyze the qualitative data. There were no preset themes for our study's focus. The primary investigator identified and coded apparent themes from the participants' responses and reported on their frequency below.

## **2.4 Results**

A total of 77 questionnaires were collected. Seven were removed for not meeting the inclusion criteria of seeing at least 30% pediatric patients or at least 10% undiagnosed patients. Seven other questionnaires were removed due to not being completed. Our analyses included the remaining 63 questionnaires described below.

The participants' demographics can be found in Table 2.1. The majority of participants were female, Caucasian, and reported that at least 30% of their pediatric patients were undiagnosed. There was a wide range of experience represented and most participants were board-certified genetic counselors.

**Table 2.1 Participant Demographics (N = 59)**

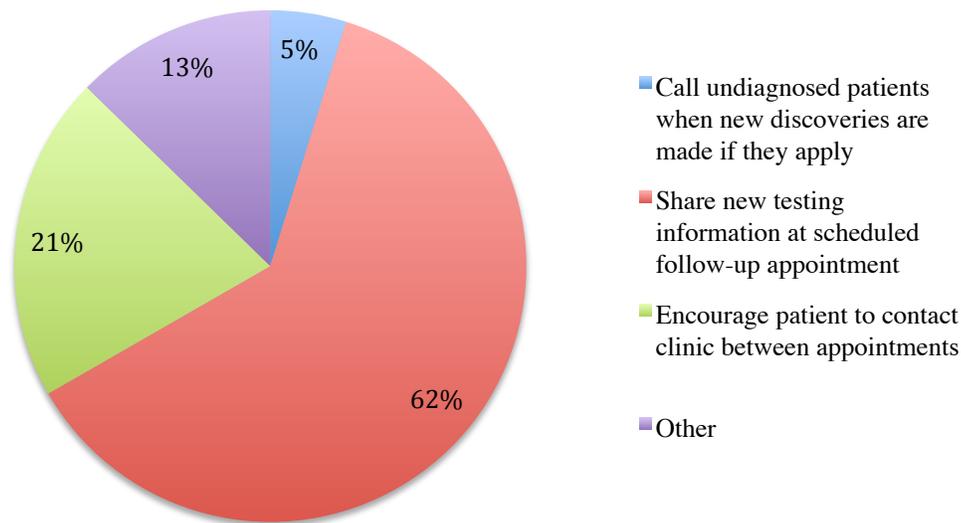
Demographic	Response	<i>n</i>	(%)
Gender	Male	2	(3)
	Female	57	(97)
Age	20-29 years	29	(49)
	30-39 years	16	(27)
	40-49 years	6	(10)
	50+ years	8	(14)
Ethnicity	Caucasian	54	(92)
	Asian/Pacific Islander	4	(7)
	Other (South Asian)	1	(2)
Years as a Genetic Counselor	<1 year	6	(10)
	1-4 years	21	(36)
	5-9 years	16	(27)
	10-14 years	5	(8)
	15+ years	11	(19)
Years as a Pediatric Genetic Counselor	<1 year	7	(12)
	1-4 years	22	(37)
	5-9 years	17	(29)
	10-14 years	6	(10)
	15+ years	7	(12)
Certification	Certified	49	(83)
	Board Eligible	10	(17)
Percentage of Pediatric Patients (N=63)	41-50%	5	(9)
	>50%	58	(92)
Percentage of Undiagnosed Pediatric Patients (N=63)	11-20%	5	(8)
	21-30%	6	(10)
	31-40%	14	(22)
	41-50%	22	(35)
	>50%	16	(25)
Percentage of Follow-Up Patients	0-10%	1	(2)
	11-20%	7	(12)
	21-30%	13	(22)
	31-40%	14	(24)
	41-50%	21	(36)
	>50%	3	(5)

**2.4.1 Definition of the diagnostic odyssey.** Participants were first asked to provide their own definition of the diagnostic odyssey. Most participants ( $n = 62$ , 98%) provided their own definition, which was generally similar to the definition that has been discussed in the literature and was provided in the questionnaire. The following themes were

identified: patients included those with an unknown underlying cause for their medical symptoms; the complex diagnostic workup including numerous tests, imaging, procedures, and specialists; and the lack of a specific timeframe ranging from months to years.

**2.4.2 Current communication practices.** Participants were asked about their current communication practices with pediatric patients, including if they have a method of recording undiagnosed patients for future identification and how they incorporate new technologies into practice for undiagnosed patients. Only about a third of participants ( $n = 23, 37\%$ ) reported having a method of recording undiagnosed patients for future identification in their clinic. Of those who did not have a method of recording patients and their diagnosis, about half ( $n = 18, 45\%$ ) believed that they needed a method.

Participants were asked how they and their colleagues incorporate new technologies into practice for undiagnosed patients. Results are shown in Figure 2.1. Of the 25 participants who commented on the method(s) they use to record undiagnosed patients for future identification, 12 (48%) discussed scheduling follow-up appointments as their main method for tracking undiagnosed patients and 14 (56%) reported having a database or spreadsheet of all pediatric patients with their diagnosis, or lack thereof, recorded for reference. Nearly half ( $n = 26, 41\%$ ) of participants thought that another method of communication for sharing new tests or novel discoveries would better benefit patients on the diagnostic odyssey.



