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Reproductive Decision Making and Genetic Predisposition to Sudden Cardiac Death

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Abstract

Background—With current genetic technology, it is possible to detect mutations associated with long QT syndrome (LQTS), a hereditary cardiac arrhythmia syndrome. As a result, prospective parents diagnosed with LQTS will have to decide whether or not to prevent its transmission to future generations, either by not procreating or through the use of assisted reproductive technologies or prenatal testing. This paper explores how a hereditary predisposition to sudden cardiac death can influence reproductive decision making.

Methods—This study draws from interviews and focus groups with individuals who have personal or family histories of cardiac arrhythmia or sudden death. A keyword search was conducted on interview transcripts to identify quotes for analysis.

Results—Participants expressed complex, often ambivalent attitudes about the prospect of having a child with a predisposition to sudden cardiac death. Their comments reveal conflicting understandings of genetic responsibility and reflect the variable effects of personal experience on reproductive decision making. This paper compares attitudes towards LQTS and other genetic conditions in analyzing the themes that emerged in interviews and focus groups.

Conclusions—The “disability critique” of prenatal testing should be applied carefully to a context of genetic predisposition to sudden cardiac death in order to understand reproductive decision making. Firsthand experience with the condition, among other factors, can weigh heavily in those decisions.

Keywords

LQTS; sudden cardiac death; reproductive decision making; genetic responsibility; parental responsibility; prenatal testing

Much has been written about the impact of various genetic conditions on reproductive decision making (see e.g., Denayer et al. 1997 for cystic fibrosis; Fortuny et al. 2009 and Smith et al. 2004 for BRCA1/2; Helbig et al. 2010 for epilepsy; Raspberry and Skinner 2011 for fragile X syndrome; Creighton et al. 2003 Decruyenaere et al. 1996, Downing 2005, Evers-Kiebooms et al. 2002, and Klitzman et al. 2007 for Huntington's disease). Evers-Kiebooms et al. (1993) compared the significance of different types of genetically-based conditions for reproductive decision makers. They asked participants to evaluate the burden and impact on their reproductive decisions of three types of genetic conditions: 1) a condition that caused physical disability (25% probability); 2) a condition that caused mental disability (25% probability); and 3) a condition that caused sudden infant death (3–5% probability). Participants rated an increased probability of sudden death as the most burdensome condition on themselves, followed by mental disability. There was a significant correlation between the perceived burden of a condition and the willingness to use prenatal testing to avoid having a child with that condition.

This paper examines the third type of condition presented by Evers-Kiebooms et al. (1993), which involves an increased probability of sudden death. There has been little discussion in the genetic testing literature about conditions that can result in sudden death, perhaps because until recently, the underlying genetic etiologies had not been identified. One such condition for which genetic testing has become available is long QT syndrome (LQTS), a condition involving an increased risk of potentially fatal cardiac arrhythmia. Symptoms include dizziness, syncope, palpitations, and sudden death, and can present at any age, starting from birth. If an individual develops symptoms, it will most often be before the age of 40 (Hendriks et al. 2008; Smets et al. 2008). Tragically, for some individuals, the first symptom will be sudden death.

Genetic testing for LQTS not only identifies individuals at an increased risk of sudden death but also provides information regarding possible triggers for cardiac arrhythmias. Those with genotypes consistent with LQT1 should refrain from participating in vigorous physical activities, while those with LQT2 genotypes should avoid startling triggers such as alarm clocks and other sudden loud noises. In contrast, individuals with an LQT3 genotype tend to have cardiac events during sleep or while at rest. Regardless of genotype, there are various prophylactic treatments for those with LQTS, including beta-blocker medication and/or a more invasive option involving the insertion an implantable cardioverter-defibrillator (ICD) (Goldenberg and Moss 2008).

These measures are highly effective for reducing risk in the majority of persons with LQTS, but the risk of sudden death cannot be entirely eliminated. Although LQTS can also be understood as a chronic disease (because ongoing risk assessment is necessary), this persistent risk of sudden death sets it apart from other genetic conditions whose effects on reproductive decision making have been studied. And it is precisely this associated risk of sudden death that has propelled recent research on the psychosocial effects of LQTS on individuals and their families (e.g. Geelen et al. In Press; Hendriks et al. 2005; Smets et al. 2008).

