Challenges in Counseling for Rare Chromosome Conditions: Genetic Counselors’ Perspective

Master’s Thesis

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By
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Abstract

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A thesis presented to the Biology Department and Genetic Counseling Program

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Waltham, Massachusetts

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Rare chromosome conditions (RCCs) are conditions for which molecular diagnostic methods exist, but little else is known in terms of prognosis, recurrence risk and therapy. Lipinski et al. (2006) explored the feelings of uncertainty and loss of control that parents of children with a RCC experience, and found a significant negative correlation between parent’s level of uncertainty and their perception of helpfulness of the genetic counselor. The aim of our study was to expand on Lipinski et al. by surveying genetic counselors with clinical pediatric experience to understand the current practices of the genetic counseling community and the challenges faced by them when counseling RCC cases. We recruited genetic counselors with clinical pediatric work experience through the NSGC listserv to participate in an online, anonymous survey. Genetic counselors were eligible to participate in this study if they have worked in a clinical pediatric setting within the last 5 years. The survey consisted of 39 multiple-choice, Likert scale and open-ended questions. A total of 112 surveys were completed. A majority (92.66%, n=101) of
the respondents indicated that counseling a RCC case was challenging. The respondents identified the top three reasons for feeling challenged: minimal prognostic information available to provide to the families; lack of information about the RCC, and lack of resources available to provide to the family. However, the majority (93.58%, n=102) of respondents indicated that they are comfortable counseling RCC cases and generally address the lack of information directly during their session with families. Our findings indicate that there is a need for increased awareness of the resources available to the counselors for their own use and to provide to these families. There is also a need for practice guidelines to provide uniform care to families of children with RCCs.
# Table of Contents

Acknowledgements .............................................................................................................. ii
Abstract ............................................................................................................................... iii
Table of Contents ................................................................................................................. v
List of Figures ....................................................................................................................... vi
List of Tables ....................................................................................................................... vi
Introduction ......................................................................................................................... 1
Methodology ........................................................................................................................ 4
  Study Design .................................................................................................................... 4
  Data Collection Tool ........................................................................................................ 5
  Data Analysis ................................................................................................................... 6
Results .................................................................................................................................. 7
  Demographics .................................................................................................................... 7
  Experience working in a clinical pediatric setting ............................................................. 10
  Experience working with RCC ......................................................................................... 11
  Challenges in counseling for RCCs .................................................................................. 15
  Open Ended Questions ...................................................................................................... 25
    Personal Reaction to Receiving Patient’s RCC Result ...................................................... 25
    Strategies Used by Genetic Counselors to Address the Lack of Information .................. 27
Case Scenario ....................................................................................................................... 28
Discussion ............................................................................................................................. 29
  Experience working with RCCs ......................................................................................... 30
  Challenges in counseling for RCC ..................................................................................... 31
  Study Limitations ............................................................................................................. 37
  Implications for Future Research ..................................................................................... 38
Conclusion ............................................................................................................................. 39
  Bibliography .................................................................................................................... 40
Appendix A: Abbreviations/Acronyms ............................................................................. 42
Appendix B: Recruitment Notice ......................................................................................... 43
Appendix C: Questionnaire ................................................................................................. 45
List of Figures

Figure 1: Age of the Respondents........................................................................................................8
Figure 2: Frequency of number of years employed as a genetic counselor...........................................8
Figure 3: Regional Representation........................................................................................................10
Figure 4: Years of experience in a pediatric genetic counseling setting................................................10
Figure 5: Current involvement in clinical pediatric setting......................................................................11
Figure 6: Frequency of the number of RCC cases counseled.................................................................12
Figure 7: Different kinds of RCC cases...................................................................................................13
Figure 8: Ascertainment of RCCs..........................................................................................................14
Figure 9: Counseling a family with a child with a confirmed diagnosis of a RCC is challenging..................16
Figure 10: Counseling a family with a child with a RCC diagnosis is more difficult than counseling a family with a child with a more common genetic condition............................................16
Figure 11: GCs comfort level in counseling a family with a child with a confirmed RCC diagnosis..........................17
Figure 12: GCs spend more time when counseling families with a child with a confirmed diagnosis of RCC Vs when counseling families with a child with a common genetic condition........................................18
Figure 13: Parents of children with RCCs feel more challenged than parents of children with more common genetic conditions..........................................................19
Figure 14: Difficulty in communicating ‘expressions of hope’ to the family when the prognosis for the RCC finding is unclear ............................................................................................22
Figure 15: Ascertainment of parent’s perception of severity of their child’s condition..................................23
Figure 16: Support group: CDO................................................................................................................24
Figure 17: Support group: Unique............................................................................................................24

List of Tables

Table 1: Changes in Cytogenetic Technology over Decades (Ledbetter, 2008) ...................2
Table 2: Sample Characteristics.................................................................................................................9
Table 3: Examples of RCCs......................................................................................................................13
Table 4: Resources used by genetic counselors when preparing to counsel for a RCC case..................14
Table 5: Reasons for feeling challenged.................................................................................................20
Table 6: Reasons parents of children with RCCs feel more challenged than parents of children with more common genetic conditions..............................................................................21
Table 7: Strategies used by genetic counselors to address the lack of information.........................28
Introduction

De novo or inherited structural chromosome rearrangements can cause imbalances in gene dosage affecting normal growth and development. Cytogenetic analysis (routine G-banded chromosome analysis, FISH, chromosome microarray etc.) are vital to the diagnostic work up of patients with developmental delays (DD), idiopathic mental retardation (MR), and dysmorphic features (Shearer et al., 2007). As illustrated in Table 1, “Cytogenetics has enjoyed a major technology breakthrough in each decade since the 1960s” (Ledbetter, 2008). In the estimated 3% of the population with MR/DD with or without additional multiple congenital anomalies (MCA) the etiology is known in approximately 50% of the cases, with visible chromosome abnormalities present in about 10%. An additional 2–5% of cases may be identified by targeted FISH analysis when a specific syndrome is suspected or with a panel of subtelomere FISH probes. However, in the remaining 50% the etiology remains unknown. Several recent studies suggest that when array-comparative genomic hybridization (array-CGH) is performed an apparently normal karyotype, the diagnostic yield increases by an additional 8–17% (Edelmann & Hirschhorn, 2009). Array-CGH is a molecular cytogenetic technique that allows rapid and comprehensive analysis of the entire genome (Lapierre & Tachdjian, 2005). Array-CGH is the most advanced method currently for assessing genomic imbalances associated with genetic disease. It has greatly enhanced the diagnostic capabilities and has led to the continued discovery of novel genetic syndromes. The technology is being implemented routinely after a normal chromosome result when a phenotype of MR/MCA is present, but it is also appropriate for patients with autism and apparently balanced translocations (Edelmann & Hirschhorn, 2009).
Ledbetter (2008) states that, “The total number of disorders is now far too large for a pediatrician, or even a pediatric geneticist, to make a specific clinical diagnosis before genetic testing. Clinicians, like researchers, can now shift to a “genotype first” model of diagnosis for children with unexplained developmental anomalies”. These improvements in the cytogenetic technologies have led to the identification of new genomic imbalances and delineation of novel syndromes at a rapid pace, but little else is known in terms of result interpretation and patient education (Darilek, et al., 2008).

Table 1: Changes in Cytogenetic Technology over Decades (Ledbetter, 2008)

<table>
<thead>
<tr>
<th>Category</th>
<th>1960s</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Prebanding cytogenetics</td>
<td>Banding Techniques</td>
<td>High-resolution banding</td>
<td>FISH</td>
<td>Cytogenetic arrays</td>
</tr>
<tr>
<td>Resolution</td>
<td>10-20 Mb</td>
<td>5-10 Mb</td>
<td>3-5 Mb</td>
<td>100 kb</td>
<td>50-500 kb</td>
</tr>
<tr>
<td>Known phenotype found to have a specific genotypic basis</td>
<td>Down syndrome</td>
<td>Klinefelter syndrome</td>
<td>Turner syndrome</td>
<td>Prader-Willi syndrome</td>
<td>Williams syndrome</td>
</tr>
<tr>
<td>Known genotype found to have a specific phenotypic manifestation</td>
<td>Trisomy 18</td>
<td>WAGR syndrome</td>
<td>Smith-Magenis syndrome</td>
<td>1p36</td>
<td>17q21.3</td>
</tr>
</tbody>
</table>

This study focuses on counseling for rare chromosome conditions (RCCs) for which molecular diagnostic methods exist, but little else is known in terms of prognosis, recurrence risk and therapy. For the purposes of this study, a RCC is defined as any
chromosomal condition that has not been well described and for which minimal prognostic information is available because they have been reported in only a few individuals (Lipinski et al., 2006).

