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In the Dark: Challenges of Caring for Sons with Klinefelter Syndrome

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The purpose of this mixed method study was to describe family management challenges for parents who have sons with Klinefelter Syndrome (KS). Standardized survey results showed that stress, quality of life and family management struggles varied by parent age. When interviewed, parents described feeling uninformed and without support to make decisions about managing their sons' KS. Parents reported that a lack of guidance and case coordination created barriers in caring for their sons throughout childhood. Given the prevalence of KS, health care providers need to be prepared to provide comprehensive evaluation and anticipatory guidance for KS boys and families.

KLINEFELTER SYNDROME (KS) is a common genetic condition that affects only males and is caused by the presence of an extra X chromosome. The prevalence of KS is approximately 1 in 450–600 male births (Bojesen, Juul, & Gravholt, 2003; Herlihy, Halliday, Cock, & McLachlan, 2011) and may be rising (Morris, Alberman, Scott, & Jacobs, 2008).

Physical characteristics and symptoms of KS are highly variable and include tall stature, wide arm span, small testes, androgen deficiency, breast development, and azoospermia (Simpson et al., 2003; Zeger et al., 2008). Most affected children appear normal at birth with phenotypic features becoming increasingly apparent during pubertal development when testicular failure typically begins (Wikstrom & Dunkel, 2008). KS is associated with language-based learning disabilities, (Graham, Bashir, Stark, Silbert, & Walzer, 1988; Rovet, Netley, Keenan, Bailey, & Stewart, 1996) as well as behavioral, (Ross et al., 2012) psychiatric (Geschwind, Boone, Miller, & Swerdloff, 2000) and psychosocial problems (Boks et al., 2007; van Rijn, Swaab, Aleman, & Kahn, 2008; van Rijn et al., 2013). A number of health risks are associated with KS, including diabetes, cardiovascular disease and osteoporosis (Bojesen, Juul, Birkebaek, & Gravholt, 2006). Reports also show that boys and men with KS suffer low self-esteem, poor quality of life and increased risk for depression compared to the general population. (Turriff, Levy, & Biesecker, 2011). KS can affect different aspects of health throughout the life span including both physical and psychosocial parameters. Little is known about how families of affected males manage the diagnosis. Parents of boys with KS are understandably concerned and confused about what to expect regarding the health of their affected sons. Since few studies of those with KS involve children, there is little evidence to guide clinicians or parents on how to care for affected boys or how to disclose and explain this condition to them during childhood and adolescence (Close, Smaldone, Fennoy, Reame, & Grey, 2013).

How parents think about a genetically-based chronic condition like KS may shape the way the family manages the needs of the affected child (Gallo, Hadley, Angst, Knafl, & Smith, 2008; Knafl, Knafl, Gallo, & Angst, 2007). The needs of a boy with KS often include a complex interplay among medical, pharmaceutical, psychosocial and educational management issues. For parents, management of their

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son's health is further complicated by the paucity of evidence-based guidelines regarding treatment and family support for KS. The purpose of this study was to describe family management challenges as parents try to meet the needs of their sons with KS.

Theoretical Framework

This study was guided by the Family Management Style Framework (FMSF) shown in Fig. 1 (Knafl, Deatrick, & Havill, 2012). The FMSF provides a structure for understanding how family members manage having a child with a chronic condition including how family members define, manage and perceive the consequences of their child's chronic health condition. The first aim of this study was to explore stress, family quality of life and family management style in parents of sons with KS. A second aim was derived from the "major component" sections of the framework. We described how parents define the situation of having a son with KS, their management of health, education and psychosocial issues and how they perceive the consequences of this condition on the family including stressors, worries and unmet needs. A summary of study variables with constructs found in the FMSF are shown in Table 1.

Design

We conducted a concurrent triangulated mixed method study to explore and describe the experiences of parents who have a son with KS. The qualitative approach was Interpretive Description (Thorne, Kirkham, & MacDonald-Emes, 1997). Interpretive Description incorporates the use of theoretical frameworks such as the FMSF, methods of sample selection and data analysis to conduct investigations into human health and illness experiences (Thorne, 2008; Thorne et al., 1997).

Methods

This study was approved by the Yale University Human Research Protection Program prior to data collection. All participants provided written informed consent. In depth semi-structured interviews and online questionnaires were conducted between December, 2012 and March, 2013.

Participants

A purposive sample of 40 parents participated in the study. Parents were recruited from a KS national advocacy association known as the Association of X and Y Chromosome Variations ©. Participants were eligible if they were English-speaking, had a KS-affected son between the ages of birth and 26 years and had access to a telephone and/or a computer. Participants were chosen using maximum variation to reflect the spectrum of parents who had sons of varying ages, differing levels of symptom severity, length of time since diagnosis, timing of diagnosis and parents whose sons were informed or not informed about their diagnosis. Sample size was determined based upon purposive sampling used in mixed methods research (Teddlie & Yu, 2007). The sample allowed for the minimum sample size required to detect differences in the survey data and to accommodate the sampling strategy for collection of interview data. Using perceived stress scores as a primary outcome measure with a two-tailed t test, 80% power with alpha at .05 would require a sample size of 33 participants assuming a large effect size.

Semi-Structured Interview Guide

Using the FMSF and a review of the literature on families who have children with genetic conditions, we developed a semi-structured interview guide that focused on the parent experience of having a son with KS. The guide consisted of items developed from the "Components" section of the FMSF concerning parental experience of raising a son with KS, information management, management of health and social issues and the perceived consequences of having a son with KS. Sample interview questions are shown in Table 2.