*Figure 2.1* Methods for incorporating new technologies into practice for undiagnosed patients.

From the 25 participants who suggested other methods of communication that might benefit patients on their diagnostic odyssey, the predominant theme was utilizing electronic modes such as secure email or patient portals, e-blasts and newsletters, or social media ( $n = 14, 56\%$ ). A second theme was the difficulty of communication and follow-up due to a lack of staff to manage the large quantity of patients and time required to contact them ( $n = 5, 20\%$ ). Four participants believed that is not the responsibility of the healthcare team to reach out to patients between appointments, regardless of updates to testing or information.

**2.4.3 Most important aspects of a genetic counseling session.** Participants compared the most important aspects of genetic counseling sessions for undiagnosed and diagnosed patients. These two patient populations assessed aspects of genetic counseling sessions for an initial appointment compared to a follow-up appointment. These responses are displayed graphically in Figures 2.2 and 2.3.

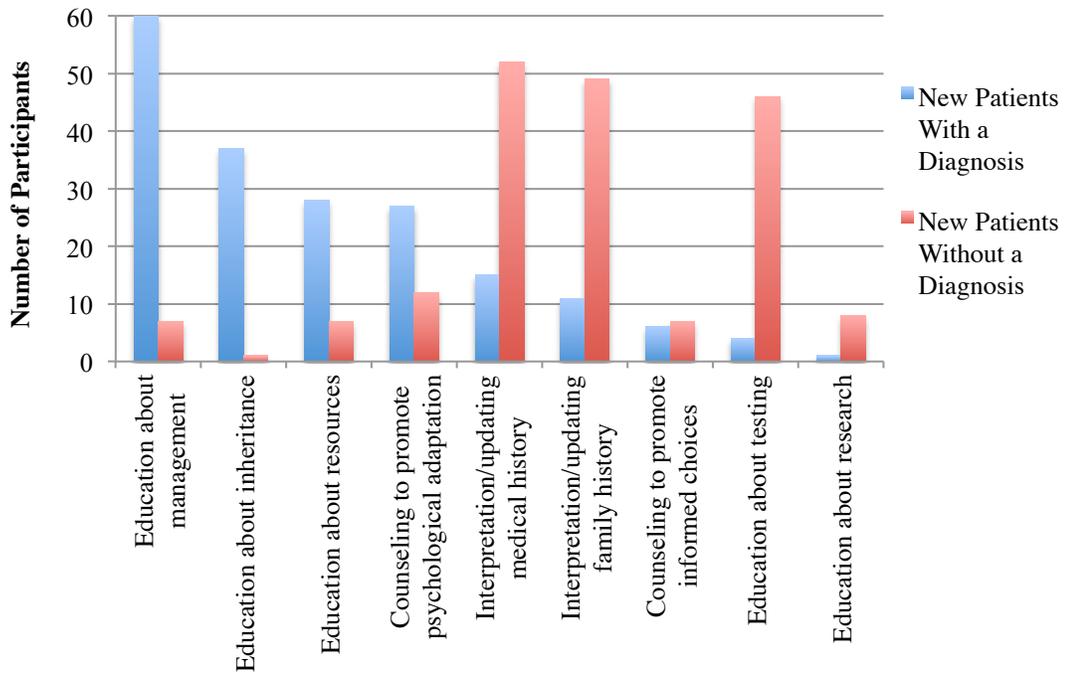


Figure 2.2 Most important aspects of a session for new patients. Participants selected the three most important aspects of a session for both patient types.