The purpose of the current study is to explore the ways in which reproductive decision making is affected by the genetic diagnosis of LQTS or other conditions that substantially increase the risk of sudden cardiac death.

METHODS

Our study is an analysis of unprompted comments by a subset (20/50) of the subjects enrolled in the Montefiore-Einstein Center for CardioGenetics' (MECC) parent study on the

ethical issues in the translation of genetic knowledge to clinical practice. This research, funded by the National Heart, Lung and Blood Institute (NHLBI) sought to evaluate and systematize ethical, legal, and social issues associated with cardiogenetic diseases linked to sudden infant death syndrome (SIDS) and sudden unexpected death syndrome (SUDS). Through the use of open-ended interviews and focus groups, the study explored the experiences of individuals who had personal experience with cardiac arrhythmia or sudden death, including individuals who had: a cardiac arrhythmia themselves, a family member with a cardiac arrhythmia, or a family member die suddenly from what was suspected or diagnosed to be a cardiac arrhythmia. Focus groups were comprised of two or more unrelated individuals; interviews were conducted with both individuals and family units (i.e., two or more related individuals).

Recruitment for interviews and focus groups was done via three channels: 1) referral from a MECC cardiologist or a medical examiner following a SIDS or SUDS death; 2) referral from the Sudden Unexplained Death in Childhood (SUDC) support group; and 3) referral from the Sudden Arrhythmia Death Syndromes Foundation (SADS). All participants provided written informed consent prior to participating in this study and completed a questionnaire providing demographic information (Table 1). This study was approved by the Institutional Review Board at Albert Einstein College of Medicine/Montefiore Medical Center, and precautions to protect human subjects were followed throughout the study. Additionally, patients at the MECC were informed that declining to participate in the study would not affect their clinical care.

Interviews were conducted from July 2010 to April 2011, audio-recorded and then transcribed. The transcripts from this parent study were analyzed by the grounded theory approach developed by Auerbach and Silverstein (2003). This approach groups regularly used words and phrases into repeating ideas and then groups similar repeating ideas into themes. One of the themes that evolved during this analysis was the anxiety associated with finding out test results. Within this theme, one of the repeating ideas was worry about the next generation (Silverstein et al., Unpublished Manuscript). For the present study, we extracted comments and identified parental perspectives specifically relevant to reproductive decision making. We identified relevant comments by performing a keyword search on all transcripts, using the keywords of “child,” “kid,” “baby,” “prenatal,” “PGD,” “adopt,” “donor,” “reproduction,” and “reproduce.”

The participants in this study were not initially asked directly about their reproductive intentions in relation to their genetic diagnosis. The following analysis is based upon comments made during open-ended interviews that explored a wide range of topics concerning the participants’ experience with cardiac problems and sudden death. In reviewing the interview transcripts, a number of issues emerged, some reflected in the literature on genetic testing’s effects on reproductive decision making and others seemingly specific to LQTS.

RESULTS

The parent study’s population was demographically diverse in terms of gender, ethnicity, race, marital status, education, annual household income, and employment status (see Table 1). Of the fifty participants, twenty discussed issues related to reproductive decision making (see Table 2). These twenty make up our study population: six from six individual interviews, six from four family interviews, and eight from five focus groups. After presenting the recurrent issues that emerged during this study’s transcript analysis, we will conclude by reflecting on their relevance for the ongoing debate over the ethics of reproductive decision making.

Guilt

Of the participants who brought up the topic of reproduction, an overwhelming majority expressed feelings of guilt or responsibility associated with passing down “defective” genes (13/15 transcripts).

I’m just gonna pray that God blesses both of my children - that’s it. It would make me feel a little guilty because I really don’t want to give this to my boy, you know?
—Person F (transcript #5)

Several conveyed the feeling that in transmitting a LQTS mutation, they would be doing something harmful to their child, as opposed to creating a child who would, unavoidably, have a serious genetic condition. This sense of harming the child by genetic transmission was reflected in a mother’s concern about which parent actually transmitted the mutation to her deceased son:

Is it something that was, is it a trait that one of us passed onto him that caused this, so, just, so I shouldn’t say ‘us,’ I say it’s ‘me’ ... —Person T (transcript #29)

The burden of guilt did not seem to be shared equally, but shouldered by the parent who passed on the mutation – a determination that some parents found it difficult to accept.