Even though individual RCCs have a low prevalence, one in every 200 babies is estimated to be born with some form of RCC (ref. Unique, www.rarechromo.org). Improvements in medical diagnostic technologies, such as the use of array-comparative genomic hybridization (array-CGH), have led to the identification of several kinds of complex chromosomal defects (e.g. microdeletions and microduplications) that have not been previously recognized (Brunetti-Pierri et al., 2007; Mefford, Sharp et al., 2008). However, these diagnostic improvements have not been matched by equivalent advances in prognostic information or estimation of recurrence risks for the children affected by these RCCs. Thus, an increasing number of genetic counselors face the prospect of counseling parents of children with rare chromosomal disorders while little is known in terms of patient education, result interpretation, recurrence risks and prognosis (Darilek et al., 2008).

Previous studies on counseling for RCCs focused primarily on the parental perspective, highlighting the lack of control and the uncertainty that parents feel when faced with the reality of having a child with a condition about which little scientific information is available (Strehle & Middlemiss, 2007; Rosenthal et al., 2001; Lipinski et al., 2006). The 2006 study conducted by Lipinski et al. consisted of 363 respondents who were parents of children with a RCC and were members of the Chromosome Deletion Outreach (CDO), a support group of families, individuals, and professionals addressing rare chromosome disorders. The results obtained from this study showed that in the absence
of prognostic information, parents want to learn about support groups like Chromosome Deletion Outreach (CDO) and Unique. They would also like to have more time to express their concerns with a genetic counselor and to hear expressions of hope from their genetic counselor. Interestingly, they found a significant negative correlation between a parent’s level of uncertainty and their perception of the helpfulness of their genetic counselor (Lipinski et al., 2006).

This project builds on the study done by Lipinski et al. (2006) by surveying genetic counselors who are members of NSGC with experience in a clinical pediatric setting about the current practices and challenges they face in their dealings with families with children with rare chromosome conditions as well as about the resources they currently use when counseling such families. This study assesses whether new strategies are needed to help genetic counselors better serve the parents of children with a RCC. This study is the first to look at the experiences and challenges of the pediatric genetic counseling community regarding RCC test results and it comes at a time when the number of children being diagnosed with RCCs is increasing rapidly.

**Methodology**

*Study Design*

We used an anonymous online survey to collect information from genetic counselors with experience in a clinical pediatric setting to understand the current practices and challenges faced by them while counseling families of children with a RCC. We forwarded an invitation to participate in this study to the members of the National Society
of Genetic Counselors (NSGC) via the NSGC general listserve (Appendix A). Judith Tsipis, project advisor, posted the recruitment notice twice over a period of three weeks in January and February, 2009. We limited the inclusion criteria to genetic counselors either currently working in a clinical pediatric genetic counseling setting or who had worked in a clinical pediatric genetic counseling setting within the last 5 years. The genetic counselors also needed to have counseled at least one family with a child with a confirmed diagnosis of a RCC.

We provided the link to the online survey in the recruitment notice. We did not require informed consent as study participation posed no more than minimal risk to participants. The Brandeis University Review Board (Protocol #09-068) approved the study proposal, all supporting documents, and the recruitment notice.

Data Collection Tool

We created the survey using an online survey tool, surveymonkey.com. The survey was anonymous and we did not compensate the respondents for their participation. The thirty-nine question survey contained three sections: demographic information, counselors’ experience working with RCCs, and open ended questions. The survey consisted of multiple-choice single answer, multiple-choice multiple answers, scaled, fill in the blank and open-ended questions (Appendix B). We designed the survey questions based on the results obtained by Lipinski et al. (2006). In the survey we included the definition of RCCs, a few examples of RCCs and some examples of chromosome conditions that do not meet the definition of a RCC. For the purposes of this study, a rare chromosome condition (RCC) is defined as per Lipinski et al. (2006), as:

- any chromosomal condition that has not been well described;
• has an upper limit population prevalence of 1/120,000;
• for which minimal prognostic information is available.

We used skip logic for certain questions to direct respondents to alternative question sets. We designed three sets of questions which were similar but worded in such a way so as to keep each question appropriate for respondents in each of the following three groups:

• Group 1: genetic counselors’ who are currently working in a clinical pediatric setting with less than one year experience in a clinical pediatric setting (<1/current);
• Group 2: genetic counselors’ who are currently working in a clinical pediatric setting with more than one year experience in a clinical pediatric setting (>1/current); and
• Group 3: genetic counselors’ who previously worked in a clinical pediatric setting (not/current).

For each question we combined the responses from the three groups and treated them as one sample except for two questions (number of RCC cases counseled and the different kinds of RCCs counseled).

**Data Analysis**

We used SPSS (Statistic Package for the Social Sciences) software version 15.0 for statistical analysis. We used descriptive statistics to describe the sample population and to determine the level of agreement with the Likert scale questions. We also used Pearson’s correlation analysis to determine the relationship between variables. A p value of 0.05 or less indicated a statistically significant relationship while a p value of <0.10 indicated a marginally significant finding. We coded the open-ended questions quantitatively for
emergent themes using ATLAS software. Finally we calculated the frequencies of the major themes and used direct quotations to supplement this data.

**Results**

A total of 126 responses were received. Six surveys were removed because respondents did not meet the inclusion criteria, and eight were removed because they were >90% incomplete, leaving a total of 112 responses.

**Demographics**

The age distribution and experience of genetic counselors who responded to the survey was varied. Figures 1 and 2 show the distribution of the age of the respondents and years of experience as a genetic counselor in comparison to the data in the NSGC Professional Status Survey (PSS) 2008. The majority of the respondents are between the age groups of 25-29 years (38.5%) and 30-34 years (32.1%). These percentages are slightly higher than those found in the PSS 2008, in which 27% are between the age group 25-29 years and 27% between the age group 30-34 years (Figure 1). The sample characteristics of the respondents are found in Table 2. Just 3% of the survey respondents were males as compared to 5% in the PSS 2008 study.
We found the number of years of experience of the respondents were similar to those in the PSS 2008 although our sample contained a smaller percent of genetic counselors with >10 years experience (Figure 2).

Figure 1: Age of the Respondents

Figure 2: Frequency of number of years employed as a genetic counselor
Table 2: Sample Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Current Study Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>109</td>
</tr>
<tr>
<td>Range</td>
<td>24-59 years</td>
</tr>
<tr>
<td>Mean</td>
<td>33.26 years</td>
</tr>
<tr>
<td>Std. deviation</td>
<td>7.95</td>
</tr>
<tr>
<td><strong>Experience working as a genetic counselor</strong></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>112</td>
</tr>
<tr>
<td>Range</td>
<td>3 months-31 years</td>
</tr>
<tr>
<td>Mean</td>
<td>7.12 years</td>
</tr>
<tr>
<td>Std. deviation</td>
<td>7.11</td>
</tr>
<tr>
<td><strong>Experience in pediatric genetic counseling</strong></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>110</td>
</tr>
<tr>
<td>Range</td>
<td>2 months-31 years</td>
</tr>
<tr>
<td>Mean</td>
<td>5.54 years</td>
</tr>
<tr>
<td>Std. deviation</td>
<td>6.49</td>
</tr>
</tbody>
</table>

Respondents were from all regions of the country and display a similar distribution to that seen in the data from the PSS 2006 and PSS 2008, although our rate was slightly higher from Regions III and IV and slightly lower from Region I, II and VI (Figure 3).
Experience working in a clinical pediatric setting

The total number of years of experience of the respondents in a clinical pediatric setting varied from 3 months to 31 years but the majority of the respondents have less than 5 years experience in a pediatric setting (Figure 4, Table 2).

Figure 3: Regional Representation

Figure 4: Years of experience in a pediatric genetic counseling setting
As can be seen in Figure 5, the majority (71.43%, n=80) of the respondents are currently working in a clinical pediatric setting and have more than one year experience working in a clinical pediatric setting (>1/current group).