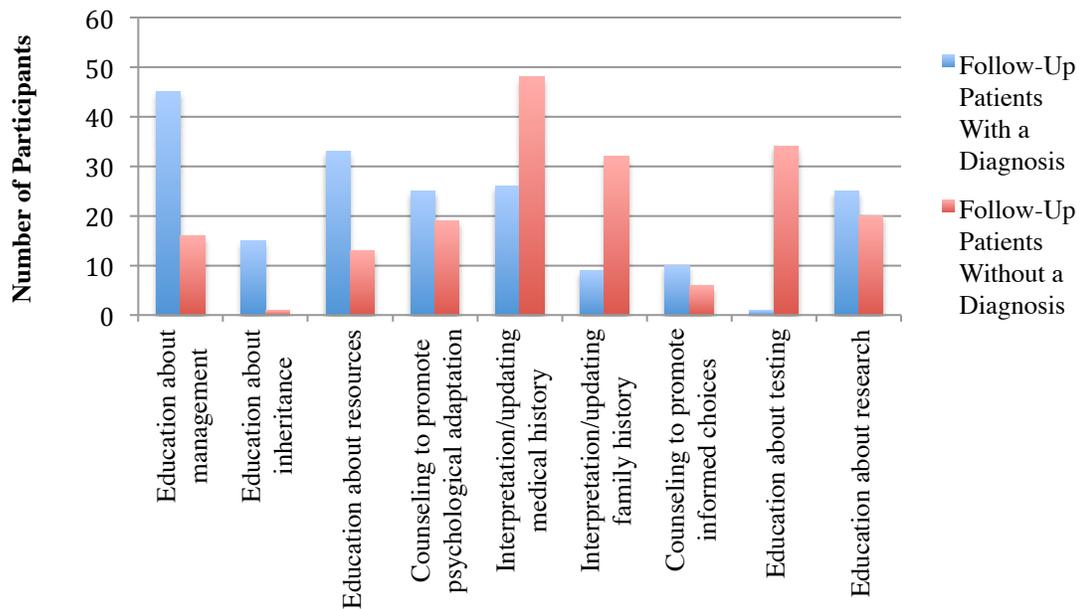
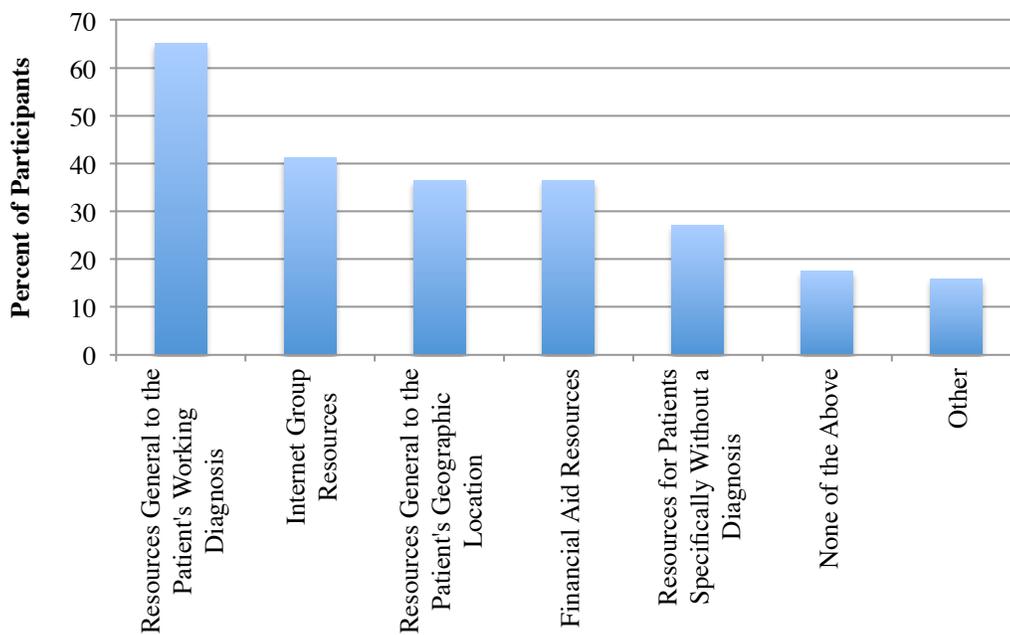


Figure 2.3 Most important aspects of a session for follow-up patients. Participants selected the three most important aspects of a session for both patient types.

Chi-square analysis was used to compare the most important aspects of a genetic counseling session for those patients with a diagnosis to those without a diagnosis. When compared across all of the aspects as a whole, there was a statistically significant difference between these two patient types for both new appointments as well as follow-up appointments ( $p < .01$ ).

**2.4.4 Resources for patients on the diagnostic odyssey.** Participants were also asked about the different resources they provide to patients on a diagnostic odyssey. These results are displayed in Figure 2.4. Most participants ( $n = 41$ , 65%) reported providing resources general to the patient’s working diagnosis or main symptoms.



*Figure 2.4* Resources provided to undiagnosed patients’ families. Participants selected all types of resources they provide.

Of the themes identified in the “Other” category, four participants utilize their institutional resources, including social workers or care coordinators, and three refer patients to appropriate research studies. Participants identified the group SWAN as being specific for patients without a diagnosis, and participants also mentioned the Rare

Genomics Institute, the National Organization for Rare Disorders (NORD), the Manton Center for Orphan Diseases, and In Need of a Diagnosis as additional resources for this particular patient population. The majority of participants ( $n = 55, 87\%$ ) felt that there is a need for more resources that specifically pertain to undiagnosed patients.

**2.4.5 Perceived purpose of a diagnosis.** The genetic counselors' perceptions of how a diagnosis benefits parents was assessed using the benefits cited by parents in previous literature, as well as which factors counselors find to be most helpful to parents (Rosenthal et al., 2001). The results are depicted in Figure 2.5. Chi-square analysis of the overall group of responses showed a statistically significant difference between the factors that counselors believe parents are hoping for compared to those that the genetic counselors believe are most helpful to the parents ( $p < .01$ ).