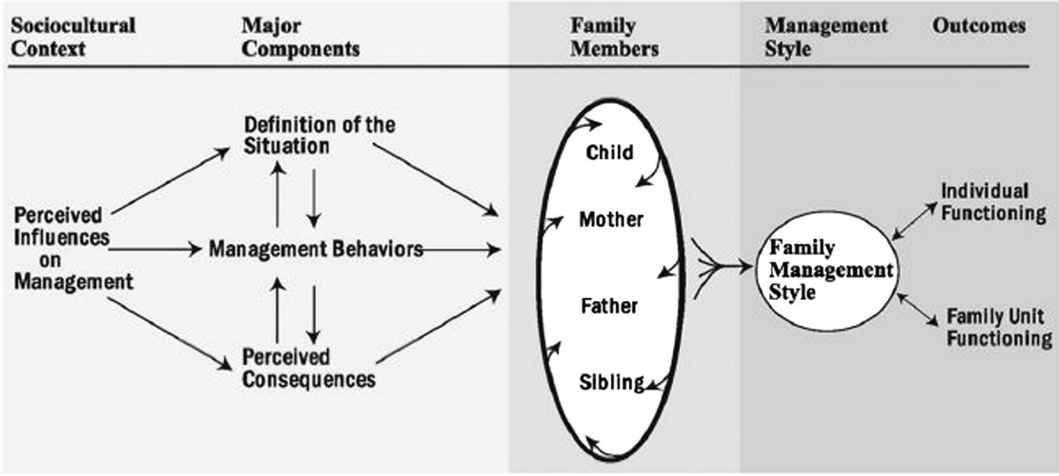


Fig. 1 The Family Management Style Framework reprinted with permission from Knafl, K, Deatrick, J. and Havill, 2012 in the Journal of Family Nursing 18 (1), 11–34.

Table 1 Variables Drawn from the Family Management Framework.

FMSF Construct	Variables	Measure
Sociocultural Context	Demographic Information: age, son's age, race/ethnicity, parent education level	Demographic survey
Major Component:	Meaning of having a son with KS	Qualitative interview using the semi-structured Interview Guide
Definition of the Situation	How KS affects the parent	
Perceived Influences on Management	How KS affects the family	
Management Behaviors	Information Needs and Information Management	
	How they manage physical and psychosocial health in KS	
Management Style	Family Management Style	Family Management Measure
Outcomes	Quality of Life	Family Quality of Life
	Parental Stress	Perceived Stress Scale

Procedures

Following informed consent, participants provided demographic information via an online questionnaire. Interviews were conducted via telephone or SKYPE® from participants' homes. Each interview, lasted approximately one hour and was audio recorded and transcribed verbatim. Transcripts were scrubbed of any identifying information and then uploaded to Atlas.ti Version 7.1.6© (GmbH, Berlin) for qualitative database management. Following interviews, participants were sent secure email links to respond to standardized surveys including Perceived Stress, (Cohen, Kamarck, & Mermelstein, 1983) Family Quality of Life, (Summers et al., 2005) and the Family Management Measure (Knafl et al., 2011) via Qualtrics©.

Survey Measures

The Perceived Stress Scale (PSS) is a 10-item survey that measures the degree to which situations in one's life are appraised as stressful. The internal consistency ratio (ICR) for the PSS ranges from 0.84-0.86 with test-retest reliability reported at 0.85. This questionnaire has been used widely in health applications over the years (Cohen et al., 1983). The Family Quality of Life Survey (FQOL) is a 25-item survey that measures quality of life via 5 subscales: family interaction, parenting, emotional well-being, physical/material well-being and disability-related support. The ICR for this survey ranges from 0.88-0.94. The test –retest reliability for this instrument ranged from 0.42-0.77 (Hoffman et al., 2006). The Family Measurement Measure (FaMM) is a 45-item survey that measures how families manage caring for a child with a chronic condition and the extent to which they incorporate condition management in their everyday lives. Subscales for this measure include: child's daily life, condition management ability, family life difficulty, parental mutuality and view of condition impact. ICR ranged from 0.72-0.90 for mothers and 0.73-0.91 for fathers. Test-retest reliability for the FaMM is 0.71-0.94 (Knafl et al., 2011).

Analyses

Survey analyses were conducted using the Statistical Package for Social Science, (SPSS version 22, IBM Corporation, Armonk, NY) for descriptive analysis and examination by one-way analysis of variance (ANOVA). Parents were grouped according to age based upon normative data from the PSS survey. Parents fell into 3 age groups: youngest (30–44 years), middle (45–54 years) and oldest (≥ 55 years). These age groups

Table 2 Semi-Structured Interview Guide Based on the Family Management Style Framework.

Components of Family Management	Interview Questions
Experience of Raising a Son with KS	Can you tell me what it is like raising a son with KS?
Information Management	How do you find information about KS?
	Tell me about the sources of information you use.
	Can you describe any barriers you think might influence getting information about KS?
Management of Health and Psychosocial Issues	Tell me about the health and psychosocial aspects of KS that affect you and your family.
	Can you explain any issues or difficulties you've had in trying to manage the health and psychosocial issues of your son?
Perceived Consequences of Having a Son with KS	Tell me about the positive and negative consequences of having a son with KS.
	What do you worry about?
	What do you think you need?
	Do have any unmet needs?

were maintained for analysis for family quality of life and family management surveys.

For the qualitative portion of the study, two authors (SC & LS) coded all interviews and these codes were used to generate themes describing how parents who have sons with KS manage their son's physical and psychosocial health. Interviews were digitally recorded and professionally transcribed. De-identified transcripts were entered into the qualitative analysis software. After each interview, the transcript was reviewed for accuracy and compared via two reviewers (SC & LS). Each interview was compared to the interview that preceded it to make adjustments to the interview strategy in order to capture rich and vivid descriptions. The research team met biweekly to compare coding. The initial transcript was reviewed by two authors to formulate a general sense of the interview and to begin open coding. An additional two transcripts were read by (SC & LS) to develop a list of emerging codes. When coding agreement reached 90%, all subsequent transcripts were coded according to a final list of 12 codes. An iterative analysis approach was used as each researcher coded and then abstracted meanings to form common categories that were reviewed and discussed until categories were reduced to themes. The themes were then reviewed against the interview transcripts. Methodological and conceptual memos were kept and discussed in an audit trail. Themes were situated in a concept map to ascertain relationships until overarching themes were agreed upon.

