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## Psychological trajectories of mothers and fathers following their child's diagnosis of a life-threatening illness or injury: A longitudinal investigation

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### Abstract

**Objective:** Explore mental health trajectories of parents following their child's life threatening illness/injury.

**Methods:** Participants were 217 parents (mean age: 34.9-40.0; 66 fathers) of 165 children who presented to a tertiary hospital with a life-threatening illness/injury.

Parents completed questionnaires about their mental health and psychosocial stressors

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within 4 weeks of the child's illness/injury (T1), and 4 months (T2), 7 months (T3) and 19 months (T4) post-diagnosis.

Results: For both mothers and fathers, mental health symptoms were elevated at diagnosis declining to normal levels by T3, with a pattern of increase at T4. Fathers demonstrated a faster decline in symptoms between T1 and T2, and fathers, but not mothers, experienced relapse in depressive symptoms at T4. Fathers reported higher rates of work changes.

Conclusions: These findings have important implications for the design and timing of parental interventions to support families of children with life threatening disease/injury.

The diagnosis of a child's life-threatening illness or injury can be traumatic. Parental stress, anxiety and depressive reactions such as shock, worry, sadness, fear and grief are common (Foster, Young, Mitchell, Van, & Curtis, 2017; Ware & Raval, 2007). In fact, estimates suggest that 27-63% of parents receiving treatment from specific hospital services (i.e. oncology (McCarthy, Ashley, Lee, & Anderson, 2012; Muscara, McCarthy, et al., 2015; Patino-Fernandez et al., 2008), neonatal (Shaw et al., 2006) and pediatric intensive care [PICU] (Balluffi et al., 2004; Muscara, McCarthy, et al., 2015), cardiac surgery (Franich-Ray et al., 2013; Muscara, McCarthy, et al., 2015)) meet criteria for acute stress disorder post-diagnosis. Acute stress in this context is considered an adaptive response, and most parents return to typical levels of distress in the months following their child's illness or injury (Muscara et al., 2018). However, up to 60% of parents have at least one lingering post-traumatic stress symptom in the months after their child's diagnosis (Franck et al., 2015; Helfricht, Latal, Fischer, Tomaske, & Landolt, 2008; Kazak, 2004; Nelson

& Gold, 2012; Poder, Ljungman, & von Essen, 2008; Shaw et al., 2009). Furthermore, up to 17% remain chronically and clinically distressed in the years following their child's injury or illness (Muscara et al., 2018). Given that children rely on their parents for their social, practical, physical and emotional needs (Foster et al., 2017), compromised parental mental health has the potential to negatively impact a child's short-term psychological (De Young, Hendrikz, Kenardy, Cobham, & Kimble, 2014; Landolt, Ystrom, Sennhauser, Gnehm, & Vollrath, 2012) and physical recovery (Chow, Otis, & Simons, 2016), as well as longer-term social, emotional and behavioral outcomes (Ramchandani, Stein, Evans, & O'Connor, 2005).

Despite what is known about parents' psychological adjustment following their child's serious illness or injury, the unique mental health profile of fathers has seldom been explored. This largely stems from the historical nature of caregiver roles. Traditionally, mothers assumed the role of primary caregiver (Goldstein, Akre, Belanger, & Suris, 2013), absorbing the majority of the burden of their child's disease and its day to day management (Quittner, DiGirolamo, Michel, & Eigen, 1992; Smith, Cheater, & Bekker, 2015). Fathers have typically been the primary breadwinner, continuing to work to support the family financially during the traumatic experience (Goldstein et al., 2013). Given that mothers are more often present at the hospital with their child, they are more likely to be recruited to research studies. However, even when specifically targeted for research studies, fathers have been difficult to recruit (Bayley, Wallace, & Choudhry, 2009). This has resulted in a historical bias towards overrepresentation of mothers in parental psychosocial research. Intervention attempts have been limited by similar issues. Typically, they target maternal functioning in the belief that mothers were most at risk of negative psychosocial outcomes given their primary caregiver role (Gavin & Wysocki, 2006). However, the social construct of a

“typical” family and related gender-based caregiver roles has changed (Cabrera, Tamis-LeMonda, Bradley, Hofferth, & Lamb, 2000; Goldstein et al., 2013). Clinically, we see fathers taking a larger role in their child’s medical treatment, and increasingly caregiver duties are being shared between both parents in a dynamic fashion (Yogman, Garfield, & Health, 2016). Despite the increased involvement in their child’s medical condition, fathers remain underrepresented in parental psychosocial research (Goldstein et al., 2013).