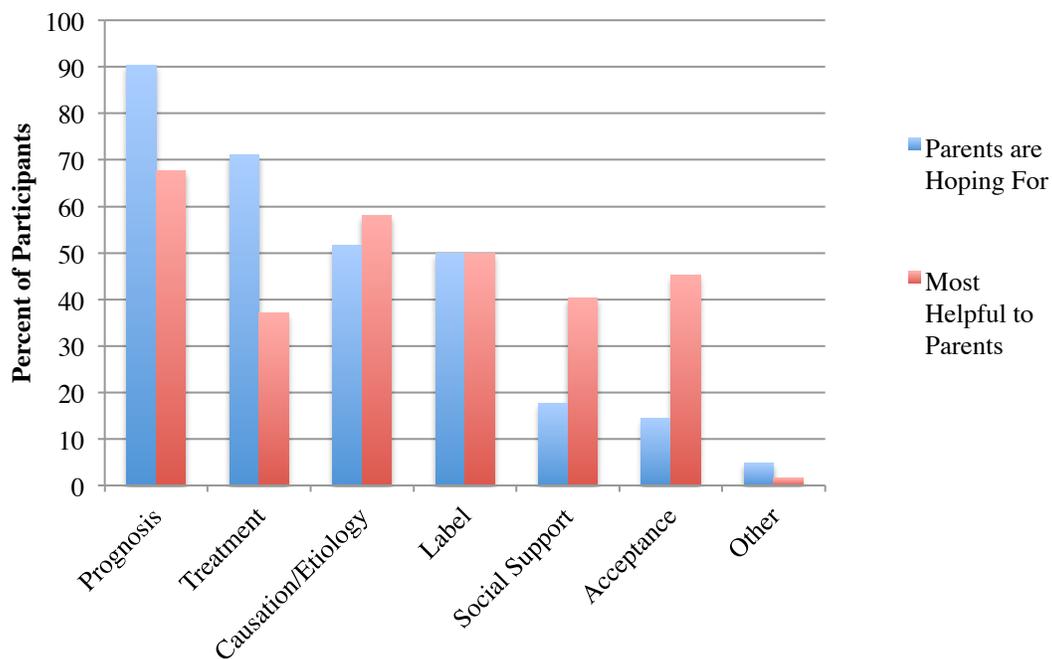


Figure 2.5 Perceived purpose of a diagnosis. The reported numbers add up to over 100% because participants selected their top three benefits.

Participants were asked to provide strategies they have found helpful for families with a child on a diagnostic odyssey and their responses fell into three main categories: emotional, informational, and support strategies.

Emotional strategies were identified by 28 of 41 participants and included maintaining hope, exhibiting empathy, and acknowledging the family's struggles and frustrations. Additionally, preparing the family for the potential of the diagnostic odyssey and managing their expectations early in the process is beneficial. Other emotional strategies included being optimistic and normalizing the experience to help the family know they are not alone in the diagnostic odyssey.

Informational strategies were identified by 20 of 41 participants and included educating families about the improving knowledge base and technology to provide hope for the future. Additionally, participants reported that it is beneficial to remind families that a genetic diagnosis will likely not change the child's medical management or treatment options.

Finally, support strategies were identified by eight of 41 participants and included directing the family to SWAN, assisting them with school accommodations and access to therapies, and connecting them with other families in similar situations. Two counselors reported not being sure of helpful strategies for families on the diagnostic odyssey.

Four themes were identified as limitations or barriers to assisting families on a diagnostic odyssey. The first theme was financial barriers, which included the cost of testing and lack of insurance coverage for genetic testing. Secondly, the informational factor included limitations in the testing itself and our current education and knowledge about various results, the lack of treatment if a diagnosis is found, and the potential lack

of information regarding the disease progression. The third theme was the emotional stress of the diagnostic odyssey, including patients feeling burnt out or losing interest from the long process and not returning for follow-up. The final theme was support, which included patients feeling that there is a lack of support when they do not have a diagnosis, a lack of specific resources, or social isolation.

**2.4.6 Impact of the diagnostic odyssey on pediatric genetic counselors.** Genetic counselors reflected on the personal impact of interacting with patients on a diagnostic odyssey. The results were diverse and are summarized in Table 2.2.

**Table 2.2 Impact of the Diagnostic Odyssey on Genetic Counselors (N = 59)**

Question	Response	n (%)	Themes: Example
Do you feel personally affected when the genetic testing/evaluation does not reveal a diagnosis for a patient?	Yes	35 (59)	Uncertainty: “I especially feel bad when families make family planning decisions based on the unknown risk of recurrence”
	No	24 (41)	Personal responsibility: “You feel like you let the family down”
Do you feel personally affected when counseling a patient who has had an ongoing diagnostic odyssey?	Yes	30 (51)	Positive feelings: “If I didn’t feel personally affected – I wouldn’t be doing my job correctly. The key is to not let it impact your performance or your emotional health”
	No	29 (49)	Negative feelings: “Some families are desperately searching for an answer and you feel inadequate when you are unable to provide one”
When a patient has an ongoing diagnostic odyssey, does this impact your counseling or ability to build rapport with the patient?	Yes	17 (29)	Builds stronger rapport: “I feel closer to these families because we work so hard on research, support, etc”
	No	42 (71)	Strains in building rapport: “Families do sometimes blame me or our team”

When asked about the utility of a positive genetic testing result for conditions with limited natural history information, most participants felt that a positive result was at least somewhat helpful or helpful ( $n = 47$ , 80%), and 12 participants felt it was very helpful. Although everyone felt a positive result was at least somewhat helpful, participants reported both benefits and limitations of that result. Benefits included providing a label for the child's condition and closure to the family, as well as eliminating blame the family may have been feeling and offering them relief. Other benefits included the ability to use the result for family planning purposes, and to focus the child's medical management and open the door to additional resources and services. Finally, participants found it beneficial to share the hope that more information would become available in the future as similar results are identified in other children.

Eleven participants discussed the limitations of a positive result if there is not well-known natural history information for the condition. These participants reported that patients want a clear answer with specific management guidelines and prognostic information and they may feel disappointed that an answer does not mean there is an effective treatment to help their child.