Trustworthiness of Qualitative Data

Scientific rigor for this project was planned and demonstrated according to criteria established by (Lincoln & Guba (1985)) Credibility refers to the truthfulness of findings. This was met by engagement with KS parents, biweekly debriefing with the research team, review of field notes and member checks. Confirmability is a check or acknowledgment of bias in the results. For this study, an audit strategy was developed by (SC & LS) involving independent review of raw data, data reduction and synthesis of themes with 90% agreement. Transferability refers to the application of our findings in other contexts. Transferability criteria were met by the use of our theoretical purposive sampling to ensure that participants were intimately experienced with sons who have KS and that they were chosen to represent diverse experiences and family situations. The consistency of findings is what is meant by Dependability. Dependability was met by the consistent recording of our audit trail that was evaluated by an independent expert in qualitative methods.

Results

Participant demographics are summarized Table 3. Parents were primarily female, Caucasian, and well-educated. Sons ranged in age from 5 months to 26 years with 52.5% of the sample with prenatal diagnosis. The parental experience of raising a son with KS varied according to the age group of parents. Descriptive results of the survey data can be found in Table 4. While stress scores appeared to be higher in all age groups of KS, only older parents (age ≥ 55 years) showed significantly higher stress than the reference group as seen in Table 5. The PSS showed a high reliability (Cronbach α = 0.92). FQOL results were analyzed by subscale. One-way ANOVA of the means for parent age group revealed significant differences among the 3 groups for two subscales: Parenting ($F_{2,37} = 4.39$; $p = 0.020$) and Disability Support ($F_{2,37} = 3.32$; $p = .047$). The Parenting subscale measures the skills parents use and their ability to recruit others to help in the household. Follow up Tukey procedure for the Parenting subscale indicated that oldest parents showed significantly lower use of skills by parents than middle-age or youngest parents. ($p = .030$). The Disability Support subscale measures how parents view their child's ability to accomplish goals at home and at school as well as achieving good social relationships and positive relationships with health care providers. The post hoc Tukey analysis for Disability Support showed significantly lower disability support quality of life for middle-age parents compared to the oldest group ($p = .049$). The FQOL also showed high reliability (Cronbach α = 0.92)

Results of the FaMM indicated a moderate reliability (Cronbach α = 0.68) with significant differences in means

Table 3 Participant Characteristics.

	Mean ± SD	Range
Age in Years		
Parent	48.6 ± 7.6	32-62
Son	13.2 ± 6.9	0.3-25
	Frequency	Percent
Gender		
Female	33	82.5%
Male	07	17.5%
Marital Status		
Married	35	87.5%
Divorced	05	12.5%
Race		
Caucasian	35	87.5%
African American	01	2.5%
Hispanic	02	5%
Other	02	5%
Parent Education		
High School Diploma or less	07	17.5%
College Degree	23	57.5%
Graduate Degree	10	25%
Son's Karyotype		
47, XXY	37	92.5%
47, XXY/XY	03	7.5%
Time of Diagnosis		
Prenatal	21	52.5%
Postnatal	19	47.5%
Disclosure of KS to Son		
Yes	25	62.5%
No	15	37.5%

Table 4 Survey Means and ANOVA Results Comparing Parent Age Groups.

Measure	Total n = 40	Youngest Age ≤ 44 n = 11	Middle Age 45–54 n = 20	Oldest ≥55 n = 9	*F* Statistic	*p* Value
Perceived Stress	15.8 ± 7.2	18.2 ± 9.0	13.8 ± 6.4	17.3 ± 5.3	1.65	0.206
Family Quality of Life						
Family Interaction	24.3 ± 3.7	24.7 ± 3.5	24.9 ± 2.5	22.6 ± 5.6	1.39	0.261
Parenting	24.1 ± 3.9	25.3 ± 3.2	24.8 ± 2.7	20.9 ± 5.6	4.39	**0.020**
Emotional Well Being	14.5 ± 3.3	15.1 ± 3.6	14.7 ± 3.1	13.4 ± 3.3	0.672	0.517
Physical/Material Well Being	21.3 ± 2.8	21.5 ± 3.5	22.0 ± 2.3	19.4 ± 2.3	2.89	0.068
Disability Support	14.7 ± 2.7	15.2 ± 2.7	15.3 ± 1.9	12.8 ± 3.4	3.32	**0.047**
Family Management Measure						
Child Life	15.7 ± 4.8	16.9 ± 4.3	17.4 ± 3.9	11.7 ± 5.1	5.68	**0.009**
Condition Management Ability	43.1 ± 7.8	43.1 ± 5.9	46.1 ± 5.7	36.3 ± 9.9	6.12	**0.005**
Condition Management Effort	9.5 ± 3.6	10.0 ± 4.1	8.6 ± 3.1	10.8 ± 3.6	1.43	0.250
Family Life Difficulty	33.5 ± 12.3	31.2 ± 11.4	30.8 ± 9.5	42.1 ± 15.8	3.17	0.054
Parent Mutuality	20.3 ± 5.8	20.5 ± 6.4	18.7 ± 4.3	24.8 ± 7.1	2.88	0.070
View of Condition Impact	27.3 ± 7.0	29.0 ± 5.7	24.9 ± 6.3	30.6 ± 8.7	2.61	0.087

Significance ≤0.05 shown in bold.