Recent studies have made a concerted effort to better examine the psychosocial adjustment of fathers, recruiting more even samples of mothers and fathers, and analyzing data from mothers and father separately. In these mostly cross-sectional studies, mothers consistently report higher rates of distress (Balluffi et al., 2004; Kazak, 2004; McCarthy et al., 2012; Poder et al., 2008). In addition, there appear to be differences in the factors affecting the mental health outcomes of fathers compared to mothers. A consistent theme in qualitative studies is fathers inability or unwillingness to discuss their emotions in both the short- and long-term (Bowes, Lowes, Warner, & Gregory, 2009; Foster et al., 2017; Huff & McGrath, 2003; Nicholas et al., 2009; Ware & Raval, 2007). This, coupled with the finding that fathers primarily rely on the support provided by their partner (Goldstein et al., 2013; Nicholas et al., 2009; Ware & Raval, 2007; Yeh, 2002), while mothers are supported by a broader social network (Hoekstra-Weebers, Jaspers, Kamps, & Klip, 1998; Ware & Raval, 2007), likely contributes to the long-term feelings of alienation, loneliness and isolation often reported by fathers (Bowes et al., 2009; Hovey, 2005; Nicholas et al., 2009; Peck & Lillibridge, 2005; Ware & Raval, 2007). Another striking difference between parents is the source of stress. Fathers appear to be more affected by logistic factors such as financial problems (Youngblut & Shiao, 1993) and work

demands/problems (Sloper, 2000), while cognitive factors such as acute anxiety uniquely predict posttraumatic stress of mothers (Best, Streisand, Catania, & Kazak, 2002). These data suggest that mothers and fathers experience their child's serious illness or injury differently.

Longitudinal data from fathers remain scarce. This study addresses this gap by examining the psychological trajectories of mothers and fathers across the 18 months following their child's hospitalization for a serious illness or injury. We hypothesize that there will be significant differences between mother and fathers in the acute and long-term severity of depression, anxiety and stress.

## Methods

### *Design*

This study utilizes data from a prospective, longitudinal study that investigated the impact of a child's life-threatening illness or injury on parents, The Take a Breath Cohort Study (see Muscara, Burke, et al. 2015 for detailed study protocol). The Take a Breath Cohort Study was conducted at The Royal Children's Hospital (RCH) in Melbourne Australia, a state-wide, tertiary hospital. Consistent with the stages of parental recovery detailed in The Pediatric Medical Traumatic Stress Model (PMTS) developed by Kazak and colleagues (Kazak et al., 2006; Price et al. 2015), data were collected from participating parents within 4 weeks of child diagnosis or hospital admission (T1), and then 4 (T2), 7 (T3), and 19 months (T4) post-diagnosis.

### Participants

Participants were parents of children aged 0-18 years who had experienced a life-threatening illness/injury within the previous four weeks and were being treated in the oncology, cardiology or PICU departments at The RCH, Melbourne Australia.

A life threatening illness/injury was classified as a new diagnosis of any cancer, life-saving cardiac surgery within the first month of life, or a stay in the PICU for >48 hours. Families were considered eligible if this was the initial presentation for the child's illness/injury.

Given recruitment took place during a highly sensitive and emotional time for families, parents were deemed ineligible and therefore not approached to participate if their child was not expected to survive longer than 6 months, or the parent had experienced another traumatic event within the preceding 2 months (e.g., the death of a loved one). Families were also excluded if there were known highly complex social situations (e.g., family violence), the child had been diagnosed with a previous chronic medical condition or the parents had a lack of proficiency in English language to complete self-report questionnaires.