For participants who felt personally affected by not finding a diagnosis for a patient after genetic testing, they described situations that fell into the themes of personal responsibility and uncertainty. Within the theme of personal responsibility, several participants reported feeling frustration, especially when they think there should be an underlying genetic cause for a child's condition that was not identified by currently available testing. One participant recalled a patient for whom she could not identify a molecular mechanism:

*I have one couple who have one daughter with an epileptic encephalopathy which we believe has a genetic basis, but we have yet to determine the molecular mechanism. The couple are understandably reluctant to consider another pregnancy without fully understanding the recurrence risks, and we have regular conversations about whether there is any additional testing available which may determine the genetic basis of their daughters epilepsy. It is frustrating both for myself and the couple that we are yet to provide them with the answers they seek.*

Participants also reported feeling disappointed and that they “*let the family down*” when they receive negative genetic test results and cannot provide additional information to the family regarding their child’s condition. However, four participants reported remaining hopeful that new clinical tests would be able to find the answers for their patients.

Most participants reported feeling frustrated all or some of the time when seeing the same patient over and over without a diagnosis ( $n = 47, 80\%$ ). Some participants ( $n = 26$ ) suggested strategies for coping with this frustration. The predominant strategies included remaining optimistic about the future ( $n = 11$ ) and lengthening the amount of time between follow-up appointments to allow technology and knowledge to catch up and be more likely to provide additional information ( $n = 4$ ). Other strategies included discussing their frustration with their colleagues or supervisors ( $n = 3$ ) and utilizing de-stressing techniques ( $n = 3$ ). Feelings of frustration were not universal; two participants felt that not having a diagnosis “*is not a big deal*” and therefore coping strategies were not necessary.

When asked about ways the diagnostic odyssey may impact the counseling or ability to build rapport with the family, counselors reported that it could both strain and strengthen the connection. Some counselors ( $n = 11$ ) reported the odyssey as having a positive effect on rapport because they continued to follow the family over time and worked hard to research the child's features and make every visit worthwhile. As one participant stated, *"I actually think this is an opportunity for deeper rapport building, as we are able to see how a family deals with uncertainty over time and provide psychosocial support as needed."* On the other hand, counselors ( $n = 13$ ) reported that families start to feel that following up with genetics is not helpful and the family may distrust the expertise of genetics' professionals because they cannot provide more information about their child's condition. One example of this was stated as, *"I feel like families lose faith and trust in you and your team when we continue to have normal results."*

## **2.5 Discussion**

The diagnostic odyssey affects a significant portion of pediatric genetic counseling patients, although there is little information on genetic counseling practices for this patient population. Based on a survey of 63 pediatric genetic counselors, this study identified current practices, including communication and follow-up methods with patients, resources that are provided to patients, important aspects of the genetic counseling session, perceived purpose of a diagnosis, and current limitations to providing information to patients and families on the diagnostic odyssey. Additionally, responses revealed the impact of the diagnostic odyssey on pediatric genetic counselors.

Our sample of pediatric genetic counselors was representative of the genetic counselor population as a whole in regards to gender, age, and ethnicity, as described by the National Society of Genetic Counselors (2014). The responses collected from participants supported some features of genetic counseling sessions that we expected to be true. This includes the fact that genetic counseling sessions differ for patients with and without a diagnosis.

**2.5.1 Definition of a diagnosis and the diagnostic odyssey.** There are a variety of definitions of a diagnosis in the current literature, including a clinical or syndromic diagnosis, a molecular or genetic diagnosis, a working diagnosis, and others that are less commonly used. The research focus was on the diagnostic odyssey, which emphasizes the process of trying to identify a specific diagnosis, which may include one or more of the above terms. However, the definitions of these terms vary and may have different meaning to patients and professionals. Based on the literature and data recorded in this study, it seems to be difficult to identify the true definition or categories of diagnoses. It is also difficult to discern which definitions and aspects are most important to patients, their families, and healthcare professionals. While it may be difficult to define a final diagnosis, participants in this study had a shared understanding of the concept of the diagnostic odyssey and expressed several consistent themes.

**2.5.2 Communication with families on the diagnostic odyssey.** Many of the current follow-up and communication methods being utilized by our participants place the responsibility of receiving updated information on the patients and their families. Examples of this patient responsibility include returning for follow-up appointments or contacting their healthcare professionals about new discoveries or testing options.

However, some participants reported that other methods of communication may also be beneficial, most of which place some of the responsibility back onto the genetics team, such as sending out newsletters or messages via a secure patient portal.

Not all participants felt this issue had a clear answer. A few genetic counselors did not believe that it was their role to contact patients between appointments, even if they may have the time or ability to do so. However, according to Lipinski et al. (2006), parents of patients want to be informed when new technologies are available that may be beneficial in their search for an answer. This may lead genetic counselors to establish a method for sharing this responsibility of communication between the healthcare team and patients.

**2.5.3 Resources for patients on the diagnostic odyssey.** Some participants cited the importance of normalizing the diagnostic odyssey and that many families do not receive the answer for which they are looking. While normalizing is reported to be helpful, less than half of participants reported referring patients to support groups specifically for patients on a diagnostic odyssey or connecting these families. Genetic counselors should be aware of support opportunities for these patients and seek to utilize them. Genetic counselors may consider working with their own patients to create a local network of families on a diagnostic odyssey. While the list of medical symptoms may not be similar, the process and feelings about a diagnosis likely are similar. As Ainbinder et al. (1998) reported, parent-to-parent support is a beneficial tool for these families, and finding a match between parents is crucial. The connection of being on a diagnostic odyssey may be sufficient for a successful relationship, and help show families that they are not alone in their search for an answer.