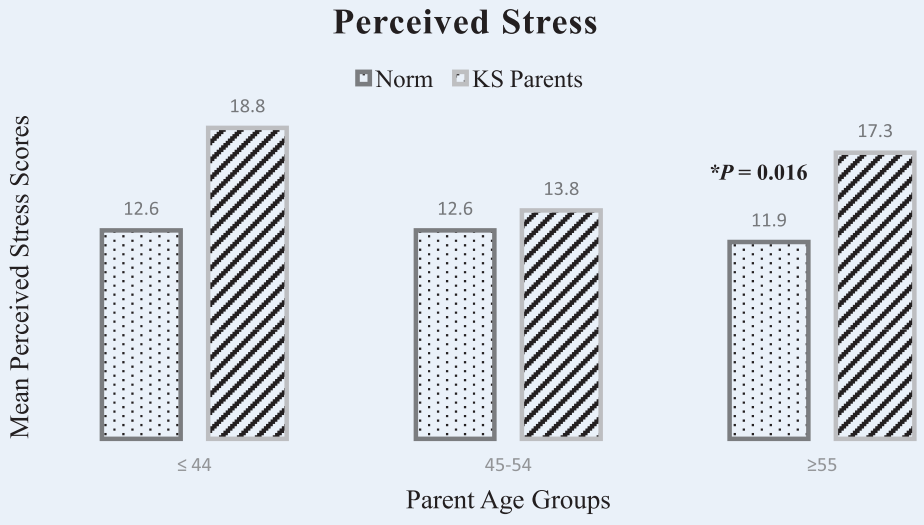
between parent age groups in perceptions of Child Life Difficulty ($F_{2,37}$ = 5.4; p = .006) and Condition Management Ability ($F_{2,37}$ = 6.1; p = .005). The Tukey procedure showed that oldest parents perceived their child's life to be worse than others compared to the middle and youngest groups (p = .006). Condition Management Ability subscale analysis showed that parents in the middle age group encountered less difficulty with condition management compared to the youngest and oldest parents (p = .003). While no differences in perceived stress were observed among parent age groups, oldest parents showed significantly higher stress than the reference norm for the measure (p = .016) as displayed in Table 5.

Qualitative Interpretive Description

While survey results indicated that parents of boys with KS reported higher stress, lower quality of life and family management issues compared to reference norms, these results do not explain what experiences or issues may underlie these negative effects. Findings from in-depth interviews were used to illuminate parental experience and identify specific problems associated with the health care setting, education, and social services.

Four over-arching themes emerged that described the "back-stories" with explicit details of how parents experienced stress, poor quality of life and family management problems. The four major themes from the Interpretive Description

Table 5 Comparison of Parent Age Group Compared to Normed Reference of Perceived Stress Survey.



analysis included: "In the Dark", "Double-Edged Sword", "Disclosure Dilemma" and "Need for a Roadmap".

Lack of Information "In the Dark"

Parents expressed burden due to lack of knowledge and misinformation as they sought to find answers in the management for their sons' special needs. Parents expressed deep concern about the lack of knowledge about KS in medical community and sparse research to inform health care providers, allied health practitioners and educators. Parents reported feeling lost, uninformed and without support to make healthcare and educational decisions for their sons.

> "Well, I would say the biggest barrier is just lack of information, lack of knowledge on the healthcare providers' end of things. You know, and I've asked a lot of questions about what should we be doing now to possibly allow my son to biologically father his own children. If you talk to three different people you're going to get three different answers. And there's an example of uncharted territory. We don't know what the panacea is. We're in the dark….the dark dark dark about this" Mother of a 16 year old

> "So even our pediatrician didn't know very much about it, and that was it. That was it with the doctors. I had no idea. I'm actually screaming out there "Who's going to help me". It's not available, not even doctors, not even psychologists. They don't really understand. They don't understand the dynamics of all of this". Mother of a 6 year old

Favorable and Unfavorable Consequences: "Double-Edged Sword"

Parents vividly describe having a son with KS was like a "double-edged sword" with positive attributes offset by KS-related symptoms and challenges. Parents described not fully understanding what effects the extra X might have on their sons. On one hand, parents described their sons as sweet, sensitive, caring, and helpful with a desire to belong. On the other hand, the parents report that the boys demonstrated a spectrum of issues including speech and language problems, delayed maturity, learning difficulties, social interaction struggles, low self-esteem and risk for psychiatric disturbance. Parents described that on first appearance, others do not recognize that their sons may have challenges. Parents often feel at a loss to explain these challenges since they do not have a good understanding of KS themselves. They described attempting to anticipate the developmental needs of their sons in the absence of an adequate foundation of information.

> "It's double-edged sword. Like from the minute I was told when I was pregnant with him, I mean it was the last thing I thought I would ever be told, that I was having a son with something that I'd never heard of in my life, an extra chromosome. I had never ever heard of that. I've gotten so much information, misinformation, good information, but really I have just followed what other mothers have kind of told me what to expect. That he would be born looking normal, behaving normal until like he would miss a milestone and then that could be something that could be a concern. But I don't – usually just looking at him and you would never know. Just so beautiful, so polite, and so loving, and just rambunctious and sweet" Mother of a 6 year old.