## Measures

### Medical and Demographic Information

Medical diagnosis, date of diagnosis and treating department were extracted from the hospital medical database. Parents completed a demographic questionnaire at baseline which asked about their age, sex, level of education (completed/did not complete high school), country of birth (Australia/other) and marital status (married/partnered/defacto or other). At every time point, parents were also asked if their work status had changed (i.e. no change to work status/an increase or a decrease in the number of hours worked) (since their child's diagnosis [T1], in the previous 3 months [T2 and T3], in the previous 12 months [T4]).

Depression Anxiety and Stress Scale - 21 (DASS) (Lovibond & Lovibond, 1995): The DASS is an adult self-report questionnaire designed to assess the severity of an individual's negative emotional state and was the primary outcome in the current

study. The questionnaire comprised 21 items; 7 items per domain (depression, anxiety, stress). Respondents rated on a 4 point Likert scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time) the severity of each negative symptom over the past week (e.g. “I found it hard to wind down”). Items are summed and then doubled to create depression, anxiety and stress subscales with a possible subscale range of 0-42, higher scores reflect higher rates of negative mental states. To assist with clinical interpretation, DASS-21 subscale severity can be interpreted using the following cut offs: Depression – normal=0-9; mild=10-13; moderate=14-20; severe=21-27; extremely severe=28+; Anxiety – normal=0-7; mild=8-9; moderate=10-14; severe=15-19; extremely severe=20+; Stress – normal=0-14; mild=15-18; moderate=19-25; severe=26-33; extremely severe=34+ (Lovibond & Lovibond, 1995). The DASS-21 is a widely-used, open-source, brief measure of negative emotional state, favored for its minimal burden on respondent. The DASS-21 has good internal consistency (Cronbach’s Alpha [CA] 0.81-0.91(Henry & Crawford, 2005)).

Psychosocial Assessment Tool (Kazak, Schneider, DiDonato, & Pai, 2015): The Psychosocial Assessment Tool (PAT 2.0) is a brief, parent-completed questionnaire designed to screen for psychosocial risk factors in parents of children with an illness. The PAT 2.0 is comprised of 7 subscales (Family Structure and resources, Social Support, Family Problems, Parent Stress Reactions, Family Beliefs, and Child Problems and Sibling Problems). For the purposes of this study, only the Social Support subscale was used. The social support subscale is comprised of four items: “Who can provide: 1. childcare/parenting, 2. emotional support, 3. financial support, and 4. information”. Items are considered to be a risk factor if the parent responds “no one”, and are scored 1. The social support subscale has shown good internal consistency (Kuder-Richardson 20 [KR20]=0.69 (Pai et al., 2007)), and was treated as a binary outcome (no risk factors=0/1 or more risk factors=1).

In addition, a single item from the Family Structure and Resources Subscale was used as a measure of financial pressures: “*Is your family currently experiencing any financial difficulties?*” Respondents are scored a 1 if they indicate they have “*many financial problems*” or “*it’s hard to meet our basic needs*”, or a 0 if they have “*no*” or “*some*” financial problems.

## Procedure

The Take a Breath study was approved by The Royal Children’s Hospital Human Research Ethics Committee (HREC 30044). Participants were recruited between November 2010 and August 2012. Admission and new diagnosis lists for the

oncology, cardiology and PICU departments were monitored by research staff daily, and potential eligible participants were confirmed with a nurse co-ordinator. Once the child's medical condition had stabilized, a member of the research team approached the parent/s and invited them to participate. There were no incentives provided to parents for participating in the study. In most cases only one parent was present during initial recruitment discussions, therefore if a second parent participated, they were most often recruited via their partner. Consenting parents completed a hardcopy questionnaire (baseline, T1) within 4 weeks of their child's diagnosis (defined as date of diagnosis for oncology patients, date of surgery for cardiology patients, and date of admission for PICU patients), with reminders provided by email, phone, text message or in person. Subsequent questionnaires were mailed to the parents at 3 months (T2), 6 months (T3), and 18 months (T4) post diagnosis. Parents were asked to return T2, T3 and T4 questionnaires within 2 weeks of receipt. Questionnaires were either returned via post or brought in to clinic and collected by the research team. All data were entered via an automated form-processing application for data entry, and double checked by the research team.