Figure 5: Current involvement in clinical pediatric setting

*Experience working with RCC*

As can be seen in Figure 6 there is a wide variation in the number of RCC cases counseled within each group.
Figure 6: Frequency of the number of RCC cases counseled

The respondents from the three groups reported that they have experience in counseling for different kinds of RCCs (Figure 7). A few examples of RCCs counseled by the respondents are mentioned in Table 3.
Figure 7: Different kinds of RCC cases

*: translocations (unbalanced), inversions, multiple marker chromosomes

**: Percentage responses do not add to 100% because respondents were able to mark multiple answers.

Table 3: Examples of RCCs

<table>
<thead>
<tr>
<th>Different kinds of RCCs</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deletions</td>
<td>17q21.31 del; 8p23 del; 2q22-q24 del; 2q31.1 del; 4p del; 1q21.1 del; 1p36 del</td>
</tr>
<tr>
<td>Duplications</td>
<td>15q13 dup; 10p14 dup; 16q22 dup; 16p11.2 dup; 5q23.1 dup; 7q11.23 dup; Xp22.2 dup</td>
</tr>
<tr>
<td>Ring chromosomes</td>
<td>Mosaic ring 7</td>
</tr>
<tr>
<td>Mosaic karyotypes</td>
<td>mosaic triploidy; mosaic trisomy 8; mosaic 9p deletion</td>
</tr>
<tr>
<td>Trisomies</td>
<td>trisomy 9p; trisomy 18p</td>
</tr>
<tr>
<td>Other</td>
<td>X;9 translocation; 10q inversion with deletions at inversion sites; non-mosaic isodicentric Y; unbalanced 5;10 translocation</td>
</tr>
</tbody>
</table>

The majority (87.96%) of the respondents reported that array-CGH (blood) was used to ascertain the RCC in their patients (Figure 8).
In Table 4 we have listed the various resources frequently used by genetic counselors when preparing to counsel for a RCC case.

Table 4: Resources used by genetic counselors when preparing to counsel for a RCC case

<table>
<thead>
<tr>
<th>No.</th>
<th>Helpful resources for genetic counselors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pubmed</td>
</tr>
<tr>
<td>2.</td>
<td>Online Mendelian Inheritance in Man (OMIM)</td>
</tr>
<tr>
<td>3.</td>
<td>Websites of support groups (Unique/Chromosome Deletion Outreach)</td>
</tr>
<tr>
<td>4.</td>
<td>Genome Browsers (UCSC, Toronto database, Genecards, DECIPHER, ECARUCA)</td>
</tr>
<tr>
<td>5.</td>
<td>Genetests.org</td>
</tr>
<tr>
<td>6.</td>
<td>Websites of the testing/diagnostic lab</td>
</tr>
<tr>
<td>7.</td>
<td>Contacting the diagnostic testing lab directly (genetic counselor/cytogenetic lab director)</td>
</tr>
<tr>
<td>8.</td>
<td>The report itself (includes helpful information and cites pertinent articles to review)</td>
</tr>
<tr>
<td>9.</td>
<td>Website: Chromosomal Variations in Man</td>
</tr>
<tr>
<td>11.</td>
<td>NSGC listservest</td>
</tr>
</tbody>
</table>
Challenges in counseling for RCCs

The majority (92.66%, n=101) of genetic counselors stated that counseling a family with a child with a confirmed diagnosis of a RCC (“RCC case”) was challenging (Figure 9). The majority of the respondents (77.98%, n=85) also stated that counseling a RCC case was more difficult than counseling a family with a child with a more common genetic condition (Figure 10). When asked to elaborate about why it is harder to counsel a RCC rather than a common genetic condition, one of the respondents said:

- “Well-defined conditions have a spectrum of severity that can be explained to the family. Often healthcare guidelines or suggested management is established for well-described conditions. Rare chromosome changes don't have such clear cut recommendations or expectations, which is difficult for the family, and in turn, difficult for the counselor.”

In contrast, another respondent who felt that counseling a RCC case was not more difficult than counseling a family with a child with a more common condition said:

- “I do not think it is as challenging as there is often less information to obtain and present. The uncertainty of the situation may be frustrating for the parents (as well as the counselor), but it allows them [the family] to retain hope.”

However, despite the fact that genetic counselors found counseling a RCC case challenging, the vast majority of genetic counselors (93.58%, n=102) did report that they were comfortable counseling a RCC case (Figure 11).

When asked to elaborate on their comfort level, some said:

- “I’m comfortable with the COUNSELING, but not always comfortable with the lack of information I can provide a family. There is a difference between counseling and education.”

- “I don’t mind saying I don’t know, or no one knows and sharing their frustration about that.”
“Counseling in these situations requires managing my own discomfort with uncertainty as well as understanding and addressing the family’s needs...”

Figure 9: Counseling a family with a child with a confirmed diagnosis of a RCC is challenging

Figure 10: Counseling a family with a child with a RCC diagnosis is more difficult than counseling a family with a child with a more common genetic condition
There is a significant correlation between the number of RCC cases counseled by the >1/current group and how likely the respondents reported that counseling RCC cases was less challenging ($r=0.25$, $p<0.05$). The genetic counselors (>1/current) who saw a greater number of RCC cases were less likely to find counseling RCC cases challenging. There is a marginally significant correlation between the number of years an individual has practiced as a clinical pediatric genetic counselor, the age of the respondents, the number of RCC cases counseled (>1/current) and how likely they were to report being more comfortable. More experienced counselors ($r=-0.16$, $p=0.09$), older respondents ($r=-0.18$, $p=0.06$) and respondents (>1/current) who counseled a greater number of RCC cases ($r=-0.2$, $p=0.08$) reported being more comfortable counseling a RCC case.

The majority (60.75%, n=65) of the respondents reported that they *sometimes* spend more time counseling RCC cases versus counseling families with a child with a common genetic condition (Figure 12).
As can be seen in Figure 13, 37.61% (n=41) of the respondents reported that parents of children with RCCs feel more challenged than parents’ of children with more common genetic conditions. A few respondents stated that the degree of challenge varies from family to family and it depends on the family’s coping styles, resources available to them, parents’ personalities, and accessibility to various services:

- “Depended almost as much on the family ability to cope than the diagnosis, although the families with common genetic conditions that were diagnosed easily and early seemed to adjust easier and more quickly than those families who had struggled for years not knowing what was wrong with their child.”

Another wrote:

- “One of the hard things is that they wish there were an easy answer to their friends and teachers when they are asked, "What’s wrong with him/her". Everyone knows about Down syndrome, but no one knows about this condition, and it gets tiresome to keep explaining that no one has good answers when you so desperately want answers yourself. From this perspective (plus the lack of EXACT
support groups), I think many of my families find it more challenging than they would if their child had something that people either had heard of or could easily Google."

Figure 13: Parents of children with RCCs feel more challenged than parents of children with more common genetic conditions

The top three reasons stated by the respondents for feeling challenged when counseling RCC cases were minimal prognostic information to provide to the family (98.1%), lack of information (95.24%) and lack of resources to provide the family (82.82%). Whereas, the majority of the respondents (49.04%) reported that the lack of experience in counseling for ‘the particular condition’ was not a reason for feeling challenged. Table 5 summarizes the data reported regarding the reasons for feeling challenged when counseling RCC cases. A few genetic counselors also reported that parental coping mechanisms and their education level were some other reasons for feeling challenged.
### Table 5: Reasons for feeling challenged

<table>
<thead>
<tr>
<th>No.</th>
<th>Reasons for feeling challenged</th>
<th>Strongly Agree/Agree (%)</th>
<th>Neither Agree nor Disagree (%)</th>
<th>Disagree/Strongly Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Minimal prognostic information to provide to the family</td>
<td>98.1</td>
<td>1.9</td>
<td>0.0</td>
</tr>
<tr>
<td>2.</td>
<td>Lack of information</td>
<td>95.24</td>
<td>2.86</td>
<td>1.9</td>
</tr>
<tr>
<td>3.</td>
<td>Lack of resources to provide the family</td>
<td>82.86</td>
<td>10.48</td>
<td>6.67</td>
</tr>
<tr>
<td>4.</td>
<td>Lack of support groups for ‘the particular’ condition</td>
<td>68.57</td>
<td>18.1</td>
<td>17.14</td>
</tr>
<tr>
<td>5.</td>
<td>Lack of resources for yourself</td>
<td>62.86</td>
<td>20</td>
<td>17.14</td>
</tr>
<tr>
<td>6.</td>
<td>Severity of the child’s condition</td>
<td>52.38</td>
<td>30.48</td>
<td>16.19</td>
</tr>
<tr>
<td>7.</td>
<td>Age of the child at the time of diagnosis</td>
<td>42.86</td>
<td>36.19</td>
<td>20</td>
</tr>
<tr>
<td>8.</td>
<td>Difficulty in calculating recurrence risks</td>
<td>34.26</td>
<td>19.05</td>
<td>45.71</td>
</tr>
<tr>
<td>9.</td>
<td>Lack of experience in counseling for ‘the particular condition’</td>
<td>30.77</td>
<td>20.19</td>
<td>49.04</td>
</tr>
<tr>
<td>10.</td>
<td>Age of the parents</td>
<td>28.57</td>
<td>33.33</td>
<td>46.67</td>
</tr>
</tbody>
</table>

Table 6 summarizes the data reported regarding genetic counselors’ perceptions of the reasons parents of children with RCCs felt more challenged than parents of children with more common genetic conditions.
Table 6: Reasons parents of children with RCCs feel more challenged than parents of children with more common genetic conditions