As described by another mother:

> "You know, it's a mixed bag. It's very difficult sometimes because on the outside he looks like any other normal child, and on the inside he's just completely wired differently. And there's a lot of – there's the mental health component to that, there's behavior issues, there's when he gets a little older there will be the medical component of possibly giving him testosterone, and not having anybody else know all that. And from his standpoint I tell him all the time he's got to work a lot harder, especially in school, to get to the point where everybody else already is, they don't have to work as hard". Mother of a 15 year old

Diagnosis Disclosure Dilemma: "To Tell or Not to Tell"

In addition to a lack of basic information and guidance, parents sought information on their own using any resources they could find. The Internet was a major resource for them. In addition to reliable information for some health conditions, the Internet can also be a source of incomplete and inaccurate information. Parents reported seeing sketches and explicit photographs of men with KS showing disturbing physical features such as breast development, short phallus, and gynoid body shape. Some information and images brought fear and intensified worry about how others might perceive their son if his diagnosis was made known to others. This fear and worry was compounded as parents developed new concerns about labeling, misunderstanding and bullying. Many parents described how they withheld information from their sons, family members and others for fear that others might search the Internet and be exposed to information that would cause them to judge or stigmatize their sons.

> "But it is like harboring a secret, like you've got a secret in your household that you just don't feel comfortable sharing" Father of a 19 year old

> "Exactly. I'm afraid to tell his teachers. I just don't want it to get out. I mean, I know a lot of people in that school. What if one teacher mentions it to another and then it gets spread around? It's a very delicate situation in my mind, very private. And that's the part I hate is that – if it didn't have to be

so private we would all feel so much better about it. Like, we harbor a secret. We harbor a secret." Mother of a 16 year old

"Okay, what does that mean?" You know? At the time, anyway. And again, you don't know what the future's going to hold. That could be a positive, but it could also be, okay, what does this mean? Also, telling other people, "My son has this syndrome. He has this extra chromosome," and, "Okay, well, does that mean he's less or more of a boy?" kind of thing like that, I've had questions like that, too. "Does that mean he's a girl? Will he behave – when he gets older, will he want to become a girl?" or things like that. I've had questions like that." Mother of a 9 year old

Lack of Anticipatory Guidance "Need for a Roadmap"

No matter the stage of development or the age of the son, parents described the need to for advice and guidance that transcends ordinary health maintenance. Parents described that after diagnosis they were often advised not to worry until the child approached puberty when there may be a need for treatment for androgen deficiency. The parents, however, needed comprehensive information, support and "treatment" in the form of anticipatory guidance throughout their child's developmental stages.

"Back to the medical thing, I think when a child is born and diagnosed, certainly diagnosed with this, the pediatrician, the child pediatrician should do a lot more. Not just the waiting the 5 – or not the 5 years, call it early childhood, the first 10 years before the child is then going to back and start getting ready to figure out when they will be going into puberty. I think that much more information could be disseminated through the pediatrician because they see the child so often, right? If nothing more than a cold, they can talk to a parent and answer questions for the parents because in this day and age, information age, there's so much more out there, but it doesn't necessarily mean anything to the parent. If the doctor is proactive and is also keeping abreast with the studies and stuff, I think the – instead of the "I don't know. We have to wait. We have to wait," they can calm a lot of the fears and worrying. I think with everybody, when there is fear, people pull back, people are reluctant to find out, so they withdraw instead of dealing and coping, they sort of rely on hope and it comes back to bite them". Father of a 19 year old

While there is great variability among individual and personal characteristics from one affected boy to another, there were common needs expressed by parents such as timing of hormone treatment, when to begin inquiry about fertility options, how to manage educational and planning for the child's life course.

Parents reported a lack of knowledge and little research on the pediatric presentation of KS to inform parents and health care providers for how to anticipate the physical, neurocognitive and social issues of the child. As boys progressed toward the end of adolescence by chronological age, some families reported struggling with issues regarding their sons' completion of education and their ability to become independent.

"Well, right now, being a young adult, the frustration right now is that he is just not maturing. I mean, it's just like, okay, buddy, you're 22 years old. Now my other kids are off and gone out to college and at this time in their life and doing some things with themselves. And he is just still living in high school." Mother of a 22 year old

"Yeah. He's very easy to – he wants to be everybody's friend, so I worry that he'll be too easy to convince to do things that may not be the best for him, easily swayed. I worry about his independence, because he's very just – he just expects things done for him maybe. But for now, I can't even imagine him holding a job." Mother of a 13 year old

Discussion

The stories of parents whose sons have KS help to explain some of the underlying reasons for parental reports of increased stress, issues with quality of life and challenges in family management. Overall issues described by parents included the need for information, understanding features and symptoms associated with KS, support for disclosing the diagnosis and desire to have a logical plan for how to provide care for their sons. Regardless of whether they received the diagnosis in the prenatal or postnatal time period, parents were disturbed at how unfamiliar health care providers were with the diagnosis, planning and treatment of KS from point of diagnosis through childhood. Greater than one-half (52.5%) of the parents in this study received a prenatal diagnosis. Timing of diagnosis may impact parents in a variety of ways. Parents receiving prenatal diagnosis experience stress and uncertainty as they search for information about what they can expect concerning the development and the future of their unborn child (Fonseca, Nazare, & Canavarro 2013; Horsch, Brooks, & Fletcher, 2013). Several parents whose sons received a postnatal diagnosis in this study described a long, arduous and frustrating process of searching for answers for their son's physical, neurocognitive and psychosocial issues prior to having a physician initiate an order for karyotyping. Once the diagnosis was confirmed, they reported feeling relieved that they learned the reason for their son's symptoms, but

overwhelmed and stressed over how they could find appropriate treatment. Continuous seeking of treatment for KS may have compounded stress as they encountered health care providers and others who were unable to offer much information or guidance. Implications for parents who receive diagnoses prenatally include the need for systematic anticipatory guidance during pregnancy and the neonatal period in order to answer questions and to support parents.