Additionally, participants reported wanting more resources for patients without a diagnosis. In addition to referring patients to identified groups such as SWAN and NORD, pediatric genetic counselors are well-equipped to play a role in developing resources that may be helpful to these families. Genetic counselors may work with affected families to create brochures, newsletters, or informational websites specific to the diagnostic odyssey and their locale.

**2.5.4 Impact of the diagnostic odyssey.** Many participants discussed the personal impact they feel from patients on the diagnostic odyssey. Importantly, genetic counselors feel responsible for finding an answer for patients and their families, and when they are unable to identify an answer, they feel frustration, disappointment, and a sense of hopelessness. However, finding a diagnosis is not listed as one of the elements of the genetic counseling process:

Genetic counseling is a process of helping people understand and adapt to the medical, psychological and familial implications of genetic contributions to disease. This process integrates:

- Interpretation of family and medical histories to assess the chance of disease occurrence or recurrence.
- Education about inheritance, testing, management, prevention, resources and research.
- Counseling to promote informed choices and adaptation to the risk or condition. (National Society of Genetic Counselors, 2015)

Some of these elements may be more difficult to accomplish when a patient does not have a diagnosis, such as education about inheritance and assessment of disease

occurrence or recurrence, but most are still possible with knowledge simply of that patient's current medical symptoms. As many counselors pointed out, managing expectations about the risk of the diagnostic odyssey can also be beneficial to the family, which is simply a different way of accomplishing the part of the process that is "counseling to promote... adaptation to the risk or condition" (National Society of Genetic Counselors, 2015).

It is important that pediatric genetic counselors recognize their feelings regarding patients on the diagnostic odyssey and consider the variety of coping strategies discussed above. Although the diagnostic odyssey can affect genetic counselors personally, they are still able to accomplish their goals and provide information to families. It is also important to acknowledge that genetics is a growing field in healthcare with new information being discovered everyday, but to remain realistic and manage the families and their personal expectations. In remaining self-aware of one's own feelings, genetic counselors can remain unbiased during sessions and eliminate countertransference while still expressing empathy and understanding toward the patient's experiences.

**2.5.5 Study limitations.** This study surveyed only a small portion of currently practicing pediatric genetic counselors; therefore, the results may not be generalized to all pediatric genetic counselors or pediatric genetics clinics. We did not assess the counselors' work setting, which may have an impact on the number of patients who are on a diagnostic odyssey and therefore influence the participants' experiences and perspectives.

The majority of the questionnaire was created based on previous research reporting patients' perspectives and experiences as well as the outlined responsibilities of

genetic counselors. Responses may have been limited or biased by these specific options for some questions, although respondents had the option to provide additional suggestions in the “Other” selection. We may have identified additional themes had the study been completed via a primarily qualitative method.

**2.5.6 Future research.** As discussed above, additional information could be collected from interviews with pediatric genetic counselors to determine their unbiased views about the diagnostic odyssey. This may reveal themes that previous research with genetics patients has not displayed up to this point. It would also be interesting to survey or interview both genetic counselors and their patients on a diagnostic odyssey to compare their desires and perspectives of the process. This would likely provide the greatest insight into the diagnostic odyssey and reveal any discrepancies between genetics professionals and their patients.

Furthermore, exploring the roles and responsibilities of genetic counselors further may be informative to identify what patients want from genetic counselors when they are on a diagnostic odyssey and what the counselors believe is their role in the process. This may help clarify the discrepancy between communication with patients and available resources and if genetic counselors should help provide additional resources or information to patients between appointments.

## **2.6 Conclusions**

Patients on a diagnostic odyssey make up a significant portion of patients seen in genetics clinics. While patients on a diagnostic odyssey are common, it is challenging for pediatric genetic counselors to incorporate new technologies, available resources, and research into practice without having published recommendations or guidelines on how

to do so. The aim of this study was to investigate current genetic counseling practices for patients on a diagnostic odyssey and the impact of the diagnostic odyssey on pediatric genetic counselors.

While about a third of pediatric genetic counselors already have a method of tracking undiagnosed patients, others report the need for further tracking of undiagnosed patients. Pediatric genetic counselors identified strategies to share the responsibility of follow-up between the patient and the healthcare provider, including patients continuing to follow-up with their clinic while also receiving newsletters or personal messages from their providers. Genetic counselors also identified a need for more resources specifically for patients on a diagnostic odyssey, potentially provided by the counselors themselves via support groups within their institution or electronic groups and resources.

A wide range of themes was identified to describe the impact that the diagnostic odyssey has on pediatric genetic counselors as well as limitations to helping the patients and their families. Many counselors reported feeling frustrated and disappointed when they are unable to provide the answers and information that parents desire. There are many coping strategies to help address these feelings, and they should be utilized to avoid countertransference. However, these feelings can be useful to acknowledge because they may help build rapport between the genetics professionals and the family by showing empathy and understanding for the family's situation.