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Reasons parents’ of children with RCCs feel more challenged than parents of children with more common genetic conditions</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minimal prognostic information available to the family</td>
<td>84.81</td>
</tr>
<tr>
<td>2</td>
<td>Lack of information</td>
<td>72.15</td>
</tr>
<tr>
<td>3</td>
<td>Uncertainty about how the child’s condition will impact their family in the long term</td>
<td>43.03</td>
</tr>
<tr>
<td>4</td>
<td>Lack of support groups for ‘the particular’ condition</td>
<td>30.38</td>
</tr>
<tr>
<td>5</td>
<td>Isolation</td>
<td>26.58</td>
</tr>
<tr>
<td>6</td>
<td>Severity of the child’s condition</td>
<td>16.46</td>
</tr>
<tr>
<td>7</td>
<td>Lack of resources provided by health professionals</td>
<td>12.66</td>
</tr>
<tr>
<td>8</td>
<td>Unclear about recurrence risks</td>
<td>10.13</td>
</tr>
<tr>
<td>9</td>
<td>Lack of control</td>
<td>5.06</td>
</tr>
<tr>
<td>10</td>
<td>Age of the child at the time of diagnosis</td>
<td>2.53</td>
</tr>
<tr>
<td>11</td>
<td>Other (difficulty to identify coping strategies)</td>
<td>1.27</td>
</tr>
<tr>
<td>12</td>
<td>Age of the parents</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The majority of the genetic counselors (51.86%, n=56) reported that they did not find it difficult to communicate expressions of hope to the family when the prognosis of the RCC finding was unclear (Figure 14).
Figure 14: Difficulty in communicating ‘expressions of hope’ to the family when the prognosis for the RCC finding is unclear

A few genetic counselors commented:

- “there is always room for hope”
- “there are different types of hope, some of which can be (and should be preserved) in families receiving this (RCC) diagnosis”
- “in the absence of information, we simply cannot predict outcome and to always assume a negative outcome is simply not true”

There is a significant correlation between the number of RCC cases counseled by the not/current group and how likely the respondents reported that communicating expressions of hope was more difficult (r= -0.49, p<0.05). Interestingly, the genetic counselors (not/current) that saw a greater number of RCC cases were more likely to report difficulty in communicating expressions of hope. We also found significant correlations between the age of the respondents, the number of years an individual has practiced as a clinical pediatric genetic counselor and how likely they were to report difficulty in communicating expressions of hope. Older respondents (r=0.30, p<0.01) and
more experienced counselors ($r= 0.27, p<0.01$) were less likely to report difficulty in communicating expressions of hope.

Of the 108 respondents, 50% of them reported that they *often* ascertained parent’s perception of the severity of their child’s condition when counseling a family with a child with a RCC (Figure 15).

![Figure 15: Ascertainment of parent’s perception of severity of their child’s condition](image)

We questioned the genetic counselors about their knowledge regarding the online support groups for RCCs such as Chromosome Deletion Outreach (CDO) and Unique. The majority of the respondents (75.23%, n=82) reported that they had heard about CDO. Of the 82 respondents who had heard about CDO, 35.37% (n=29) reported that they *always* inform the parents of children with a RCC about CDO (Figure 16).
The vast majority of the respondents (87.96%, n=95) reported that they had heard about Unique. Of the 95 respondents who had heard about Unique, 38.04% (n=35) reported that they always inform the parents of children with a RCC about Unique (Figure 17).
The majority of the respondents (77.07%) reported that they would be interested in attending a short course or an EBS (educational based symposium) at an NSGC annual educational conference (AEC) on the topic of counseling for RCCs if they were attending the AEC.

**Open Ended Questions**

**Personal Reaction to Receiving Patient’s RCC Result**

We asked the respondents to share their personal reaction when they receive a patient’s test result of a RCC. The majority of genetic counselors expressed feelings of “frustration” for different reasons. A few genetic counselors expressed frustration over the lack of information:

- “I often find it frustrating to not be able to answer questions as fully as possible due to lack of published information.”

Whereas, some genetic counselors expressed frustration over array-CGH technology:

- “Frustration that the technology is so far ahead of our experience.”

A few genetic counselors expressed frustration over the inability to inform the parents if the RCC finding is in fact the cause of their child’s symptoms:

- “Frustrated--it's nice to find something in a child known to have delays, but when you can’t tell for sure if it's relevant . . . or, if it is thought to be causative, when it doesn't gain you much information about prognosis, etc.”

Some respondents also expressed frustration over the extra time they have to invest in literature search which is unsuccessful most of the time due to the lack of available information.
“Not again! Now I have to do an extensive lit search.”

“Frustrated, and often we now need to test the parents, so dismayed at extra work/cost/explanations required, when we may end up not really knowing anything.”

A few genetic counselors expressed feelings of “happiness”, “gladness” and “relief” after receiving patient’s RCC result:

- “Happy to have found an answer for the child, frustrated not to be able to provide more specific information to the family.”
- “Usually gladness that we have identified a reason for this family that is so desperately searching for a diagnosis. Sometimes surprise if we were suspicious of something else.”
- “I am generally relieved that we have finally managed to answer the family’s question of what has caused my child's delays.”

Whereas some genetic counselors expressed their personal reaction using one word emotional expression:

- “Crap, this family is going to want more info than what is available on this particular RCC.”
- “Oh no!”
- “Here we go again!”
- “[deep sigh], then extensive literature searching”

A few genetic counselors implied receiving patient’s RCC result was intellectually stimulating:

- “Interest. It allows me to delve into research and learn something new.”
- “I find it interesting in an academic way.”
- “Excitement due to having an answer for the family. Also I enjoy researching rare chromosomal conditions.”

Interestingly, some genetic counselors stated that they have no strong reaction when receiving a patient’s RCC result:

- “I have to call out a result. I don't really have a reaction because it is my job.”
- “We get so many, I'm not sure I really have a reaction, although often I am relieved for the family to have an answer for their child's issues.”

Few other personal reactions expressed by the respondents include feeling concerned for the family, disappointment, mixed feelings as well as feeling uncomfortable.

**Strategies Used by Genetic Counselors to Address the Lack of Information**

We asked the respondents to discuss how they addressed the lack of information about an RCC to provide to a family. Table 7 summarizes the various strategies used by the respondents to address the lack of information about the RCC.
Table 7: Strategies used by genetic counselors to address the lack of information

<table>
<thead>
<tr>
<th>Strategies used by genetic counselors</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steer families towards research opportunities</td>
<td>2</td>
</tr>
<tr>
<td>Help the families gain a sense of control</td>
<td>5</td>
</tr>
<tr>
<td>Discuss issues with obtaining services for the child (OT, PT, early interventions etc.)</td>
<td>6</td>
</tr>
<tr>
<td>Research various databases &amp; contact the diagnostic testing labs to determine all the currently available information</td>
<td>10</td>
</tr>
<tr>
<td>Discuss with the family that we will learn from their child</td>
<td>11</td>
</tr>
<tr>
<td>Encourage family to follow up</td>
<td>11</td>
</tr>
<tr>
<td>Focus the discussion on the child’s current symptoms and how to manage them better</td>
<td>12</td>
</tr>
<tr>
<td>Refer the families to support groups (CDO, Unique, local parenting groups for children with special needs)</td>
<td>13</td>
</tr>
<tr>
<td>Hope that they will gather more information in the future as we learn more about the RCC</td>
<td>19</td>
</tr>
<tr>
<td>Explain to the family the reason for the lack of information</td>
<td>24</td>
</tr>
<tr>
<td>Use psychosocial counseling skills to address the lack of information: discuss uncertainty, coping mechanism of parents etc.</td>
<td>24</td>
</tr>
<tr>
<td>Honesty</td>
<td>31</td>
</tr>
</tbody>
</table>

Case Scenario

We provided the respondents with the following case and asked them to answer two questions after reading the case.

**CASE:** Tia a 7-year old girl has a diagnosis of autism and is followed by the Neurology Department in your institution. Her test results are normal for karyotype, fragile X and Rett syndrome. So they order an array-CGH to determine the cause of Tia’s diagnosis. The results come back with a confirmed abnormal result: a microdeletion of 112 kb at chromosome band/region 2p21. The lab report says that this region has the MSH2 gene known to be a susceptibility gene for HNPCC (Lynch) syndrome and is completely deleted in Tia. The Neurology Department refers Tia to you.

We asked the respondents if they had a similar experience to the case that is discovered an abnormal result unrelated to the reason for referral. We also asked the respondents if
they had a similar experience to the case and to explain how it was handled. Of the 78 respondents who answered the question, 51.28% (n=40) reported that they had a similar experience to the case. A few examples mentioned were microdeletions in the $MSH2$ gene, $BMPR1A$ gene, $APC$ gene and $RB1$ gene.