In this sample, parents sought information from obstetricians, neonatal pediatricians, general pediatricians, pediatric endocrinologists, urologists, psychiatrists and educational psychologists. Almost universally, parents reported that health care professionals were not specifically familiar with KS so they were unable to be guided by professional expertise or advice relative to their questions and concerns. Without health care advice from professionals, parents sought information from the Internet where they encountered a spectrum of information and advice with a range of accuracy that was variable and unreliable. Parents reported that information from the Internet was often conflicting, confusing and often scary to them. They discussed that when they brought Internet-based information back to their health care providers, they were frustrated to learn that their questions could not be answered. Parents often described feeling unheard and lost as they tried to get a better understanding of KS and were left without satisfactory answers to their concerns. Central to the issue regarding lack of information is a large gap in the literature about how to treat KS. While the literature offers many descriptive studies and case reports, there are very few intervention studies that can provide answers for the best ways to address treatment. In reality, the literature does not provide adequate evidence to direct health care providers for treatment options.

The KS phenotype is variable and is not well-understood across the lifespan. Parents who seek understanding of their sons' physical, neurocognitive and psychosocial issues have little reference for how their son's phenotype varies from unaffected boys and how it varies within the spectrum of others with KS. Their concerns about favorable versus unfavorable characteristics are left largely unaddressed. Parents of boys with KS often remark that they don't know if a certain trait or symptom is due to the child's individual familial traits or if they were attributable to the extra X chromosome. Since there is large variability in the physical and neurocognitive phenotype in KS, parents of sons who are more severely affected may feel a more urgent need to seek advice about symptoms that are most bothersome to their child and family. Without knowledge and support from health care providers, parents are left to manage information, formulate health care plans and navigate uncertain educational challenges with little support.

Many issues surround the complex decision regarding diagnosis disclosure. Parents struggle with their own adaptation process after learning of the diagnosis and their questions about when and how to inform the child and others of the diagnosis (Gallo, Angst, & Knafl, 2005). Some may make their own interpretations of the meaning of the diagnosis when questioning whether their child possesses certain signs or symptoms associated with the condition (Whitmarsh, Davis, Skinner, & Bailey, 2007).

Among parents of children with other genetic conditions, there can be patterns of how they understand a diagnosis ranging from accurate, to confused, to discrepant (Gallo, Knafl, & Angst, 2009). These patterns suggest that parents' access, interpret and convey information about their child's diagnosis in unique and often disorganized ways that may have adverse consequences for the child and the family. Parents need targeted guidance about KS during the child's development to anticipate and to respond to the special medical, psychological, education and social needs of each child and family.

Findings from this study support the findings of a recent study by Bourke et al. who conducted a qualitative exploration of parental experiences of having sons with KS and how they learned of the diagnosis (Bourke, Snow, Herlihy, Amor, & Metcalfe, 2013). Parents described how they had to "come to terms" after receiving the diagnosis and that the impact of the diagnosis affected how they viewed their sons, which in turn, affected family interactions. Their findings were consistent with ours regarding a lack of knowledge and misinformation from health care providers (HCPs) that had a negative impact on how parents perceived the consequences of having a son with KS. Research has shown that parents who have children with disabilities are at risk for increased stress and poor mental health (Hall et al. 2012; Hung, Wu, Chiang, Wu, & Yeh 2009).

Stressors, reduction in quality of life and family management issues for parents may vary according to the severity of a child's phenotype, developmental stage of the child or compounding factors associated with family situation and resiliency (Hall et al. 2012). Our study shows that stress is increased for parents of sons with KS especially for the younger and older parent age groups. Parents of very young boys with KS reported worrying about whether their sons would have developmental and intellectual disability while some struggled with access to early intervention services. Parents of boys who were of school-age spoke of feeling of relief from stress while their son was at school knowing that he was in a learning environment under supervision of other adults. Parents of the school-aged boys were in the middle age range of our sample showing that stress was reduced, but they still struggled with management issues such as disability support as they attempted to advocate for special services related to school. Since older parents had older children this may represent cumulative years of challenge in raising a son with KS with little support. Older parents showed reduced family quality of life in terms of the parenting skills of recruiting help from others and they perceived that their sons had reduced quality of life compared to others. Parents who reported that their son was unhappy and without good quality of life described that they felt the burden of their child's unhappiness and that this

increased stress for them. Older parents may also be dealing with issues related to failure-to-launch when sons are unable to achieve independent living and must rely on continued parental support as they enter adulthood.

Effective family management for a child with KS requires a dynamic interplay of accurate information, support and guidance from the health care community. When little management guidance exists families are without connection to professional resources to guide them. This is true not only for KS, but also for other sex chromosome aneuploidy conditions such as 47 XXX and 47 XYY. Many other chronic conditions of childhood continue to leave parents on their own to search for answers to their questions. Family management challenges such as parent concern for their child's daily life, impact on family life and the parent's ability to manage the condition are intimate issues for those dealing with more well-known conditions such as diabetes and asthma as well other diagnosed conditions such as survivors of childhood brain tumors (Deatrick, Mullaney, & Mooney-Doyle, 2009; Knafl, Breitmayer, Gallo, & Zoeller, 1996; Kurnat & Moore, 1999; Rearick, Sullivan-Bolyai, Bova, & Knafl, 2011).

Individual and family functioning depends upon how these components are used to build a supportive structure of resources that will benefit the whole child in the context of his family. Variables for the quantitative section of this study and areas included in the semi-structured interview guide used for interviews were derived from the FMSF. Our findings support the structure of this framework insofar as the major components (definition of the situation, management behaviors and perceived consequences) and how these impact family members and levels of functioning as measured by stress, quality of life and family management. What the framework may lack, however, is a temporal component. Families may experience the major components of this framework in different ways over time. Families newly diagnosed with a genetic or chronic condition have different perspectives and needs than those who have dealt with the condition during various periods in their lives. Family members mature in stages and phases that could impact how the major components of this framework relate to family members, management style and outcomes which may help to promote understanding and explanation of how family management varies dynamically over the family lifespan.