### Statistical Analysis

Comparisons of parent and child demographic characteristics were carried out between mothers and fathers. Linear regressions tested continuous characteristics between groups, and logistic regressions were employed for binary characteristics. Potential confounding variables for mental health outcomes were tested between mothers and fathers. Due to the relatedness of parents, all analyses were adjusted for within-family clustering.

Trajectories of parent mental health over the four time points were analyzed using longitudinal multilevel generalized linear models (GLM). Multilevel GLMs allow for the inclusion of all valid data, without the requirement of complete participant data at every time point (Hedeker & Gibbons, 1997). Due to heavy skew, negative binomial distributions were employed. Data were clustered at the family level, and an exchangeable working matrix was employed. Models included a quadratic time term to accommodate for an expected non-linear effect of time, as well as the covariates in experiencing social support issues, financial difficulties, not being partnered, or work changes at any time during the study period. Incidence rate ratios (IRR) and 95% confidence intervals (CI) were presented, and raw group mean DASS scores (and 95% CI) were plotted to illustrate group trajectory differences between mothers and fathers.

## Results

Of the 282 recruited families (Muscara, Burke, et al., 2015), 90 were lost to follow up (did not return questionnaire, withdrew or child died). A further 27 families did not complete the DASS at any time point. The final sample consisted of 217 parents of 165 children, with 151 (70%) being mothers. The sample included data from 52 parent couples, as well as unclustered data from 99 mothers and 14 fathers. Within the mother- and father-only data, eight mothers identified as being single, four as separated/divorced, and one “other”. Three fathers were separated/divorced and no parents identified as step-parents. For the 151 participating mothers, 82% completed T1, 74% T2, 62 for both T3 and T4. For fathers, 88% completed T1, 55% T2, 56% T3 and 58% T4. Illness groups were relatively even for children, with 39% from oncology, 30% from cardiology, and 32% from PICU. Demographic characteristics of children and parents were compared between mothers and fathers (see Table 1). On

average, fathers were significantly older (5.0 years, 95% CI 2.7-7.4) than mothers ( $p < 0.001$ ). No significant differences were found for education (81.1% completing high school), country of birth (83.4% born in Australia) or relationship status (91.7% being partnered). Moreover, illness department proportions were similar between parent groups.

Internal consistency for the DASS-21 in the current study at time point 1 was excellent (depression CA=0.86, anxiety CA=0.80, stress CA=0.99), and the PAT 2.0 Social Support subscale was found to be average (KR20=0.52). At diagnosis, mothers and fathers on average experienced mild to moderate depression and anxiety, and moderate to severe stress symptoms (Figures 1-3). In the 7 months following their child's diagnosis, depression, anxiety and stress symptoms for both mothers and fathers were within the normal range. At 18 months post-diagnosis, parents reported normal level of anxiety symptoms, mild to moderate stress symptoms, and fathers reported mild depressive symptoms. Highly endorsed depression items at T4 for fathers include "difficult to work up the initiative to do things" (47%), "couldn't seem to experience positive feeling" (34%), and "felt downhearted and blue" (34%).

Psychosocial support factors associated with mental health outcomes were compared between mothers and fathers, adjusting for within-couple correlation. Multilevel GLM models found no statistically significant differences between mothers and fathers on social support ( $p = 0.10$ ) or financial difficulties ( $p = 0.08$ ). Participating fathers were more likely to be partnered throughout the study (95.5% vs. 90.1%); however very little variability was found within dyads (i.e., couples were of the same SES status), and clustering was not possible. Fathers were significantly more

likely to experience work changes than mothers, with 65.2% of fathers experiencing work changes during the study compared to 44.4% of mothers ( $p=0.006$ ).