The most common reactions expressed by the respondents to this situation were frustration and annoyance. Some genetic counselors also felt that this situation was stressful and difficult for them and presented an ethical challenge. A few comments expressed by the respondents:

- “Frustration- much more difficult to be first meeting a family and having to discuss these results- better if family has met with Genetics first so a groundwork can be laid.”
- “Annoyed that another department orders test like this without thoroughly explaining the implications to the family or appropriately following up on the results.”
- “I find this situation stressful, since the result is so far off from what we are looking for. However, unexpected results are possible with any genetic test, not just microarray, so we can’t just choose not to pursue them.”
- “It can be difficult, since the family is hearing information they hadn’t expected.”
- “Yuck-- What an ethical dilemma. It makes me worried about the patients that I don't always have time to explain CGH testing to before blood is drawn.”

**Discussion**

This study provides insight into the experience and challenges faced by genetic counselors with pediatric work experience when counseling a family with a child with a
confirmed diagnosis of a RCC (“RCC case”). For the purposes of this study, a rare chromosome condition (RCC) is defined as any chromosomal condition that has not been well described and for which minimal prognostic information is available because they have been reported in only a few individuals. The overall findings from the 2006 study conducted by Lipinski et al. suggested that parents of children with RCCs had heightened uncertainty and low levels of control. The uncertainty associated with a diagnosis with minimal prognostic information was interpreted as a negative experience. They also found a significant negative correlation between a parent’s level of uncertainty and their perception of the helpfulness of their genetic counselor (Lipinski et al., 2006). Since for most RCCs there is limited information available on natural history, prognosis and management implications, they present unique challenges to the parents as well as the genetics provider. To better address the needs of these parents, genetic counselors should be aware of challenges faced by the parents.

Our survey of genetic counselors with pediatric work experience who have experience counseling for RCCs suggest that counseling RCC cases is challenging due to the minimal prognostic information available to provide to the families, the lack of information about the RCC and the lack of resources available to provide to the family. However, genetic counselors are comfortable counseling RCC cases and generally address the lack of information directly during their session with the families.

**Experience working with RCCs**

Overall, the typical respondent to the survey was a clinical pediatric genetic counselor who had 1-4 years of experience in a clinical pediatric genetic counseling setting. Most had counseled 2-5 RCC cases within the last six months. The majority of the respondents
reported that array-CGH (blood) was used to ascertain the RCC in their patients with routine blood karyotype as the second most commonly used method. Table 1 illustrates the resolution for various cytogenetic techniques: karyotype analysis with high-resolution banding is 3-5 Mb; for FISH analysis is 100 kb; and with array-CGH is 50-500 kb. Even though FISH has a good resolution (~100 kb) it is limited to a targeted approach. Whereas with array-CGH it is possible to achieve comprehensive genome wide assessment which is equivalent to thousands of FISH probes (Ledbetter, 2008). Thus with array-CGH technology it is possible to detect copy number variants that would not have been previously identified. It is now the standard of care to offer molecular cytogenetic screening techniques such as array-CGH to patients with unexplained mental retardation or developmental delays but who do not have clinical signs that suggest one particular genetic syndrome (Lapierre & Tachdjian, 2005).

**Challenges in counseling for RCC**

The 2006 study conducted by Lipinski et al. explored the feelings of uncertainty and loss of control that parents of children with a RCC feel over their child's overall health condition and found a significant negative correlation between a parent’s level of uncertainty and their perception of helpfulness of their genetic counselor. Given this interplay between the parents’ reactions to a diagnosis of an RCC in their child and their remembered experiences with their genetic counselor, our study focused on the genetic counselor’s perceptions of counseling for RCCs with the hope that a better understanding might lead to more effective counseling for future families with children with a RCC. Overall respondents’ report that counseling a RCC case is challenging and most state that it is more challenging than counseling for a common genetic condition. Nevertheless, the
majority of the respondents were comfortable counseling RCC cases. As expected, the currently working pediatric genetic counselors with more than one year experience in clinical pediatric genetic counseling who saw a greater number of patients with a RCC were less likely to find counseling RCC cases challenging and were more comfortable counseling this type of case.

Furthermore, the three most commonly cited reasons for counselors’ feeling challenged are minimal prognostic information to provide to the family, lack of information about the RCC and lack of resources to provide to the family. While each of these challenges individually is not unique to RCC cases, the combination of all three is, hence genetic counselors may need to devise strategies to prepare for RCC cases. Genetic counselors need to feel a sense of control prior to and during the session, which they generally achieve by performing a thorough case preparation. It can be frustrating for them if after hours of literature search they are not able to find useful information for them or for the family. Therefore, it is important to educate the counselors about the various databases and support groups for RCCs (Table 4). Some of the strategies suggested in this study to address the minimal prognostic information are to focus the discussion to address the child’s current symptoms and to reassure the parents that specialists are available, to help with any medical problems that may arise. Some counselors also discuss the issues with obtaining services for the child (e.g. early intervention, occupational therapy, physical therapy etc.) and encourage the family to follow up since more information is gathered as we learn more about the RCC. Some of the strategies suggested in this study to address the lack of information are to research various databases (including support group websites) and to contact the diagnostic labs to determine all the currently available
information. Most counselors use psychosocial counseling skills to address the lack of information and explain to the family the reason for the lack of information.

Most genetic counselors feel that lack of experience in counseling for ‘the particular’ condition does not make counseling RCC cases challenging. This finding may be explained by the fact that genetic counselors may clump all RCC’s together and treat them as a group or they may group them depending upon the kind of RCC (e.g. deletion, duplication etc.). Alternatively, genetic counselors may be naïve in not believing that their own lack of experience has an impact on their counseling for RCC cases.

The majority of the genetic counselors also reported that difficulty in calculating recurrence risks was not a reason for feeling challenged. Since a majority of the RCCs are sporadic, genetic counselors can counsel about RCC recurrence risks the same way that they would any other sporadic condition (Gardner & Sutherland, 2004). When a particularly complex case arises (e.g. one of the parents has a balanced translocation), the genetic counselor may have the option of contacting a researcher (e.g. Dr. C. Trunca) who calculates the recurrence risks for them. Another explanation for this finding is that in a pediatric setting the parents may focus more on managing their child’s symptoms than on recurrence risks.

In our study the genetic counselors did not feel that a parent’s age affected the counseling dynamics nor did they feel that parent’s age was a reason they felt more challenged than parents of children with more common genetic conditions. The results from Lipinski et al. (2006) study indicated that parents of children with RCCs, who were younger, had higher levels of uncertainty and perceived that they had less control over their child’s condition. Given this discrepancy, genetic counselors should be more sensitive to the
higher levels of uncertainty among younger parents and may try to use emotion-focused coping strategies (Lipinski et al., 2006).

The majority of the genetic counselors reported that they sometimes spend more time counseling RCC cases compared to counseling families with a child with a common genetic condition. They also expressed that the time spent depends upon the family’s need and the complexity of the case. Genetic counselors often have to convey complex genetic and medical information to a family (e.g. fragile X syndrome) in a short amount of time. Therefore, it may be that the complexity of the material presented in a genetic counseling session and the number of questions asked by the family rather than “RCC cases” themselves is what determines how long a counselor will spend with a particular family. Counselors often have a limited amount of time to spend with each family regardless of the indication for counseling. This time limit is especially true in a pediatric genetic counseling setting where the genetic counselor has to divide the time with other members of the team (e.g. medical geneticist). In the Lipinski et al. (2006) study parents specifically mentioned that in the absence of prognostic information regarding their child they would like to have more time with the genetic counselor to express their concerns. Hence, it is important for the genetic counselor to be aware of the family’s needs and if possible allot extra time to listen to parents’ concerns.

Another issue raised in the Lipinski et al. (2006) study is that parents would like to hear expressions of hopefulness from their genetics provider even in the absence of specific prognostic information. The majority of the genetic counselors in our study were comfortable communicating expressions of hope to the families. The older respondents and those with more experience were the least likely to report difficulty in
communicating expressions of hope. Younger and less experienced counselors report lower levels of comfort with expressing hope to families when the prognosis of the child is unclear which may have a number of explanations. They may be less confident counselors overall or they may still be learning to manage their own discomfort with uncertainty. A common strategy used to express hope was to focus the parents’ attention to their child’s health issues and medical management:

- **In some ways, I think it is easier to provide hope because we can honestly say that only "Bobby" is going to show us how he will do over time.**

- **I think it is possible to stay positive with a family even when the prognosis is unclear- you know the child's health and learning concerns at the time, and while you may not be able to tell them what to expect 10 years from now, you can still make a plan for care and estimate based on the current situation.**

Interestingly, the counselors who are currently not working in a pediatric genetic counseling setting and who saw a greater number of RCC cases were more likely to report difficulty in communicating expressions of hope. It is difficult to comment on this finding since none of the respondents explained their choice.

