

Listening to Family Life After Serious Pediatric Injury: A Study of Four Cases

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Abstract

Following a serious child injury, the entire family can be affected. Gaining an understanding of family support, interactions and stress levels can help clinicians tailor treatment. Presently, these factors are assessed mainly via self-reports and structured observations. We aimed to explore the value of naturalistic observation of post-injury parent-child interactions, in order to highlight how clinicians might use these data in their practice. Our qualitative study involved an in-depth analysis of four cases from the Ear for Recovery project, against the backdrop of the larger sample's characteristics. Children who had been hospitalised with a serious injury wore the Electronically Activated Recorder (EAR). Over a two-day period post-discharge, the EAR recorded 30-second audio "snippets" every 5 minutes. Families also completed self-report measures on family functioning, child stress and social support, parent stress, optimism and self-efficacy. For each case, two coders independently used an ethnographic method, integrating self-report measures, family and injury characteristics, audio recordings and transcripts to mimic integration of information within clinical practice. The coders then reached consensus on the main themes for each case through discussion. Families showed substantial variation in their communication in terms of content, tone and frequency, including moments of conflict, humor, and injury-related conversations. We explored how these recorded interactions converged with and diverged from the self-report data. The EAR provided an opportunity for rich descriptions of individual families' communication and activities, yielding potential clinical information that may be otherwise difficult or impractical to obtain.

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Child hospitalization can be a stressful experience for the whole family (Kosta et al., 2015). Following a child's serious injury, both parents and children can develop traumatic stress symptoms (American Psychiatric Association, 2013; Zatzick et al., 2006) and parental behavior may influence the development of child posttraumatic stress disorder (PTSD; Williamson et al., 2017). Illustrating the impact of parent behavior on child functioning, the relational model of PTSD (Scheeringa & Zeanah, 2001) described several ways in which the parent's own traumatic stress symptoms can hinder their ability to respond appropriately to their child and moderate the development of child PTSD. "Withdrawn" parents may feel unable to be emotionally present for their child as a result of their own trauma symptoms. "Overprotective" parents may take excessive action to prevent future injury to the child. "Re-enacting" parents may become obsessed with details about the trauma, talking excessively and in detail about the event. Conversely, parental responsiveness, or their ability to perceive and respond to a child's needs, has been noted as an important protective factor for children (Alisic et al., 2012).

More generally, parents play a role in providing support for their children and modelling their own emotion regulation, particularly in stressful times (Kichline, Kassam-Adams, Weiss, Herbers, & Marsac, 2017; Morris, Silk, Steinberg, Myers, & Robinson, 2007). For example, parents may model adaptive "approach" behaviors, by talking about the trauma, or they may avoid the topic (Alisic, Boeijs, Jongmans & Kleber, 2012; Kassam-Adams, 2014). Parent-child interactions can therefore provide an opportunity for processing of cognitions and emotions (Bauer et al., 2005), and coping strategies can be co-created within a family (Hildenbrand, Clawson, Alderfer, & Marsac, 2011; Marsac, Donlon, Hildenbrand, Winston, & Kassam-Adams, 2014). With the value of parent-child interactions in mind, we

might expect families that talk openly and supportively might experience better emotional adjustment following a trauma.

Despite the apparent importance of parent-child interactions, it is difficult for both researchers and clinicians to naturalistically observe what takes place within the home. While self-report measures and clinical interviewing can provide insight into subjective experience, observation remains the “gold standard” for measuring parental behavior and parent-child interaction (Kichline et al., 2017; Williamson et al., 2017). Self-report measures may be constrained by what is within the individual’s conscious awareness and willingness to report, whereas an observer might notice what appears unremarkable or normal to the family (Coyne & Bolger, 1990; Mehl, Robbins & Deters, 2012).

Furthermore, combining self-report measures and observation appears to provide a clearer picture than either method alone (Kichline et al., 2017; Scheeringa & Zeanah, 2001). For example, Kichline and colleagues (2017) used a structured observational tool, the Trauma Ambiguous Situations Task (TAST) to examine avoidant coping coaching by parents following a serious child injury. Parents who reported traumatic stress symptoms were found to also report more avoidant coaching, however this relationship between PTSD and avoidant coping coaching was not demonstrated in observed interactions with their child. Interpretations of the aforementioned finding highlighted the importance of a multimethod approach, which explores both global and situation-specific behaviors, rather than relying on one method alone.