He felt a lot of guilt eventually especially as we found out more, that he was the one to give it to her, you know what I am saying ... we came home and he was like, he wouldn’t talk. Finally, that’s why he, he got mad and he said it was me. He said it had to be me ... —Person N (transcript #17)

Another woman explained that even if she was unaware of her mutation and didn’t knowingly pass it down to her own children, she still feels “bad.”

... for me personally as a mother, I feel bad that something you had you know passed to your child but and now I don’t have to, you know I feel bad about that with them because I didn’t give it to them they got it, not that I ever meant to do it obviously but you still feel bad ...—Person M (transcript #16)

Responsibility and Prevention

For many of the participants, parental responsibility entailed finding out their individual genetic status and knowing what the risk was in passing the mutation on to their offspring. In addition to the frequent expressions of “I feel guilty” or “I have a lot of guilt,” several participants framed their feelings in terms of their obligations as a parent. One woman, who had previously lost a baby to SUDS discussed why she needed to test herself:

I was like cuz I’m her mother and I need to know what happened to her. I need to know why it happened and I need to know if I have other children that this is not gonna happen...—Person B (transcript #1)

One might then surmise that many affected parents would regard the only responsible action as taking all possible measures to prevent passing the mutation on to their children. That was indeed the case for some participants. One woman explained that if the results of her teenage son’s genetic test came back positive, he had already decided he would not have children “because he would be afraid that he would be passing the genetic marker and he definitely didn’t want to do that” (Person Q; transcript #24).

Not all participants, however, saw the only responsible options as refraining from procreation or testing and terminating a pregnancy following positive test results. A woman with a LQTS mutation discussed the tension between her husband’s desire to use preimplantation genetic diagnosis (PGD) and her ambivalence about it:

... my husband and I unfortunately aren't really on the same page about it and my cardiologists have recommended that we go through IVF and PGD preimplantation genetic determination and they take the embryo you know of it, so that we can guarantee that we have a child without long QT but it's expensive and my husband would rather pay the money and just make sure that we don't have a child with long QT and for me I feel like okay, yes it's not great odds, you don't want to do, but you know I am 34 and I am alive and I have a good life. If it's a matter of us putting our child on medication right away and kind of maybe encouraging them not to play competitive sports, I am okay with that ...—Person S (transcript #28)

Other participants implied that they or their affected relatives would (continue to) have children, but use the knowledge that they carried the mutation to get their newborns tested immediately after birth. By determining whether the newborn inherited the mutation, parents could start treatment and monitoring early, if warranted. One woman, despite currently not having children, said, “if I have them [children], I gotta get them tested sooner or later just to start the process early if it's needed” (Person C; transcript #3).

Person M, previously quoted as feeling “bad” about passing on the mutation to her children, mused about her niece's possible future reproductive plans and options, saying,

... if my niece has another baby when she has the baby she can get it genetically tested and then she can know okay this baby has it God forbid, treat the child, or no the baby doesn't have it yeah you can play sports, you can do whatever you want ...

Person T, previously quoted as blaming herself for passing on the mutation to her son, discussed her parental responsibility to test any children she and her partner were “lucky enough to have,” saying,

...I definitely think it's something important for us to do. You know they may not find anything, but it would give me some peace of mind to know we tested, I have taken that first step, I have done as much as I can do, try to protect my child ...

In all, the prospect of newborn testing was raised in five of the fifteen interviews. Interestingly, only one of these five participants mentioned the possibility of prenatal testing for this protective purpose. We have no way of knowing whether this was because the participants associated prenatal testing with pregnancy termination rather than postnatal precautions, because they were concerned about the risk of miscarriage from prenatal tests, or simply because the prospect of such testing never came up in the discussion.

The Double-Edged Nature of Firsthand Experience with the Genetic Condition

The experience of living with LQTS was a source of both confidence and anxiety. As the preceding quotes suggest, having a LQTS mutation would not prevent some affected individuals from having (additional) children that could have that mutation. These individuals appeared to feel that they could cope with the stress of having a child with LQTS, and that they and their children can lead a “good life” despite the limitations such a condition can place on an affected individual (e.g. limited physical exertion, avoidance of loud noises) and the treatment and regular monitoring required to maintain health.