Rosenthal et al.’s study (2001) indicated that parents of children with undiagnosed syndromes expressed concerns and were anxious about their child’s life expectancy. This feeling was true even for parents of children with relatively few physical health problems. We can extrapolate these results to the RCC cases since there is minimal prognostic information available to the families. We hypothesized that parents would be anxious about their child’s life expectancy. While, overall, respondents report that they do
ascertain the parent’s perception of the severity of their child’s condition it is important that genetic counselors always explore this thought with the families to help facilitate parents’ adaptation to their child’s condition.

It is important to explore with the parents the reasons they are looking for a diagnosis instead of assuming the obvious reason, that is to determine what is wrong with their child. With the advancement in molecular diagnostic technologies, children without a definitive clinical diagnosis of a particular syndrome may be identified with a RCC. These parents will be left with unanswered questions and concerns about recurrence risks, etiology, prognosis, and treatment. Previous studies suggest that parents of children with an undiagnosed syndrome or with various medical conditions are looking for a diagnosis for various reasons: labels, etiology, recurrence risks, short-term and long-term prognosis, treatment options, acceptance, and social support (Rosenthal et al., 2001). Hence it is necessary to explore the reasons with the families so that the genetic counselors can appropriately address their concerns.

In the Lipinski et al. (2006) study, parents expressed that in the absence of prognostic information regarding their child they want to learn about resources like the CDO and Unique. The importance of support groups in adaptation to unexpected outcome is well known (Law et al., 2001; Kerr & McIntosh, 2000). To be able to refer a family to a RCC support group website, the genetic counselors themselves should be familiar with them. Although the majority of the respondents had heard about CDO and Unique, 27.44% of the respondents had not heard about CDO and 12.04% had not heard about Unique. Even among the respondents who had heard about these support groups, less than 40% reported that they always inform the parents about these resources. Therefore, it is important to
raise awareness about the online support groups such as CDO and Unique as well as the importance of mentioning them to all the families with a child with a RCC.

**Study Limitations**

This study relied on counselors’ self-report of their counseling practices and is therefore subject to the possibility of inaccurate self-report and the counselors’ biases. We included genetic counselors from three groups to have a larger sample size but for analysis purposes we combined the groups and treated them as one sample. Even though we did not find any differences between the three groups, it may have added some biases to the study. We included counselors with past experience in pediatric genetic counseling since we did not want to miss out on valuable insights by genetic counselors that have experience with RCC cases. This inclusion may have added recall biases since we included counselors who worked within the last 5 years, but are not currently working.

It is not possible to calculate the response rate of the survey since the PSS 2008 does not include the inclusion criteria used for our study.

The way certain questions were worded may have added ascertainment biases. We asked the respondents if they felt counseling RCCs was more challenging than counseling common genetic conditions. It may have been more appropriate if we had worded the question to compare RCCs with common chromosome conditions, such as conditions that were excluded from the study (e.g. trisomy 21, trisomy 18).

Lipinski’s study found a relationship between level of uncertainty and age of the parents with younger parents having high levels of uncertainty. In our study we asked the genetic counselors to choose the top three reasons parents felt challenged. We can assume that by the way the question was worded the likelihood of the counselors to select age of the
parent as a challenge was low. Perhaps if we had framed the question to ascertain the level of agreement for each reason that was provided, it would have been possible to determine if counselors felt it was a challenge.

It would have been interesting to know the role of the geneticist and the genetic counselor in the pediatric setting. In Lipinski’s study the parents were unable to distinguish between the roles of genetic counselors and medical geneticists. In a pediatric setting the effectiveness of the genetic counseling session depends upon the combined effort of the geneticist and the genetic counselor. Therefore, the variation in responses may be influenced by the importance given to the genetic counselor in his/her work place.

In the open ended questions we wanted to explore the emotion focused coping strategies used by the genetic counselors while counseling RCC cases, but none of the answers directly revealed the strategies used to facilitate coping. It may have been due to the fact that the questions were towards the end of the survey and the respondents were tired and did not write-in detailed answers.

Implications for Future Research
Additional studies are needed to explore in depth the themes mentioned by our respondents either by doing a qualitative study or a quantitative study using clinical case scenarios. It would be interesting to determine if prenatal genetic counselors in have had similar experiences when working with RCC cases. For example, in the prenatal setting, different sets of challenges may arise since the couple may be debating pregnancy interruption depending upon the type of RCC identified in the fetus. The respondents answers to the case indicate that a number of ethical issues arise from the use of array-
CGH technology and the rapid expansion of RCC diagnosis, which can be individually explored further to determine if there is a need for practice guidelines.

**Conclusion**

The current study’s overall findings illustrate the unique complexities of counseling for rare chromosome conditions. Genetic counselors should be aware of the heightened level of uncertainty felt by parents of children with RCCs and they must address the lack of information during their counseling session. There is a need for increased awareness of the resources available to the genetic counselors for their own use as well as resources available to provide to these families. Based on the results of Lipinski et al. (2006) and the current study we conclude that there is a need for practice guidelines in providing uniform care to families with children with a confirmed diagnosis of a RCC. Guidelines may provide valuable information to medical genetics providers, currently practicing genetic counselors, and new genetic counselors that may not have had exposure to RCC test results.
Bibliography


Appendix A: Abbreviations/Acronyms

Rare chromosome conditions – RCC

National Society of Genetic Counselors – NSGC

Array-Comparative Genomic Hybridization – Array-CGH

Fluorescence in situ Hybridization – FISH

Genetic Counselors – GCs

Mental retardation – MR

Developmental Delays – DD
Appendix B: Recruitment Notice

Subject: Research Volunteers Needed with Pediatric Work Experience

Are you (or have you ever been) a pediatric genetic counselor?
Do you have experience in counseling patients regarding rare chromosome conditions?

I am a student in the Brandeis University Genetic Counseling Program, and I am conducting a research project focused on assessing challenges that genetic counselors encounter when counseling families who have a child with a rare chromosome condition (RCC). For the purposes of this study, a RCC is defined as any chromosomal condition that has not been well described and for which minimal prognostic information is available.

You are eligible to participate in this study if:

- You are currently working in a clinical pediatric genetic counseling setting and have counseled at least one family with a child who has a rare chromosome condition.

OR

- You are currently not working in a clinical pediatric genetic counseling setting but have worked in a pediatric setting within the last 5 years and have counseled at least one family with a child who has a rare chromosome condition.

Study participation involves an anonymous online survey which will take approximately 20 minutes to complete. If you would like to participate in this study and complete a survey on counseling for rare chromosome conditions, then please click on the following link, which will be active until February 22, 2009:
http://www.surveymonkey.com/

Thank you very much for your consideration and participation. Please feel free to contact me at shraddha@brandeis.edu with any questions or concerns.

Sincerely,
Shraddha V. Gaonkar, M.Sc.
Genetic Counseling Student
Brandeis University
Appendix C: Questionnaire

CHALLENGES IN COUNSELING FOR RARE CHROMOSOME CONDITIONS (RCC)

Welcome!
Thank you for taking the time to complete this survey. Participation in this survey is completely voluntary and anonymous. You may stop taking this survey at any point.
*This research project has been approved by the IRB at Brandeis University

Section 1: DEMOGRAPHICS
1. What is your gender?
   a. Male
   b. Female
2. How old are you (Years)?
3. In which country or NSGC region are you currently practicing?
   a. Region I
   b. Region II
   c. Region III
   d. Region IV
   e. Region V
   f. Region VI
   g. Other (please specify)
4. How many years have you been practicing as a genetic counselor in any setting? OR
   How many months (if less than a year) have you been practicing as a genetic counselor in any setting?
   a. ------- Years OR b. ------- Months
5. What is your current area of practice (choose as many as apply)?
   a. Pediatric
   b. Prenatal
   c. Adult
   d. Cancer Genetics
   e. Specialty Disease
   f. Screening (Multiple Marker)
   g. Molecular/Cytogenetics/Biochemical Testing
   h. Neurogenetics
   i. Teratogens
   j. Psychiatric
   k. Infertility, ART/IVF
   l. Cardiology
   m. Public health/newborn screening
n. Other (please specify)

6. Please indicate your involvement in a clinical pediatric setting:
   A. Currently work in a clinical pediatric setting (skip to 6.a.1)
   B. Previously worked in a clinical pediatric setting (skip to 6.b.1)
   C. Never worked in a clinical pediatric setting (skip to 6.c.1)

6.a.1. Approximately what percent of your time each week is spent in a clinical pediatric setting?
   a. ----------- Percent