Furthermore, structured observational tasks like the TAST can provide insight into interactions within a controlled environment with researchers or clinicians present, but may not represent interactions in daily life. Where multiple methods converge on similar findings (e.g. Holman & Jarvis, 2003), methodology is not an issue. However, the more spontaneous or routine aspects of family life are difficult to tap into in a clinical setting. On the other hand,

naturalistic observation can demonstrate interactions in the home, but can also be a costly and time-consuming process involving recording equipment, and time to review content (e.g. Repetti, Reynolds & Sears, 2015; Vosoughi, Goodwin, Washabaugh & Roy, 2012). Recent developments in ecological momentary assessment techniques allow the monitoring of a multitude of factors in real time, including stress, mood and family communication (Dunton et al., 2018; Miller, 2012; Timmons et al., 2017). The field of family research has begun to explore the potential for these naturalistic observations within both research and clinical practice, hopefully enabling easier application of therapeutic interventions into everyday life.

The Ear for Recovery study (Alisic et al., 2015, 2017), used a naturalistic observational tool, the *Electronically Activated Recorder* (EAR; Mehl, 2017) to explore home-based family interactions in the context of trauma (serious injury). In the past, EAR research has typically involved aggregating data across cases and using quantitative methods (Mehl et al., 2012). Conversely, the present paper will use a qualitative, ethnographic method to integrate information from different sources from the perspective of case studies. This method is intended to acknowledge the uniqueness of each family as, in therapeutic settings, research findings tend to be “tailored” to individual families (Kazdin, 2008, p.149).

Our first aim was to explore the potential for enhancement of existing family interventions using a combination of self-report measures and home-based audio recordings, using our work with the EAR as an example. Our second aim was to describe family interactions post-discharge from the hospital, using a combination of EAR recordings and self-report measures, in order to illustrate naturally unfolding social processes within the family post-trauma.

Method

The Ear for Recovery study (see Alisic et al., 2015, 2017 for recruitment details, procedure, participant demographics and descriptions of measures for the full sample, $N = 71$

families) was approved by the Human Research Ethics Committee of the Royal Children's Hospital Melbourne (study number 33103) and the Monash University Human Research Ethics Committee (file number CF13/2515-2013001322).

Participants

We recruited children aged 3 to 16 years who had been hospitalized for at least 24 hours at the Royal Children's Hospital Melbourne with a serious, unintentional injury. Of the 339 families approached, 99 consented and 71 (21%) had useable EAR data, a figure similar to other studies of family traumatic stress post-child injury (Coakley et al., 2010; Marsac & Kassam-Adams, 2016). Most common reasons for not consenting were not being interested (31.67%), not being contactable (22.92%) or being too busy (22.50%), overwhelmed (17.5%) or ineligible (13.33%). A proportion of those approached did not wish to participate because of the audio recording element of the study (13.33%).

Informed consent was obtained from parents and assent from children who were able to do so, as required by the Australian National Statement on Ethical Conduct in Human Research (2018). The families included in the present study had at least 100 30-second snippets of audio data, and completed all relevant questionnaires at all three time points (following discharge, then six weeks and three months post-discharge). Ten families met this criteria because of the intensive nature of our data collection method (up to 351 data points per family, depending on child age and family composition), and late inclusion of the *Family Adaptability and Cohesion Evaluation Scale IV* (FACES-IV). According to the Mann-Whitney U test, the subset of 10 children included in the present study did not differ from the full sample ($N = 71$) with regard to age (mean rank_{fullsample} = 37.68, mean rank_{subset of sample} = 25.75), $U = 202.50$, $p = .089$, injury severity (mean rank_{fullsample} = 35.59, mean rank_{subset of sample} = 38.50), $U = 280.00$, $p = .670$, days in hospital (mean rank_{fullsample} = 36.16, mean rank_{subset of sample} = 35.00), $U = 295.00$, $p = .865$, or interaction time (mean rank_{fullsample} =

34.31, mean rank_{subset of sample} = 46.30), $U = 202.00$, $p = .089$. We chose four cases to present within this paper to demonstrate the themes and variability in our sample.

Measures

Where possible, children aged 8 and over were eligible to complete child reports, and both mothers and fathers completed questionnaires. At follow up, children over eight years and one parent were requested to provide data; this was usually the mother. These questionnaires are summarised in Table 1.

[insert Table 1 here]

Child demographics and injury severity. Age, sex, and *Injury Severity Scale* (ISS, Bolorunduro et al., 2011; Gennarelli & Wodzin, 2005) scores were obtained from the hospital registry. Higher ISS scores denoted more severe injuries, and we used categories of mild (<9), moderate (9-15), severe (16-24) and profound (≥ 25), as in Bolorunduro et al. (2011).