In other cases, however, firsthand experience made prospective parents anxious about having other children with LQTS. One woman described how it was “scary” for her to think about the possibility of the condition having been passed onto her children: “and having [them] go through the same thing I went through, the seizures and everything like that” (Person I; transcript #10).

Other participants had more practical concerns about their own condition, worrying about whether they would be able to fulfill their obligations to children who might require heightened vigilance. Several participants with a LQTS mutation brought up concerns about their ability to raise children, on account of the possibility that they could suddenly have a fatal cardiac event. One participant in our study put it plainly by saying, “I want to be able to be around as long as I can for my children” (Person R; transcript #27).

Person S, who earlier discussed her ambivalence about using IVF and PGD, explained how parenthood might change her perspective about treatment options, because she would need to remain alive in order to fulfill her responsibilities:

I feel like if I die because of long QT, this just means you are taken into course and I have lived the life that I wanted to live. I feel good about all the choices that I have made and I am okay with that. If I have a child, that may change because then it becomes someone else's life is dependent on me, but right now I am really okay with that choice and I am okay with making my style changes and taking the medication and doing everything else I can to avoid you know dying from this, but I am really not okay with cutting my body open and putting that box inside from the fact that, you know, there have been problems with ICDs, they have the recalls, and it's not really perfect yet ...

Sudden Death and Loss of Control

Participants expressed a variety of fears about having a child with LQTS. Like other genetic conditions studied, LQTS has both reduced penetrance and variable expressivity. Not all individuals who carry a mutation for LQTS will exhibit symptoms, and the symptoms of an affected individual can range from palpitations and syncope to sudden death shortly after birth or later in life. The latter prospect loomed large for many participants. Perhaps the starkest comment came from Person B who had already lost a child: “I need to know if I have other children that this is not gonna happen cuz I know I'm not living through it twice.”

Person D (transcript #3) discussed how the fact that the condition causes sudden death was “a big deal,” and how she was terrified about not being able to monitor her children's condition in a way that she could with other congenital disabilities.

I know that I can watch their spines, I can have them x-rayed, I can check them, that's something I can keep an eye on. But I have no control over their hearts and so that scares the living shit out of me, to put it mildly.

Several participants expressed a similar dread of having to live with chronic uncertainty, lacking control over the risks faced by their children.

Although parents recognized that the risks of LQTS could be significantly reduced by various measures, those measures were often seen as intrusive or oppressive. The woman just quoted went on to say:

And I don't want them to have to get an MRI and have all these tests and stuff. They're not invasive, but they're tests, and they're little kids. So, what I'm struggling with is - what age do I need to test them? I got tested -everything except the genetic test. So I had the echo and the MRI with contrast and all that stuff, and it was negative. But I have to keep getting tested and it just sucks. It really just sucks.

Person B, who resolved that she was “not living through it twice,” also recoiled at the prospect of continual testing to avoid that outcome: “There doesn’t need to be any testing. We don’t need to test for anything to their entire life these kids being pin-cushions...”

Some participants regarded the measures to reduce risk as stifling to children and adolescents, depriving them of a carefree, exuberant youth. Recall that Person M, quoted earlier, imagined the great relief that would follow from a negative test result, saying, “yeah, you can play sports, you can do whatever you want.”

One participant described the stifling effect of the restrictions imposed on herself and her sister:

I hope my kids don’t inherit it. I mean I pray to God that they don’t. For them to have to live their life scared. You know my son is really active so is my daughter. I don’t want them to have to stop doing what they’re doing. Even with my sister. When my mom said, that her doctor said that she had to stop dancing - I cried. I was like ‘How you gonna tell her to stop dancing - that’s her life!’ I had to stop dancing because I used to love to dance. My nickname growing up was wild child. I was never still. And for something like this to have happened to me? I’m still wild, but I’ve calmed down a lot from where I used to be because of this. Because if I exert my heart to a certain extent is it just gonna pop me and I’m just gonna fall over wherever I’m at? I don’t even go dancing anymore, I don’t go out to clubs. Or anything like that because I’m scared that something might happen to me. —Person H (transcript #8)

Another participant, who was not diagnosed until later in life, worried about the impact a positive result would have on her son, who was still growing up:

For myself, [the diagnosis] didn’t mean much, didn’t mean anything. Don’t forget at my age I feel like I’ve lived a lot of my life, and my children haven’t. — Person E (transcript #4)

The Complexity of Reproductive Decisions Involving Risk of Sudden Cardiac Death

One general impression left by our participants was that reproductive decisions are not simple - a conclusion which finds ample support in the literature. Instead, they are usually quite complex, reflecting complicated relationships, varied external influences, highly specific situations, and personal idiosyncrasies. Person T ticked off a number of factors that came into play when she and her husband contemplated having more children after the death of their son.