6.a.2. Approximately how many new patients do you see a week?
   a. 0    b. 1-5    c. 6-15    d. 16-25    e. 26-35    f. 36-45    g. >45

6.a.3. Approximately how many return patients do you see every week?
   a. 0    b. 1-5    c. 6-15    d. 16-25    e. 26-35    f. 36-50    g. >50

6.a.4. How many total months (if less than a year) or years of experience in your career do you have in a clinical pediatric genetic counseling setting?
       a. ----------- Months       OR       b. ----------- Years

6.a.5. How many months (if less than a year) or years have you been in your current job?
       a. ----------- Months (Skip to Section 2.A.a)       OR       b. ----------- Years (Skip to Section 2.A.b)

6.b.1. How many total months (if less than a year) or years of experience do you have in a pediatric genetic counseling setting?
       a. ----------- Months       OR       b. ----------- Years

6.b.2. Approximately what percent of your time each week did you spend in your last job in a clinical pediatric setting?
       a. -----------Percent

6.b.3. When did you last work in a clinical pediatric setting?
       a. 2007
       b. 2006
       c. 2005
       d. 2004
       e. 2003

6.b.4. What was your approximate new patient volume (per week) at your last job in a pediatric setting?
       a. Zero    b. 1-5    c. 6-15    d. 16-25    e. 26-35    f. 36-45    g. >45

6.b.5. What was your approximate return patient volume (per week) at your last job in a pediatric setting?
       a. 0    b. 1-5    c. 6-15    d. 16-25    e. 26-35    f. 36-50    g. >50
(Skip to Section 2.B.)
6.c.1. Thank you for your interest, but this survey is to be completed by genetic counselors who have worked (within the last 5 years) or are currently working in a clinical pediatric setting.

Section 2.A.: EXPERIENCE IN WORKING WITH RCCs

Definition: Rare Chromosome Condition (RCC)
*For the purpose of this survey:
A rare chromosome condition (RCC) is defined per Lipinski et al (2006), as:

- any chromosomal condition that has not been well described;
- has an upper limit population prevalence of 1/120,000;
- for which minimal prognostic information is available.¹

**INCLUDES:** Deletions (e.g. del 2q37), Ring chromosomes (e.g. Ring 18), Duplications (e.g. dup 8q), Mosaic karyotypes (e.g. Trisomy 8 mosaicism), Trisomies (e.g. Trisomy 9).

**EXCLUDES:** Well-studied conditions such as Trisomy 21, Trisomy 13, Trisomy 18, DiGeorge Syndrome (del 22q11.2 or 10p13-p14), Cri du chat syndrome (del 5p15.2), Smith-Magenis Syndrome (del 17p11.2), Williams Syndrome (del 7q11.2), Charcot Marie Tooth 1A (duplication of PMP22 gene on 17p12)

Section: 2.A.a
1. Approximately how many families with a child with a RCC diagnosis have you counseled in your current clinical pediatric work place?
   a. None b. 1 c. 2-5 d. 6-10 e. 11-15 f. ≥16
2. Which kinds of RCCs have you counseled for in your current clinical pediatric work place? (Select all that apply and include examples if you recall)
   a. Deletions *******
   b. Duplications *******
c. Ring chromosomes

d. Mosaic Karyotypes

e. Trisomies

f. Other (Please specify)

(Skip to Section 2.A.ab)

Section: 2.A.b

1. In the last six months approximately how many families with a child with a RCC diagnosis have you counseled?
   a. None  b. 1 c. 2-5 d. 6-10 e. 11-15 f. ≥16

2. Which kinds of RCCs have you counseled for within the last 6 months? (Select all that apply and include examples if you recall)
   g. Deletions
   h. Duplications
   i. Ring chromosomes
   j. Mosaic Karyotypes
   k. Trisomies
   l. Other (Please specify)

(Skip to Section 2.A.ab)

Section: 2A.ab

1. How have the RCCs you have counseled for been ascertained? (select all that apply)
   a. Routine blood karyotype
   b. FISH-analysis
   c. High resolution G-banding
   d. Array-CGH (Blood)
   e. Prenatal karyotype
   f. Amnio-array
   g. Other: Please specify

2. At your medical institution on a scale of 1-5 (1=most often to 5=least often) rank who generally discloses the new RCC results to the family:

   ---- I usually do (Genetic Counselor)
   ---- Attending geneticist
   ---- Resident
   ---- Genetic counseling student
   ---- None of the above: the family usually comes in with the results

2.a. COMMENTS (optional) -------

3. How are the results of the RCC diagnosis in the child typically provided to the families at your medical institution? (Select all that apply)
a. Always in person
b. Over the phone
c. Over the phone followed by an in-person consultation
d. Neither. The lab directly mails the results to the parents
e. Other: please specify

4. To what extent do you agree or disagree with the following statement: Counseling a family with a child with a confirmed diagnosis of a RCC is challenging.
   a. Strongly Agree
   b. Agree
   c. Neither Agree nor Disagree
   d. Disagree
   e. Strongly Disagree

5. If you selected options a, b or c for the question number 4: Please indicate your level of agreement with regards to how challenging each item makes counseling a family with a child with a confirmed diagnosis of a RCC.

<table>
<thead>
<tr>
<th>Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tbody>
<tr>
<td>a. Lack of experience in counseling for ‘the particular condition’</td>
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<td>b. Lack of information</td>
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<td>c. Minimal prognostic information to provide to the family</td>
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<td>COMMENTS (optional)</td>
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<td>d.</td>
<td>Age of the child at the time of diagnosis</td>
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<td>e.</td>
<td>Lack of resources for yourself</td>
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<td>f.</td>
<td>Lack of resources to provide the family</td>
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<td>g.</td>
<td>Difficulty in calculating recurrence risks</td>
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<td>h.</td>
<td>Lack of support groups for ‘the particular’ condition</td>
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<td>i.</td>
<td>Severity of the child’s condition</td>
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<td>j.</td>
<td>Age of the parents</td>
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</table>
6. To what extent do you agree or disagree with the following statement: Counseling a family with a child with a RCC diagnosis is more difficult than counseling a family with a child with a more common genetic condition.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
6.a. Please explain: (open-ended)

7. How comfortable are you counseling a family with a child with a confirmed RCC diagnosis?
   a. Very comfortable
   b. Somewhat comfortable
   c. Neither comfortable nor uncomfortable
   d. Somewhat uncomfortable
   e. Very uncomfortable
7.a. COMMENTS (optional)

8. To what extent do you agree or disagree with the following statement: I find it difficult to communicate ‘expressions of hope’ to the family when the prognosis for the RCC finding is unclear:
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
8.a. COMMENTS (optional)

9. What resources do you find most helpful when preparing to counsel for a RCC? (Select all that apply)
   a. Genetests.org
   b. OMIM/Pubmed
   c. Websites of the testing/diagnostic lab
   d. Websites of support groups (Unique/CDO)
   e. Genome Browsers (UCSC, Toronto Database, Genecards, DECIPHER, ECARUCA)
   f. Other (please specify)

10. Have you heard of the Chromosome Deletion Outreach (CDO), an online support group for families, individuals and professionals addressing RCC (www.chromodisorder.org)?
10.a. If yes, do you inform the parents of children with a RCC about the CDO?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

11. Have you heard about Unique, a rare chromosome disorder support group (www.rarechromo.org)?
   a. Yes
   b. No

11.a. If yes, do you inform the parents of children with a RCC about Unique?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

12. Do you generally spend more time counseling families with a child with a confirmed diagnosis of a RCC as compared to counseling families with a child with a common genetic condition?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never
   12.a. COMMENTS (optional)

13. Approximately what percent of your time do you spend giving information versus addressing psychosocial issues when counseling a family about the RCC diagnosis in their child?
   a. 100 % giving information vs. 0% addressing psychosocial issues
   b. 75 vs. 25%
   c. 50 vs. 50%
   d. 25 vs. 75%
   e. 0 vs. 100%
14. To what extent do you agree or disagree with the following statement: Parents of children with RCCs feel more challenged than parents of children with more common genetic conditions?
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree

14.a. COMMENTS (optional)

15. If you selected options a, b or c for the question number 14: Please rank the top three reasons parents of children with RCCs feel more challenged than parents of children with more common genetic conditions?
   a. Lack of information
   b. Minimal prognostic information available to the family
   c. Uncertainty about how the child’s condition will impact their family in the long term
   d. Lack of resources provided by health professionals
   e. Unclear about recurrence risks
   f. Lack of support groups for ‘the particular’ condition
   g. Severity of the child’s condition
   h. Age of the child at the time of diagnosis
   i. Age of the parents
   j. Lack of control
   k. Isolation
   l. Other (please specify)

15. When counseling a family with a child with a RCC do you ascertain the parent’s perception of the ‘severity’ of their child’s condition?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

17. Do you contact the parents after giving the RCC results to check how they are doing?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
18. Do you contact the parents when additional information is learned regarding their child’s diagnosis or prognosis?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never
   18.a. COMMENTS (optional)

19. To what extent do you agree or disagree with the statement: I would be interested in attending a short course or an EBS (educational based symposium) at an NSGC annual educational conference on the topic of counseling for RCC if I were attending the AEC.
   a. Strongly agree
   b. Agree
   c. Neither Agree nor Disagree
   d. Disagree
   e. Strongly Disagree
Section 2.B.: EXPERIENCE IN WORKING WITH RCCs

**Definition:** Rare Chromosome Condition (RCC)

*For the purpose of this survey:
A rare chromosome condition (RCC) is defined per Lipinski et al (2006), as:

- any chromosomal condition that has not been well described;
- has an upper limit population prevalence of 1/120,000;
- for which minimal prognostic information is available.¹

**INCLUDES:** Deletions (e.g. *del 2q37*), Ring chromosomes (e.g. *Ring 18*), Duplications (e.g. *dup 8q*), Mosaic karyotypes (e.g. *Trisomy 8 mosaicism*), Trisomies (e.g. *Trisomy 9*).