Limitations and Strengths

The authors acknowledge several limitations in this study for the quantitative analysis including a small sample, cross-sectional design, self-report surveys, and selection bias since the participants were recruited from a parent advocacy organization. The sample size using maximum variation, however, was a strength of the qualitative portion of study since the data reflected variation in parental experiences, but with recurring and consistent themes occurring across diverse family situations. Survey results must be interpreted with caution due to the small sample size divided into age groups without recruitment specifically for a balanced cell size.

Conclusions

Results of this study highlight the need for future research on the development and testing of interventions that will benefit boys and their families including how families can access multidisciplinary services, coordination of care and support and how to disclose the diagnosis of KS. Essential to this work, also, is capturing the experience of KS from the perspective of those boys and young men with the condition and their family members. Important practice implications exist for health care practitioners who care for boys with KS and their families. For boys not yet undiagnosed, KS may be hiding in plain sight while boys are receiving normal health maintenance and illness-related visits. Pediatric health care providers and nurses need to incorporate a diagnostic index of suspicion when parents report a triad of physical, neurocognitive and social symptoms. For patients already diagnosed, boys and parents need to receive accurate developmentally-appropriate information, professional support and a progressive, integrated treatment plan to optimize physical and psychosocial health throughout the lifespan.

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Conflict of Interest Statement

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References

Bojesen, A., Juul, S., Birkebaek, N. H., & Gravholt, C. H. (2006). Morbidity in Klinefelter syndrome: A Danish register study based on hospital discharge diagnoses. *Journal of Clinical Endocrinology and Metabolism*, *91*, 1254–1260, http://dx.doi.org/10.1210/jc.2005-0697 (jc.2005-0697, pii).

Bojesen, A., Juul, S., & Gravholt, C. H. (2003). Prenatal and postnatal prevalence of Klinefelter syndrome: A national registry study. *Journal of Clinical Endocrinology and Metabolism*, *88*, 622–626.

Boks, M. P., de Vette, M. H., Sommer, I. E., van Rijn, S., Giltay, J. C., Swaab, H., et al. (2007). Psychiatric morbidity and X-chromosomal origin in a Klinefelter sample. *Schizophrenia Research*, *93*, 399–402, http://dx.doi.org/10.1016/j.schres.2007.03.015 (S0920-9964(07)00148-X, pii).

Bourke, E., Snow, P., Herlihy, A., Amor, D., & Metcalfe, S. (2013). A qualitative exploration of mothers' and fathers' experiences of having a child with Klinefelter syndrome and the process of reaching this diagnosis. *European Journal of Human Genetics*, http://dx.doi.org/10.1038/ejhg.2013.102.

Close, S., Smaldone, A., Fennoy, I., Reame, N., & Grey, M. (2013). Using information technology and social networking for recruitment of research participants: experience from an exploratory study of pediatric Klinefelter syndrome. *Journal of Medical Internet Research*, *15*, e48, http://dx.doi.org/10.2196/jmir.2286.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*, 385–396.

Deatrick, J. A., Mullaney, E. K., & Mooney-Doyle, K. (2009). Exploring family management of childhood brain tumor survivors. *Journal of Pediatric Oncology Nursing*, *26*, 303–311, http://dx.doi.org/10.1177/1043454209343210.

Fonseca, A., Nazare, B., & Canavarro, M. C. (2013). Clinical determinants of parents' emotional reactions to the disclosure of a diagnosis of congenital anomaly. *JOGNN - Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *42*(2), 178–190.

Gallo, A., Angst, D., & Knafl, K. (2005). Parents sharing information with their children about genetic conditions. *Journal of Pediatric Health Care*, *19*, 267–275.

Gallo, A., Hadley, E., Angst, D., Knafl, K., & Smith, C. (2008). Parents' concerns about issues related to their children's genetic conditions. *Journal for Specialists in Pediatric Nursing*, *13*, 4–14.

Gallo, A., Knafl, K., & Angst, D. (2009). Information management in families who have a child with a genetic condition. *Journal of Pediatric Nursing*, *24*, 194–204, http://dx.doi.org/10.1016/j.pedn.2008.07.010.

Geschwind, D. H., Boone, K. B., Miller, B. L., & Swerdloff, R. S. (2000). Neurobehavioral phenotype of Klinefelter syndrome. *Mental Retardation and Developmental Disabilities Research Reviews*, *6*, 107–116, http://dx.doi.org/10.1002/1098-2779(2000)6 (2 < 107::AID-MRDD4 > 3.0.CO;2–2, pii).

Graham, J. M., Jr., Bashir, A. S., Stark, R. E., Silbert, A., & Walzer, S. (1988). Oral and written language abilities of XXY boys: Implications for anticipatory guidance. *Pediatrics*, *81*, 795–806.

Hall, H. R., Neely-Barnes, S. L., Graff, J. C., Krcek, T. E., Roberts, R. J., & Hankins, J. S. (2012). Parental stress in families of children with a genetic disorder/disability and the resiliency model of family stress, adjustment, and adaptation. *Issues in Comprehensive Pediatric Nursing*, *35*(1), 24–44.

Herlihy, A. S., Halliday, J. L., Cock, M. L., & McLachlan, R. I. (2011). The prevalence and diagnosis rates of Klinefelter syndrome: an Australian comparison. *Medical Journal of Australia*, *194*, 24–28.

Hoffman, L., Marquis, J., Poston, D., Summers, J. A., & Turnbull, A. P. (2006). Assessing family outcomes: Psychometric evaluation of the beach family quality of life scale. *Journal of Marriage and Family*, *68*, 1069–1083.

Horsch, A., Brooks, C., & Fletcher, H. (2013). Maternal coping, appraisals and adjustment following diagnosis of fetal anomaly. *Prenatal Diagnosis*, *33*(12), 1137–1145.