For us, we have done no genetic testing since our son passed away, but as we think about wanting to have another child, it plays a very important role because you know my husband and I are both older, I just turned 40 and a few months ago, he will be 50 this year, and so you know, for us, it’s thinking about if we have more children should we get tested beforehand.

Another woman described how the decision about having another child was not hers alone, but was complicated by her husband’s guilt and denial about transmitting the LQTS mutation to the deceased child:

I was a little more pragmatic about it than my husband was. When I started talking to him about it, he didn’t want to really hear about it. He felt a lot of guilt eventually especially as we found out more, that he was the one to give it to her, you know what I am saying and so when we started talking about having another child, he said, you know, what if this one has it too? ... And while we were there talking with the genetic counselor, I asked at that point about long QT and they

gave us quite a bit of information about it and I think really that started the feeling that he was, and we came home and he was like, he wouldn't talk. Finally, that's why he, he got mad and he said it was me. He said it had to be me ... —Person N (transcript #17)

Furthermore, as Person S commented, economic and financial considerations can come into play when deciding whether or how one should procreate, particularly in light of having a genetic predisposition. Expenses to be considered can fall into two categories: one for individuals concerned enough about passing on the gene mutation to their offspring to try to prevent it – the costs of prenatal testing, preimplantation genetic diagnosis, donor conception, or adoption – and another for individuals who are ambivalent about passing on the gene mutation to their offspring – the costs of preventative medications and/or implanting an ICD.

DISCUSSION

All the participants in this study had family experience with cardiac arrhythmia or sudden cardiac death. Some had lost a child or other family member to a diagnosed or suspected arrhythmia; some had experienced, or had family members who experienced, near-death episodes caused by cardiac dysfunction; some had been, or had family members who had been, diagnosed with LQTS or similar syndromes. As commercially available genetic testing for LQTS mutations becomes part of the medical evaluation of an individual with LQTS or an individual suspected of having died from LQTS, affected families can take that condition into consideration when deciding whether to have a(nother) child or continue a pregnancy. Thus, it is important to learn about these families' unique perspectives on reproductive decision making.

Their very personal exposures to cardiac arrhythmias had a profound effect on the attitudes of participants towards reproduction, whether they were actively contemplating having a child, recounting a decision to have or not have a child, or discussing the reproductive choices of family members. The most common theme was guilt – guilt for transmitting the condition to a child directly, for being “complicit” in its transmission by a spouse, or for failing to take steps to protect a child, even a child who had not yet been diagnosed with or suspected of having the condition. Such parental guilt for children's genetic conditions is widely reflected in the literature (Downing 2005; Ducruyenaere et al. 1996; Fortuny et al. 2009; Geelen et al. In Press; Kelly 2009; Klitzman et al. 2007; Raspberry and Skinner 2001).

This guilt may have been unreasonable, as some of the participants clearly recognized, but it was nevertheless a powerful motivating force. It was accompanied by a strong sense of responsibility to prevent or mitigate similar harm to other children and family members. This accords with a consistent finding in the literature: that once a prospective parent has been diagnosed as having or carrying a genetic condition, an obligation arises to “manage the risk” of passing on such a condition to the next generation (Hallowell 1999). It may be considered irresponsible (by oneself as well as others) not to manage the risk appropriately. But what exactly is “appropriate?” Some regard the appropriate thing to do as anything that ensures that the gene mutation does not get passed down to offspring. It is acceptable to have additional children only if the embryos are screened or the fetus is tested for the condition. If one undergoes pregnancy with prenatal testing, the assumption is that if the test results are positive, then the affected fetus will be aborted in order to prevent transmitting the gene mutation to one's progeny.