**EXCLUDES:** Well-studied conditions such as *Trisomy 21*, *Trisomy 13*, *Trisomy 18*, DiGeorge Syndrome (del 22q11.2 or 10p13-p14), *Cri du chat syndrome* (del 5p15.2), Smith-Magenis Syndrome (del 17p11.2), Williams Syndrome (del 7q11.2), Charcot Marie Tooth 1A (duplication of PMP22 gene on 17p12)

---

1. At you last job in a clinical pediatric setting *approximately* how many families with a child with a RCC diagnosis would you counsel per month?
   a. None b. 1 c. 2-5 d. 6-10 e. 11-15 f. ≥16

2. Which kinds of RCCs have you counseled at you last job in a clinical pediatric setting? (Select all that apply and include examples if you recall)
   a. Deletions 
   b. Duplications 
   c. Ring chromosomes 
   d. Mosaic Karyotypes 
   e. Trisomies 
   f. Other (Please sp

3. How were the RCCs you have counseled for generally been ascertained? (select all that apply)
a. Routine blood karyotype
b. FISH-analysis
c. High resolution G-banding
d. Array-CGH (Blood)
e. Prenatal karyotype
f. Amnio-array
g. Other (Please specify)

4. At your medical institution on a scale of 1-5 (1=most often to 5=least often) rank who generally disclosed the new RCC results to the family:

---- I usually do (Genetic Counselor)
---- Attending geneticist
---- Resident
---- Genetic counseling student
----- None of the above: the family usually comes in with the results

2.a. COMMENTS (optional) ----------

5. How were the results of the RCC diagnosis in the child typically provided to the families at your medical institution? (Select all that apply)

a. Always in person
b. Over the phone
c. Over the phone followed by an in-person consultation
d. Neither. The lab directly mails the results to the parents
e. Other: please specify

6. To what extent do you agree or disagree with the following statement: Counseling a family with a child with a confirmed diagnosis of a RCC is challenging.

a. Strongly Agree
b. Agree
c. Neither Agree nor Disagree
d. Disagree
e. Strongly Disagree

7. If you selected options a, b or c for the question number 6 :Please indicate your level of agreement with regards to how challenging each item makes counseling a family with a child with a confirmed diagnosis of a RCC.

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<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tr>
<td>a. Lack of experience in</td>
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<td><strong>counseling for ‘the particular condition’</strong></td>
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<td>b. Lack of information</td>
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<tr>
<td>c. Minimal prognostic information to provide to the family</td>
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<td>d. Age of the child at the time of diagnosis</td>
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<td>e. Lack of resources for yourself</td>
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<td>i. Severity of the child’s condition</td>
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7.a. COMMENTS (optional)
8. To what extent do you agree or disagree with the following statement: Counseling a family with a child with a RCC diagnosis is more difficult than counseling a family with a child with a more common genetic condition.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
8.a. Please explain: (open-ended)
9. How comfortable were you counseling a family with a child with a confirmed RCC diagnosis?
   a. Very comfortable
   b. Somewhat comfortable
   c. Neither comfortable nor uncomfortable
   d. Somewhat uncomfortable
   e. Very uncomfortable
9.a. COMMENTS (optional)
10. To what extent do you agree or disagree with the following statement: I used to find it difficult to communicate ‘expressions of hope’ to the family when the prognosis for the RCC finding was unclear:
    a. Strongly agree
    b. Agree
    c. Neither agree nor disagree
    d. Disagree
    e. Strongly disagree
10.a. COMMENTS (optional)
11. What resources did you find most helpful when preparing to counsel for a RCC? (Select all that apply)
    a. Genetests.org
    b. OMIM/Pubmed
    c. Websites of the testing/diagnostic lab
    d. Websites of support groups (Unique/CDO)
    e. Genome Browsers (UCSC, Toronto Database, Genecards, DECIPHER, ECARUCA)
f. Other (please specify)

12. Have you heard of the Chromosome Deletion Outreach (CDO), an online support group for families, individuals and professionals addressing RCC (www.chromodisorder.org)?
   a. Yes
   b. No

12.a. If yes, did you inform the parents of children with a RCC about the CDO?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

13. Have you heard about Unique, a rare chromosome disorder support group (www.rarechromo.org)?
   a. Yes
   b. No

13.a. If yes, did you inform the parents of children with a RCC about Unique?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

14. Did you generally spend more time counseling families with a child with a confirmed diagnosis of a RCC as compared to counseling families with a child with a common genetic condition?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

14.a. COMMENTS (optional)

15. Approximately what percent of your time did you spend giving information versus addressing psychosocial issues when you counseled a family about the RCC diagnosis in their child?
   a. 100 % giving information vs. 0% addressing psychosocial issues
b. 75 vs. 25%
c. 50 vs. 50%
d. 25 vs. 75%
e. 0 vs. 100%

16. To what extent do you agree or disagree with the following statement: Parents of children with RCCs feel more challenged than parents of children with more common genetic conditions?
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree

16.a. COMMENTS (optional)

17. If you selected options a, b or c for the question number 14: Please rank the top three reasons parents of children with RCCs feel more challenged than parents of children with more common genetic conditions?
   c. Lack of information
d. Minimal prognostic information available to the family
f. Uncertainty about how the child’s condition will impact their family in the long term
g. Lack of resources provided by health professionals
h. Unclear about recurrence risks
i. Lack of support groups for ‘the particular’ condition
j. Severity of the child’s condition
k. Age of the child at the time of diagnosis
l. Age of the parents
m. Lack of control
n. Isolation
o. Other (please specify)

18. When counseling a family with a child with a RCC did you ascertain the parent’s perception of the ‘severity’ of their child’s condition?
   a. Always
   b. Often
c. Sometimes
d. Rarely
e. Never

19. Did you contact the parents after giving the RCC results to check how they are doing?
   a. Always
   b. Often
c. Sometimes
  d. Rarely
  e. Never

20. Did you contact the parents when additional information was learnt regarding their child’s diagnosis or prognosis?
   a. Always
   b. Often
   c. Sometimes
   d. Rarely
   e. Never

20.a. COMMENTS (optional)

21. To what extent do you agree or disagree with the statement: I would be interested in attending a short course or an EBS (educational based symposium) at an NSGC annual educational conference on the topic of counseling for RCC if I were attending the AEC.
   f. Strongly agree
   g. Agree
   h. Neither Agree nor Disagree
   i. Disagree
   j. Strongly Disagree

Section 3: Open-Ended

1. Briefly describe your personal reaction to receiving a patient’s test result of a RCC.

2. When there is little information about an RCC to provide to a family, how do you address the lack of information?

3. Please read the following case and answer the questions:

   **CASE:** Tia a 7-year old girl has a diagnosis of autism and is followed by the Neurology Department in your institution. Her test results are normal for karyotype, Fragile X and Rett Syndrome. So they order an array-CGH to determine the cause of the Tia’s diagnosis. The results come back with a confirmed abnormal result: a microdeletion of 112 kb chromosome band/region on 2p21. The lab report says that this region has the MSH2 gene known to be a susceptibility gene for HNPCC (Lynch) Syndrome and is completely deleted in Tia. The Neurology department refers Tia to you.
a. Have you had a similar experience to this case (i.e. discovered an abnormal result unrelated to the reason for referral)? If you have, how was it handled?

b. What is your reaction to this situation?

c. How would you proceed with Tia and her family? Would you still evaluate for causes of autism?

Thank you!
Thank you again for completing this survey. If you have any questions or comments regarding this study please contact me at shraddha@brandeis.edu.

Sincerely,
Shraddha Gaonkar