Longitudinal multilevel GLM explored trajectories of parent mental health, adjusting for covariates. Separate models were conducted for depression, anxiety and stress over the 4 study time points (1[T1], 4[T2], 7[T3] and 19[T4] months; centred at 9.5 months), presented in Table 2. Data was available for 84%, 77%, 64% and 65% of participants at T1 to T4, respectively. Significant IRRs for linear and quadratic time terms (all  $p<0.001$ , see Table 2) confirmed the polynomial nature of parent mental health over time. A significant interaction (parent\*time) term was found in the depression model (IRR=1.04,  $p=0.024$ ), indicating the depression trajectories of mothers and fathers differed over time. Relating these findings back to raw values, Figures 1, 2 and 3 plot the mean mothers/fathers mental health symptoms over time, alongside clinical cut-offs. In general, trajectories of parental mental health follow a quadratic curve, with higher levels at T1, decreasing to time T3, and a slight upward inflection at T4. Figures 2 and 3 illustrate relatively similar trajectories of anxiety and stress between mothers and fathers, respectively. However, Figure 1 suggests fathers demonstrated a faster reduction in depressive symptoms between T1 and T2 compared to mothers. Furthermore, fathers have an increase in depressive symptoms – from ‘normal’ to ‘mild’ – between T2 and T4 (7 and 19 months post diagnosis), whereas mothers’ depressive symptoms decreased from ‘mild’ to ‘normal’ over the same period.

Financial difficulties were associated with significantly increased mental health problems across all outcomes (depression IRR=1.91,  $p=0.002$ ; anxiety IRR=2.90,  $p<0.001$ ; stress IRR=1.43,  $p=0.001$ ), and changes to work status were

related to higher rates of depressive symptoms (IRR=1.46,  $p=0.035$ ) and stress (IRR=1.39,  $p=0.001$ ).

## Discussion

The current study explored the trajectory of mothers and fathers symptoms of depression, anxiety and stress in the 18 months following their child's life-threatening illness or injury. Our hypothesis that the psychological trajectories of mothers and fathers would differ over the 18 months following their child's diagnosis was partially supported, and our findings suggest important role specific changes over time. Our findings suggest parents are adjusting well overall. Both parent groups experienced expected elevated levels of depression (mild-moderate), anxiety (mild-moderate) and stress (moderate-severe) symptoms at diagnosis, which resolved to normal levels by 6 months post-diagnosis (McCarthy et al., 2012; Poder et al., 2008). Despite this, fathers experienced a faster reduction in depressive symptoms between diagnosis and 3 months post illness/injury, and a second peak in depressive symptoms a year and a half after their child's diagnosis. This peak in symptoms was beyond the expected level for an adult population (mild range) (Crawford & Henry, 2003), with this pattern not replicated in mothers.

These results extend the current literature which has focused on parental mental health outcomes at the acute discharge/diagnosis phase (Rowe & Jones, 2010; Shudy et al., 2006), or within 1 year post diagnosis (Katz et al., 2018; Nelson & Gold, 2012). In line with our findings, previous studies have typically reported an initial, expected increase in anxiety, stress and depression, with rates resolving steadily over time (McCarthy et al., 2012; Muscara et al., 2018; Poder et al., 2008). Our findings provide quantitative support for existing qualitative findings that indicate fathers

experience long-term depressive symptoms in the context of parenting a child with an illness (Bowes et al., 2009; Nicholas et al., 2009; Peck & Lillibridge, 2005; Ware & Raval, 2007). Interestingly, the delayed response in depression symptoms is not mirrored in mothers. It may be that mothers, who often act as the primary caregiver in the hospital, receive more emotional support while attending the inpatient ward during the acute phase of their child's illness. This allows them to process the trauma related emotions, an opportunity which may not be as readily available to fathers. For example, mothers may receive informal emotional support through talking with other parents and nurses on the inpatient ward (Hopia, Tomlinson, Paavilainen, & Åstedt-Kurki, 2005; Obeidat, Bond, & Callister, 2009), as well as more formal logistical/resources information from social workers (Ware & Raval, 2007). Fathers often receive this important information via their partner in an ad hoc manner (Goldstein et al., 2013). Having easy access to information about their child's illness has been identified as an important coping strategy for parents (Ware & Raval, 2007), therefore a lack of direct access to accurate information may make fathers feel less in control of their situation.