Like the carriers of other genetic conditions (D'Amico et al. 1992; Decruyenaere et al. 1996; Denayer et al. 1997; Evers-Kiebooms et al. 2002; Fortuny et al. 2009; Kelly 2009; Smith et

al. 2004), some of our participants believed that they should not procreate; others believed that they should not undergo pregnancy without either prenatal testing (PNT), presumably followed by termination in the case of a positive result, or preimplantation genetic diagnosis (PGD), presumably followed by the implantation of unaffected embryos.

This understanding of parental responsibility was by no means universal, however. While seven participants stated that they or their family members would be likely to have no (more) children or to employ PGD or PNT, five focused on the need for newborn testing, and only one of those five mentioned prenatal testing. Admittedly, some participants simply may have been unaware of, or inattentive to, prenatal testing options. Other participants, however, may have been reluctant or unwilling to test prenatally, or to use the results of prenatal testing to terminate the pregnancy. At least some of the participants appear to have seen their responsibility as a matter of accepting, and caring adequately for, any child they would be “lucky enough to have” (Person T).

Our study is not the first to find evidence of this perspective. Kelly (2009) noted that some individuals believe that prospective parents with a genetic condition may responsibly procreate without prenatal testing. For these individuals, parental responsibility does not require efforts to prevent the birth of children who will have a genetic condition, but rather to care for their children, regardless of whether they are affected or not.

A willingness to give birth to a child regardless of genetic condition did not necessarily reflect complacency about that condition. Several of the participants who did not discuss the option of prenatal testing expressed a strong commitment to newborn screening. Although rare, LQTS is a prime candidate for newborn screening because the danger it presents can be significantly reduced through early detection. Risk- and harm-reduction have been the principal rationales for the expanding public health program on newborn screening, which now includes a panel of approximately 30 genetic conditions (Howell 2006). The literature does not discuss this use of the parents’ own genetic status in deciding to test offspring postnatally, perhaps because the genetic conditions that have been studied generally had later onset and could be “prevented” only by pregnancy termination.

Discomfort with selective abortion may have been reflected not only in a lack of interest in prenatal testing but in the decision of some affected or carrier parents, reported in several studies as well as our own (Denayer et al. 1997; Helbig et al. 2010; Kelly 2009; Raspberry and Skinner 2011), to have no (additional) children. Kelly (2009) argues that this choice may reflect a view of parental responsibility that rejects both further transmission and prenatal selection; a view expressed in a deliberate choice to not choose among equally unpalatable options.

Admittedly, Kelly’s participants were drawn from a rural, largely conservative Protestant population in the United States. But ambivalence and disagreement about prenatal testing are hardly limited to any one demographic group. As Andre et al. (2000, 145) note, people are deeply divided over the meaning of genetic responsibility and “the appropriateness of controlling reproductive outcomes.”

The attitudes expressed by some of Kelly’s subjects are reflected in the broader “disability critique” of prenatal testing and PGD. The critique takes issue with the assumption that parents have an obligation to prevent the birth of a child with a genetic condition. It argues that such conditions are almost always consistent with a rich, worthwhile life, a prospect that is obscured by the fear and stigma associated with those conditions (Asch and Wasserman 2005). Prospective parents facing a decision to test or terminate for a genetic condition often fail to recognize that “although genetics enables us to predict (more or less) the phenotype an organism will have, it cannot say much about how that phenotype will be experienced in

an individual life” (Scully 2008, 801). Proponents of the disability critique claim that those offering and accepting prenatal selection generally exaggerate “the burdens of disability” for the child, her family, and society (Asch 1999; 2003).

And yet the disability critique must be applied very cautiously to the choices faced by prospective parents with a LQTS mutation. As Evers-Kiebooms et al. (1993) found, parents regarded the prospect of sudden childhood death as worse than significant physical or mental disability. Moreover, although the impact of a child’s death on parents and siblings may be more variable and complex than commonly assumed (Wjingaards-de Meij, et al. 2005; Wortman and Boerner 2007), there is no reason to suspect that common assumptions are shaped by the kind of invidious stereotyping or exaggeration of widely-held assumptions about disability. In particular, parents who have experienced the death of a child from a cardiac arrhythmia can hardly be accused of exaggeration in their resolve not to “liv[e] through it twice.” Admittedly, it is far from certain, perhaps even unlikely, that a second child with LQTS would die prematurely, but it is understandable that grieving parents may regard any significant odds of premature death as too high.