It is important for pediatric genetic counselors to recognize the difficulties experienced by patients and families on a diagnostic odyssey and listen to what the family needs. Genetic counselors should focus each session on the family's goals while presenting new genetic information and testing as appropriate for each patient. Genetic

counselors play a crucial role in the diagnostic odyssey and have an opportunity to make the complex process an easier one by communicating with patients and remaining open and honest with the families they assist.

### **Chapter 3: Conclusions**

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## Appendix A: Participant Invitation Email

Dear NSGC member,

Are you a **pediatric genetic counselor**? Do you see patients that are on a **diagnostic odyssey**?

If so, you are invited to participate in a research study investigating your role in the diagnostic odyssey. One goal of the study is to understand current practices of pediatric genetic counselors for patients on a diagnostic odyssey. We also hope to investigate the impact that the diagnostic odyssey has on pediatric genetic counselors.

Participation in this study is open to all pediatric genetic counselors. The study consists of an anonymous online survey that should take no longer than 20-30 minutes to complete. Participation is voluntary, and you may withdraw at any point.

If you are interested in participating in this survey, please follow the link below:  
<https://www.surveymonkey.com/r/N3SL3CZ>

If you have any questions or comments, please feel free to contact me by email at [amy.cordell@uscmed.sc.edu](mailto:amy.cordell@uscmed.sc.edu) or the University of South Carolina faculty advisor, Emily Jordon, at [emily.jordon@uscmed.sc.edu](mailto:emily.jordon@uscmed.sc.edu).

Thank you for your consideration,

Amy Cordell Wardyn, B.S.  
University of South Carolina  
School of Medicine  
Genetic Counseling Program

## **Appendix B: Participant Introductory Letter**

University of South Carolina School of Medicine  
Genetic Counseling Program

Dear Potential Participant,

You are invited to participate in a graduate research study focusing on pediatric genetic counselors and undiagnosed patients. I am a graduate student in the genetic counseling program at the University of South Carolina School of Medicine. My research investigates the current practices of pediatric genetic counselors for patients on a diagnostic odyssey. The research involves completing one online survey.

The surveys attempt to gather information about current practices and the impact of undiagnosed patients on pediatric genetic counselors. If you do not wish to answer a certain question, please skip that question and continue with the rest of the survey.

All responses gathered from the surveys will be kept anonymous and confidential. We do not ask for your name or contact information. The results of this study might be published or presented at academic meetings; however, participants will not be identified.

Your participation in this research is voluntary. By completing the survey, you are consenting that you have read and understand this information. At any time, you may withdraw from the study by not completing the survey.

Thank you for your time and consideration to participate in this survey. Your responses may help inform recommendations for counseling patients while on their diagnostic odyssey. If you have any questions regarding the research, you may contact either myself or my faculty advisor, Emily Jordon, MS, CGC, using the contact information below. If you have any questions about your rights as a research participant, you may contact the Office of Research Compliance at the University of South Carolina at (803) 777-7095.

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## Appendix C: Participant Questionnaire

1. Please provide your definition of a diagnostic odyssey.

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Definition of a diagnosis: Providers working in pediatric genetics clinics may make diagnoses in a number of different ways, such as based on clinical symptoms or genetic testing. For the purposes of this survey, we are focusing on patients on a diagnostic odyssey. These patients have a collection of symptoms that the medical team believes to be related, but a single unifying cause or descriptive label has not been identified. The patients may be collectively referred to as “undiagnosed”.

2. Please estimate the percentage of your clinical genetic counseling patients that are pediatric.

- 0-10%
- 11-20%
- 21-30%
- 31-40%
- 41-50%
- >50%

3. Please estimate the percentage of your pediatric patients that remain undiagnosed after a complete genetic workup.

- 0-10%
- 11-20%

- 21-30%
- 31-40%
- 41-50%
- >50%

4. Does the clinic you work with have a method of recording undiagnosed patients for future identification?

- Yes
- No

5. If so, what method(s) does your clinic use to record undiagnosed patients for future identification? \_\_\_\_\_

6. If you answered no to question 4, do you believe your clinic needs a method of recording undiagnosed patients for future identification?

- Yes
- No

7. How do you and other genetics professionals in your clinic incorporate new technologies (such as new tests) into practice for undiagnosed patients?

- You call undiagnosed patients when new discoveries are made if they may apply to their specific case
- You share new testing information with the patient when they return for their scheduled follow-up appointment
- You encourage the patient to contact the clinic between follow-up appointments to check on new testing developments
- Other (please specify) \_\_\_\_\_

8. Do you think another method of communication for new genetic tests or novel gene discoveries would better benefit patients on their diagnostic odyssey?

- Yes
- No

9. If you answered yes above, please describe other methods of communication that you think would benefit patients on their diagnostic odyssey.

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For each of the four patient populations listed below, please select the **3** aspects of a session *you find most important*. While we understand this will be dependent on each individual patient's case, please do your best to answer in a way that is generalizable to most patients in each population. If you would like, feel free to make comments in question 14.