During this acute phase of diagnosis, it may be that fathers are more likely to discount the severity of the acute problem to provide immediate, solution-focused support such as providing financial stability for the family (Affleck & Tennen, 1991). In doing so, this role biased opportunity to receive emotional support and express their own emotions may exacerbate naturally occurring and socially encouraged gender differences in the ability to discuss and process feelings (Ware & Raval, 2007). It is established that unprocessed negative feelings and memories relating to a traumatic event can result in long term feelings of distress and depression (Solomon & Heide, 2005). This may, in-part, explain our results indicating a resurfacing of

depressive symptoms for fathers a year and a half post the initial trauma. Conveying this difference in mental health trajectories to parents may be a beneficial component to a psychoeducational parent intervention. Further exploration of this relationship between acute processing of emotions, coping strategies and long-term mental health trajectories is warranted.

These results provide novel insights into the differential experience of mothers and fathers in the months and years following their child's serious illness or injury, and may be useful in the tailoring of content and timing of parental interventions, in this context. Prevention and intervention for parental adjustment difficulties in the context of their child's serious illness or injury are most commonly targeted at either the mother directly (Fedele et al., 2013; Lundahl, Tollefson, Risser, & Lovejoy, 2007; Melnyk, 1994; Melnyk et al., 2004; Preyde & Ardal, 2003; Sahler et al., 2013; Streisand, Rodrigue, Houck, Graham-Pole, & Berlant, 2000; Ware & Raval, 2007) or at parents more generally (Burke et al., 2014; Timko, Stovel, & Moos, 1992) in the acute phase of the child's illness. While there is evidence to suggest having both parents attend intervention sessions together is important for facilitating skill development (Tiano & McNeil, 2005) and better mental health outcomes (May et al., 2013), the current results suggest interventions might be improved by incorporating content that is specific to the symptoms (e.g. depressed mood and motivation) and stressors (e.g. more strategies around work-related issues for fathers). Additionally, parental interventions in the context of a child's serious illness or injury are often conducted acutely, i.e. while the child is an inpatient (Fedele et al., 2013; Melnyk et al., 2004; Sahler et al., 2013), or in the months following the acute period (Burke et al., 2014; Marsac et al., 2013). Results presented here suggest that after the initial diagnosis phase, overall parents report psychological symptoms in the normal range.

Given this, a brief, cost-effective intervention may be an appropriate solution to address the issue of under-resourced hospital staff and busy parents.

Recent efforts toward delivering therapy in a secure, online platform (Marsac et al., 2013; Rayner et al., 2016; Wakefield et al., 2016) may provide a brief, cost-effective, easily accessible solution to target parental mental health (Breitenstein, Gross, & Christophersen, 2014), particularly if interventions can be delivered early to mitigate escalating difficulties. This approach has been trialed across a range of pediatric illness groups with high levels of acceptability and feasibility by parents and staff (Canter, Christofferson, Scialla, & Kazak, 2018; Rayner et al., 2016; Wakefield et al., 2016) and parent participation and completion rates significantly higher than in the equivalent face-to-face programs (Rayner et al., 2016). In addition to overcoming accessibility obstacles for those located rurally or remotely, online interventions will likely reduce cost barriers associated with travel and child-minding, identified in previous research as obstacles to engaging with parents, in particular, fathers (Panter-Brick et al., 2014; Rayner et al., 2016; Tully et al., 2017; Wakefield et al., 2016). Our results suggest a second targeted time for intervention may be around 18 months post-diagnosis, where the focus of the intervention may be around managing the ongoing stress associated with having a child who is ill. For fathers in particular, the focus should be on managing their own depressive symptoms. A review of the literature found only one online program targeting longer term parental mental health outcomes (Wakefield et al., 2016), however this program was specifically designed for parents of children with a cancer diagnosis.