The concerns raised by the disability critique may have more bearing in understanding the ways that some prospective parents view the *lives* of children with LQTS. Most participants recognized that preventative measures, from beta-blockers to ICDs, could greatly reduce the risk of sudden death. For some, this reduction was sufficient to make the prospect of parenting a child with LQTS acceptable. Others, however, felt that the pervasive anxiety provoked by LQTS and the relentless vigilance it required would be overwhelming. And others felt that even with the protective measures available, they would face a terrifying loss of control over their child’s safety, health, and well-being. (Hendriks et al. (2005) note that parents tend to feel a sense of heightened apprehension about their child(ren)’s risky behaviors during the time of adolescence, which often times is characterized as a rebellious period.) Several felt that the activity restrictions needed to reduce risk would be devastating or intolerable. It is in assessing these attitudes and expectations about life with LQTS that the disability critique may offer some insight.

Although LQTS is not a visible disability in the way that spina bifida or cerebral palsy is, the appraisal of its challenges may be subject to similar exaggeration. It is undeniable that LQTS increases the risk of sudden death faced by children and adolescents, and that even stringent precautions cannot eliminate that additional risk entirely. It is also undeniable that those precautions place additional demands on parents and impose restrictions on children and adolescents that some may find very frustrating, particularly the exclusion of competitive sports and other intense athletic activity. Although these risks and burdens are real, the literature on disability in other domains has documented a strong tendency to exaggerate the vulnerability of people with disabilities and the burdens of reducing their risk (see White 2003). Moreover, many parents face some special burdens in raising their children, and many children are restricted from participating in some activities they would find deeply rewarding. The question then becomes whether, or how significantly, the quality of life for children and their parents is reduced by LQTS.

The research of Smets et al. (2008) sheds some light on this matter. Their study investigated how quality of life for Dutch children with LQTS compared to that of a representative sample of their peers. Additionally, the researchers investigated the extent to which the affected children’s own judgments of their quality of life corresponded to their parents’ judgments. Interestingly, even with the lifestyle modifications required by their conditions, children with LQTS did not differ in self-assessed quality of life compared to their peers. Their parents however, rated their children’s quality of life as lower than the children themselves did. This difference may be partly explained by the parents’ own burden of care-

giving and their own anxieties about the risk of sudden death (Smets et al. 2008). But it may also reflect the so-called “disability paradox”: the repeated finding that people with disabilities rate their own happiness or well-being much higher than others do, even others very close to them, like family members. Indeed, the self-reported happiness or well-being of people with many disabilities is not significantly lower than that of people without disabilities (Chipman 2006; Klein 2011).

It might seem surprising that such a difference would be found in families with LQTS, where the “others” are parents or prospective parents with firsthand or close secondhand experience of life with the condition. Yet there are several reasons why parents with LQTS may have had a heightened, if not exaggerated, concern about the impact of that condition on their children. First, if they themselves had been diagnosed with LQTS in adolescence or later, they may have had to give up cherished activities, like the sister who cried when her mother told her she could no longer dance. But children diagnosed at or before birth, discouraged from taking part in such activities, should not experience the same profound sense of loss, even if they sometimes feel frustrated or deprived.

Second, many parents lived most of their lives happily unaware that they had a life-threatening condition and unencumbered by that knowledge. As one stated, “[f]or myself, [the diagnosis] didn’t mean much, didn’t mean anything. Don’t forget at my age I feel like I’ve lived a lot of my life, and my children haven’t” (Person E). This sentiment also suggests a third reason for heightened parental concern about children’s hardships – as parents, they may simply find it worse to see their children suffer a given hardship than to suffer it themselves. This sentiment may in some cases have been reinforced by guilt, however unreasonable, at having caused the child to experience that hardship.

A final reason is not specific to disability; it concerns perceptions of risk and control. In general, people may be overconfident that they can control risks related to their own agency, or simply may be more willing to tolerate such risk. This judgment or preference is reflected in the familiar finding that people have a greater tolerance for the risks of driving a car rather than the much smaller risks of flying in a commercial airliner (Wendler et al. 2005). A parent may find it less tolerable to endure a heightened risk of death for herself than her child not only because of her parental feelings, but because of an exaggerated sense that she can control the risks to herself.