10. New patients WITH a diagnosis

- Interpretation/updating family history
- Interpretation/updating medical history
- Education about inheritance
- Education about testing
- Education about management of disorder or symptoms
- Education about available resources
- Education about current research
- Counseling to promote informed choices
- Counseling to promote psychological adaptation to the risk or condition

11. Follow-up patients WITH a diagnosis

- Interpretation/updating family history
- Interpretation/updating medical history
- Education about inheritance
- Education about testing
- Education about management of disorder or symptoms
- Education about available resources
- Education about current research
- Counseling to promote informed choices
- Counseling to promote psychological adaptation to the risk or condition

12. New patients WITHOUT a diagnosis

- Interpretation/updating family history
- Interpretation/updating medical history
- Education about inheritance
- Education about testing
- Education about management of disorder or symptoms
- Education about available resources
- Education about current research
- Counseling to promote informed choices
- Counseling to promote psychological adaptation to the risk or condition

13. Follow-up patients WITHOUT a diagnosis

- Interpretation/updating family history
- Interpretation/updating medical history
- Education about inheritance

- Education about testing
- Education about management of disorder or symptoms
- Education about available resources
- Education about current research
- Counseling to promote informed choices
- Counseling to promote psychological adaptation to the risk or condition

14. For questions 10-13, please provide any additional comments here.

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15. Please select all of the following that you provide to undiagnosed patients' families. Each type of resource listed may include brochures, websites, referrals to support groups, or other resources. You are able to specify what these resources are in the following question.

- Resources for patients specifically without a diagnosis
- Resources general to the patient's geographic location
- Resources general to the patient's working diagnosis/main symptoms
- Internet group resources
- Financial aid resources
- None of the above
- Other (please specify) \_\_\_\_\_

16. For the items you selected above, please elaborate on the specific resources you provide to patients. \_\_\_\_\_

17. Do you believe there is a need for more resources that specifically pertain to undiagnosed patients?

- Yes
- No

18. If you are aware of any particular resources that specifically pertain to undiagnosed patients or patients continuing on their diagnostic odyssey, please list them here.

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19. What do you think parents are hoping for in a diagnosis for their child? *Please select your top 3 responses.*

- Label: to help with understanding and explaining the condition
- Causation/etiology: to provide recurrence risk and/or explanation of how this happened
- Prognosis: to prepare for the child's future health, intellectual, or physical challenges
- Treatment: to mitigate physical symptoms or improve functioning
- Acceptance: to understand the permanence and natural history of the child's condition
- Social support: to connect with support groups, other parents, and to procure services
- Other (please specify) \_\_\_\_\_

20. What aspects about a child receiving a diagnosis do you think are most helpful to their parents? *Please select your top 3 responses.*

- Label: to help with understanding and explaining the condition
- Causation/etiology: to provide recurrence risk and/or explanation of how this happened

- Prognosis: to prepare for the child’s future health, intellectual, or physical challenges
- Treatment: to mitigate physical symptoms or improve functioning
- Acceptance: to understand the permanence and natural history of the child’s condition
- Social support: to connect with support groups, other parents, and to procure services
- Other (please specify) \_\_\_\_\_

21. What are some strategies you have found helpful for families with a child on a diagnostic odyssey? \_\_\_\_\_

22. Please identify any limitations or barriers you have encountered in helping families who have a child on a diagnostic odyssey. \_\_\_\_\_

23. How helpful do you think a positive result from genetic testing, such as Whole Exome Sequencing (WES), is to parents of an undiagnosed child if there is no additional information to provide regarding natural history of the newly discovered disorder?

- |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
| Not at all helpful    | Somewhat helpful      | Helpful               | Very helpful          |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

24. Please elaborate on your response to question 23.

\_\_\_\_\_

25. Do you feel personally affected when the genetic testing/evaluation does not reveal a diagnosis for a patient?

- Yes
- No

26. If so, please describe a situation when you felt personally affected by not finding a diagnosis for a patient after genetic testing. \_\_\_\_\_

27. Do you feel personally affected when counseling a patient who has an ongoing diagnostic odyssey?

- Yes
- No

28. If so, please describe a situation when you felt personally affected counseling a patient on their diagnostic odyssey. \_\_\_\_\_

29. Do you find the repetition of seeing the same patient over and over without a diagnosis frustrating?

- Yes
- No
- Sometimes

30. If you do find this repetition frustrating, please describe that situation and strategies you have used to cope with the frustration. \_\_\_\_\_

31. When a patient has an ongoing diagnostic odyssey, does this impact your counseling or ability to build rapport with the patient?

- Yes
- No

32. If so, please describe the ways that the diagnostic odyssey may impact your counseling or ability to build rapport. \_\_\_\_\_

33. How many years have you been working as a genetic counselor?

- < 1 year

- 1-4 years
- 5-9 years
- 10-14 years
- 15+ years

34. How many years have you been working in clinical pediatric genetic counseling?

- < 1 year
- 1-4 years
- 5-9 years
- 10-14 years
- 15+ years

35. Are you a certified genetic counselor?

- Yes
- No
- Board eligible

36. For your average clinical schedule, please estimate the percentage of cases that are follow-up appointments.

- 0-10%
- 11-20%
- 21-30%
- 31-40%
- 41-50%
- >50%

37. Gender

- Male
- Female

38. Age

- 20-29 years
- 30-39 years
- 40-49 years
- 50+ years

39. Ethnicity

- Caucasian
- African American
- Hispanic
- Native American
- Asian/Pacific Islander
- Other (please specify) \_\_\_\_\_

You have reached the end of the survey. Thank you for your participation.