The results of the current study should be interpreted within the context of several limitations. Firstly, due to the exclusion criteria of the broader Take a Breath

study (Muscara, McCarthy, et al., 2015), families who had experienced a traumatic event in the 2 months preceding their child's diagnosis and families of children who were unlikely to survive longer than 6 months at the time of recruitment were excluded from the study. These exclusion criteria may have resulted in an underrepresentation of parents with more severe mental health responses. However, by excluding these groups, our results are more likely to reflect mental health response specifically related to trauma of their child's illness or injury. Secondly, although our sample of fathers is one of the largest collected in longitudinal research in this field, fathers represented only a third of the entire parent sample, highlighting the difficulties associated with recruiting fathers to research in a hospital setting. Most fathers in the current study were not present during the initial recruitment discussion, and were subsequently recruited to the study via their partner. Future studies should incorporate father-direct recruitment strategies to increase opportunities for father participation in research (Goldstein et al., 2013; Sicouri et al., 2018; Tully et al., 2017). This coupled with a natural shift toward a more shared caregiver role when a child is in hospital (McNeill, 2007) will likely result in increased representation of fathers in psychosocial research over the next decade. Lastly, it was not possible in the current study design to explore the differential impact of psychosocial stressors/risk factors on mothers and fathers. Despite this, we did find only the frequency of changes to work status significantly differed between parent groups. Reported financial problems, lack of social support and relationship status were consistently endorsed by both mothers and fathers. Addressing these issues in a larger sample of fathers will be an important goal for future studies.

In conclusion, the mental health trajectories of mothers and fathers of children with a life-threatening illness or injury differ in the 18 months following diagnosis.

While both parent groups experience expected increased symptoms of acute stress, anxiety and depression, which resolve to typical levels in the several months following diagnosis, fathers may struggle with increased feelings of depression that emerge many months later. With this information, prevention and intervention strategies can be tailored specifically to the caregiver role to maximize outcomes not just for the parent, but for the child and broader family system. This study identifies an opportunity to intervene with appropriately timed and tailored support, with the goal of positively altering mental health trajectories of fathers. Future studies should explore additional long-term interventions, with a particular focus on fathers, as well as the differential impact of psychosocial stressors.

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### Figures

Figure 1. 18 month trajectory of mother and father depression response.

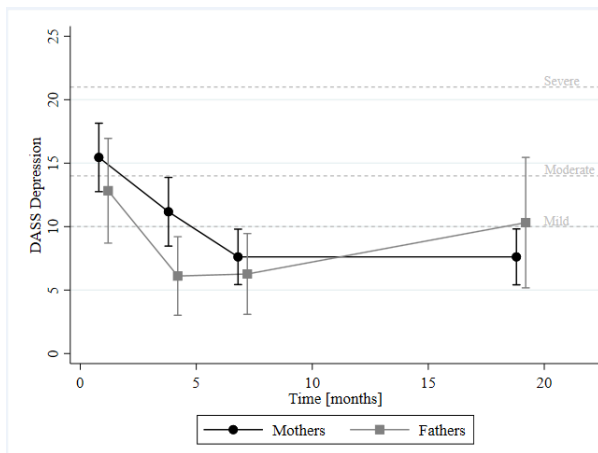


Figure 2

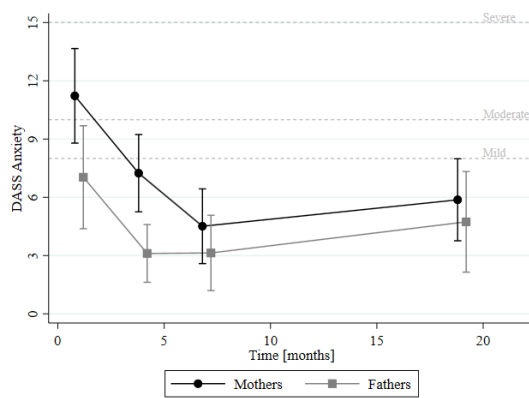


Figure 3. 18 month trajectory of mother and father stress response.