A tendency to exaggerate the “burdens of disability” may also be found in the concerns expressed by some affected parents about their capacity to parent. The concern about an affected individual’s ability to take care of a child has been reported in the literature with respect to other genetic conditions (see e.g., Smith et al. 2004 for BRCA1/2; Klitzman et al. 2007 for Huntington’s disease; and Helbig et al. 2010 for epilepsy). In the case of LQTS, this concern is hardly unreasonable. Affected parents, even those who take precautionary measures, may well be at increased risk of dying before they have finished raising their children. Yet that risk need not be seen as a compelling reason to refrain from having children. The probability of premature death is unknown, and most parents with LQTS may live well beyond their children’s youth and adolescence. The odds of an affected 35-year-old parent living to see his children graduate college may be as great or greater than those of an unaffected 55-year-old parent, or an unaffected 25-year-old parent facing multiple military combat deployments. If parents with LQTS are more reluctant to have children, it may be in part because of the greater stigma attached to the increased risk of death from genetic disease, as opposed to normal aging or war.

Limitations

It should be noted that our study's small sample size and reliance on unprompted comments limit the confidence with which we can generalize its findings. However, as shown in the preceding discussion, the issues that emerged from the interviews and focus groups reinforce findings from earlier studies of reproductive decision making and suggest intriguing leads for further research.

CONCLUSION

In conclusion, persons who have direct or family experience with LQTS, like people with the experience of many other genetic conditions, have widely varying opinions about reproductive decision making. There is no single way that people with or carriers of the condition feel about reproductive options. As the literature on other genetic conditions has demonstrated, these decisions are typically based on a multitude of factors, including personal experience with the condition and its symptoms, as well as what it means to lead a "good life" (Decruyenaere et al. 1996; Denayer et al. 1997; Evers-Kiebooms et al. 2002; Klitzman et al. 2007; Raspberry and Skinner 2011).

Our conclusions about the significance of LQTS for reproductive decision making are obviously tentative. The participants discussed a broad range of issues concerning their experiences with sudden cardiac death and did not focus exclusively on reproductive options. There clearly is a need for further research to explore the attitudes of affected individuals toward measures to prevent the birth of a child with an LQTS mutation, including prenatal and preimplantation testing, and the use of donor gametes. It would also be valuable to learn how perspectives on reproduction can change over time, with increased knowledge and experience (France et al. 2011; Kelly, 2009). It will become increasingly important to understand the reproductive impact of genetic diagnosis as laboratory research identifies the genetic bases for a growing number of conditions that increase the risk of sudden death. Such an understanding will be critical to developing informative, non-coercive, and respectful approaches to prenatal counseling and testing.

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Table 1

Participant Demographics (n=50)

Male	11
Female	39
Hispanic or Latino	10
Not Hispanic or Latino	40
American Indian/Alaskan Native	0
Asian	1
Other Pacific Islander	0
Black or African American	7
White	42
Married	28
Unmarried, Living Together	2
Separated	2
Divorced	1
Single	16
Widow	1
Less than 9 th Grade	1
GED	2
High School	5
Some College	12
College Degree	14
Graduate Degree	16
<\$25,000	6
\$25,000–\$50,000	6
\$50,000–\$80,000	13
>\$80,000	23
Refused to Specify	2
Employed Full-Time	25
Employed Half-Time	12
Unemployed (or Disabled)	8
Refused to Specify	5

Table 2

Reproductive Decision Making Themes

Transcript #	1*	3*	4	5	8*	10*	13*	16	17	18	20	24	27	28	29
Guilt/Responsibility	X	X	X	X	X	X	X	X	X	X	X	X			X
Reproductive decisions are complex	X								X			X		X	X
Uncertainty/loss of control	X	X	X												
Carriers likely to use PGD/PNT or to not procreate	X				X		X	X			X	X		X	
Possibility of (further) reproduction		X			X	X	X	X	X					X	X
Get offspring test after birth		X					X	X	X						X
Concerns over specifics of LQTS		X	X												
Concerns over ability to raise kids					X								X	X	

Please note the following: Transcripts #1, 3, 13, 20, and 29 are from focus groups. Transcripts #4, 8, 10, and 27 are from family unit interviews. Transcripts #5, 16, 17, 18, 24, and 28 are from individual interviews.

* These transcripts involve more than one participant discussing reproductive decision making.