Hung, J. W., Wu, Y. H., Chiang, Y. C., Wu, W. C., & Yeh, C. H. (2009). Mental health of parents having children with physical disabilities. *Chang Gung Medical Journal*, *33*(1), 82–91.

Knafl, K., Breitmayer, B., Gallo, A., & Zoeller, L. (1996). Family response to childhood chronic illness: Description of management styles. *Journal of Pediatric Nursing*, *11*, 315–326, http://dx.doi.org/10.1016/S0882-5963(05)80065-X.

Knafl, K., Deatrick, J. A., Gallo, A., Dixon, J., Grey, M., Knafl, G., et al. (2011). Assessment of the psychometric properties of the Family Management Measure. *Journal of Pediatric Psychology*, *36*, 494–505, http://dx.doi.org/10.1093/jpepsy/jsp034.

Knafl, Deatrick, J., & Havill, N. (2012). Continued development of the family management style framework. *Journal of Family Nursing*, *18*, 11–34, http://dx.doi.org/10.1177/1074840711427294.

Knafl, K. A., Knafl, G. J., Gallo, A. M., & Angst, D. (2007). Parents' perceptions of functioning in families having a child with a genetic condition. *Journal of Genetic Counseling*, *16*, 481–492, http://dx.doi.org/10.1007/s10897-006-9084-x.

Kurnat, E. L., & Moore, C. M. (1999). The impact of a chronic condition on the families of children with asthma. *Pediatric Nursing*, *25*, 288–292.

Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry.* Newbury Park, California: Sage Publications.

Morris, J. K., Alberman, E., Scott, C., & Jacobs, P. (2008). Is the prevalence of Klinefelter syndrome increasing? *European Journal of Human Genetics*, *16*, 163–170, http://dx.doi.org/10.1038/sj.ejhg.5201956 (5201956, pii).

Rearick, E. M., Sullivan-Bolyai, S., Bova, C., & Knafl, K. A. (2011). Parents of children newly diagnosed with type 1 diabetes: Experiences with social support and family management. *Diabetes Educator*, *37*, 508–518, http://dx.doi.org/10.1177/0145721711412979.

Ross, J. L., Roeltgen, D. P., Kushner, H., Zinn, A. R., Reiss, A., Bardsley, M. Z., et al. (2012). Behavioral and social phenotypes in boys with 47,XYY syndrome or 47,XXY Klinefelter syndrome. *Pediatrics*, *129*, 769–778, http://dx.doi.org/10.1542/peds.2011-0719.

Rovet, J., Netley, C., Keenan, M., Bailey, J., & Stewart, D. (1996). The psychoeducational profile of boys with Klinefelter syndrome. *Journal of Learning Disabilities*, *29*, 180–196.

Simpson, J. L., de la Cruz, F., Swerdloff, R. S., Samango-Sprouse, C., Skakkebaek, N. E., Graham, J. M., Jr., et al. (2003). Klinefelter syndrome: expanding the phenotype and identifying new research directions. *Genetics in Medicine*, *5*, 460–468, http://dx.doi.org/10.1097/01.GIM.0000095626.54201.D0.

Summers, J. A., Poston, D. J., Turnbull, A. P., Marquis, J., Hoffman, L., Mannan, H., et al. (2005). Conceptualizing and measuring family quality of life. *Journal of Intellectual Disability Research*, *49*, 777–783, http://dx.doi.org/10.1111/j.1365-2788.2005.00751.x.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling. *Journal of Mixed Methods Research*, *1*, 77–100.

Thorne, S. (2008). *Interpretive description.* Walnut Creek, California: Left Coast Press.

Thorne, S., Kirkham, S. R., & MacDonald-Emes, J. (1997). Interpretive description: a noncategorical qualitative alternative for developing nursing knowledge. *Research in Nursing & Health*, *20*, 169–177.

Turriff, A., Levy, H. P., & Biesecker, B. (2011). Prevalence and psychosocial correlates of depressive symptoms among adolescents and adults with Klinefelter syndrome. *Genetics in Medicine*, http://dx.doi.org/10.1097/GIM.0b013e3182227576.

van Rijn, S., Stockmann, L., Borghgraef, M., Bruining, H., van Ravenswaaij-Arts, C., Govaerts, L., et al. (2013). The social behavioral phenotype in boys and girls with an extra X chromosome (Klinefelter syndrome and trisomy X): A comparison with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, http://dx.doi.org/10.1007/s10803-013-1860-5.

van Rijn, S., Swaab, H., Aleman, A., & Kahn, R. S. (2008). Social behavior and autism traits in a sex chromosomal disorder: Klinefelter (47XXY) syndrome. *Journal of Autism and Developmental Disorders*, *38*, 1634–1641, http://dx.doi.org/10.1007/s10803-008-0542-1.

Whitmarsh, I., Davis, A. M., Skinner, D., & Bailey, D. B., Jr. (2007). A place for genetic uncertainty: Parents valuing an unknown in the meaning of disease. *Social Science and Medicine*, *65*, 1082–1093, http://dx.doi.org/10.1016/j.socscimed.2007.04.034.

Wikstrom, A. M., & Dunkel, L. (2008). Testicular function in Klinefelter syndrome. *Hormone Research*, *69*, 317–326, http://dx.doi.org/10.1159/000117387 (000117387, pii).

Zeger, M. P., Zinn, A. R., Lahlou, N., Ramos, P., Kowal, K., Samango-Sprouse, C., et al. (2008). Effect of ascertainment and genetic features on the phenotype of Klinefelter syndrome. *The Journal of Pediatrics*, *152*, 716–722, http://dx.doi.org/10.1016/j.jpeds.2007.10.019 (S0022-3476(07)00985-7, pii).