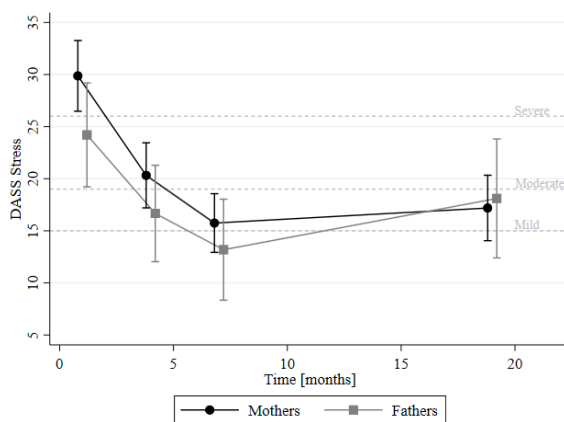


Table 1. Parent demographic information and medical department of participants

	Mothers		Fathers		p
	(n=151)		(n=66)		
Parent Age, M (SD)	34.9	(7.5)	40.0	(9.0)	<0.001
Education [ $\leq$ High School], n (%)	29	(19.2)	12	(18.2)	0.843
Country of birth [...], n (%)	126	(83.4)	55	(83.3)	0.992
Relationship Status [married/partnered], n (%)	137	(90.7)	62	(93.9)	0.455
Psychosocial factors, n (%)					
Social Support Issues*	32	(21.2)	21	(31.8)	0.087
Financial Difficulties*	78	(51.7)	27	(40.9)	0.074
Not Partnered*	15	(9.9)	3	(4.5)	0.140
Work Changes*	67	(44.4)	43	(65.2)	0.002
Department, n (%)					
Oncology	54	(35.8)	30	(45.5)	0.146
Cardiology	48	(31.8)	20	(30.3)	
PICU	49	(32.5)	16	(24.2)	

\*At any time during study period.

M=mean; SD=standard deviation; p=between mother and father group p-value, adjusting for within-couple clustering.

Table 2. Multilevel GLM (negative binomial) models, DASS over time (centred), including quadratic effect of time, clustered by family.

	Depression			Anxiety			Stress		
	IR R	95%CI	p	IR R	95%CI	p	IR R	95%CI	p
Time									
Linear	<b>0.93</b>	<b>(0.91-0.96)</b>	<b>&lt;0.001</b>	<b>0.94</b>	<b>(0.91-0.97)</b>	<b>&lt;0.001</b>	<b>0.96</b>	<b>(0.95-0.97)</b>	<b>&lt;0.001</b>
Quadratic	<b>1.01</b>	<b>(1.01-1.01)</b>	<b>&lt;0.001</b>	<b>1.01</b>	<b>(1.01-1.02)</b>	<b>&lt;0.001</b>	<b>1.01</b>	<b>(1.00-1.01)</b>	<b>&lt;0.001</b>
Parent [male]	0.76	(0.53-1.10)	0.143	0.75	(0.49-1.14)	0.179	0.84	(0.67-1.04)	0.103
Parent-Time Interaction	<b>1.04</b>	<b>(1.00-1.08)</b>	<b>0.008</b>	1.04	(0.98-1.09)	0.181	1.02	(0.99-1.04)	0.222
Social Support Issues*	0.93	(0.60-1.44)	0.749	1.27	(0.83-1.96)	0.272	0.97	(0.76-1.24)	0.803
Financial Difficulties*	<b>1.91</b>	<b>(1.28-2.84)</b>	<b>0.002</b>	<b>2.90</b>	<b>(1.92-4.36)</b>	<b>&lt;0.001</b>	<b>1.43</b>	<b>(1.15-1.79)</b>	<b>0.001</b>
Not Partnered*	1.92	(0.96-3.82)	0.064	1.52	(0.77-3.00)	0.229	1.28	(0.87-1.87)	0.212
Work Changes*	<b>1.46</b>	<b>(1.03-2.08)</b>	<b>0.003</b>	1.22	(0.84-1.77)	0.288	<b>1.39</b>	<b>(1.14-1.70)</b>	<b>0.001</b>

IRR=incidence rate ratio; CI=confidence interval; p=model term p-value, adjusting for within-couple clustering and covarying for illness group.

\*At any time during study period.