Child-reported social support. At baseline, eligible children completed a measure of perceived social support from family, friends and another significant person, the *Multidimensional Scale of Perceived Social Support* (MSPSS, Zimet, Dahlem, Zimet & Farley, 1988). The MSPSS has demonstrated subscale validity and very good internal consistency reliability ($\alpha = .84$; Zimet, Powell, Farley, Werkman & Berkoff, 1990) and has been used with injured youth (e.g. Haden, Scarpa, Jones, & Ollendick, 2007). Responses to 12 items (e.g. “My family really tries to help me”; Zimet et al., 1990, p. 35) were rated on a seven point scale from “very strongly disagree” (1) to “very strongly agree” (7). Total scores ranged from 12 to 84, with ranges for low (12 – 48), moderate (49 - 68), and high perceived social support (69 – 84; Okonkwo, Larkan & Galligan, 2016).

Child-reported traumatic stress. Children completed the *Children’s Impact of Event Scale-Revised* (CRIES-13, Children and War Foundation, 2005) at baseline and the *Child Posttraumatic Stress Scale* (CPSS, Foa, Johnson, Feeny & Treadwell, 2001) at all time

points, as measures of DSM-IV traumatic stress. Both measures have been used with children exposed to single-event traumas, among a range of other populations (Mitchell, Brennan, Curran, Hanna & Dyer, 2017). The CRIES-13 phrased symptoms in question form, for example “Do you try not to talk about it?” (Children and War Foundation, 2005, p. 3), whereas the CPSS required ratings of frequencies of a list of symptoms, for example “Trying not to think about, talk about or have feelings about the event” (Foa et al., 2001, p. 380). Both scales were valid and demonstrated high internal consistency ($\alpha = .80$ for the CRIES-13, $\alpha = .89$ for the CPSS; Children and War Foundation, 2005; Foa et al., 2001) for children over 8 years. Both were rated on a four-point Likert scale, with higher scores denoting higher incidence and/or severity of symptoms.

Family functioning. Parents and children over 12 years completed an individual self-report measure of family flexibility, cohesion and satisfaction, the *Family Adaptability and Cohesion Evaluation Scale IV* (FACES-IV; Olson, 2011; Olson, Gorall, & Tiesel, 2006), which has been used with seriously ill children in a hospital setting (Marsac & Alderfer, 2011). The FACES-IV has demonstrated good internal consistency, as well as both construct and concurrent validity (α ranged from .77 to .89; Olson, 2011). The FACES-IV is based on the Circumplex Model of Marital and Family Systems (see Olson, Sprenkle & Russell, 1979) whereby families operate best when flexibility (e.g. “Our family is highly organized”, Olson et al., 2006, p.6) and cohesion (e.g. “We spend too much time together”, Olson et al., 2006, p.6) are both “balanced” and neither extreme. Responses were rated on a 5-point scale from “1 = does not describe our family at all” to “5 = describes our family very well” and was completed independently by family members.

Parent-child interactions. The present study used the “EAR” (Mehl, 2017), or the iEAR app on an iPod Touch, to record 30-second audio snippets every five minutes between 7:00 and 22:00, yielding up to 2.73 hours of recordings per family. The iPod was enclosed

within a belt worn by the child for a two-day period at home (with one exception where only one day of recording was available) as close to discharge as possible. The files were transcribed, and interactions were coded by two trained independent coders according to the child's conversation partner(s), current activity, the topic of conversation and emotional tone (see Alisic et al., 2017 for more details on coding). Intraclass correlations (ICC [1,2]) for all reported variables exceeded 0.8, indicating adequate inter-coder agreement.

Parent acute stress. The *Acute Stress Disorder Scale* (ASDS, Bryant, Moulds & Guthrie, 2000) assessed four categories of DSM-IV Acute Stress Disorder (ASD) symptoms, including Reexperiencing (e.g. "Have memories of the event kept entering your mind?", p. 68), Avoidance (e.g. "Have you tried not to think about the event?", p. 68), Arousal (e.g. "Have you become jumpy since the event?", p. 68) and Dissociation (e.g. "During or after the event, did you ever feel in a daze?", p. 68), at baseline. The 19 items were rated on a 5-point Likert scale, with higher total scores representing greater symptom incidence and severity. A sensitive and specific cutoff score for probable ASD was derived from scores of ≥ 9 on Dissociation and ≥ 28 on the sum of the other subscales. The scale demonstrated excellent internal consistency ($\alpha = .96$; Bryant et al., 2000) and validity.

Parent optimism. The *Life Orientation Test – Revised* (LOT-R, Scheier, Carver & Bridges, 1994, e.g. "I'm always optimistic about my future") 10-item measure of optimism, including 4 filler items not used for scoring. The LOT-R has demonstrated adequate validity and internal consistency reliability ($\alpha = .78$; Scheier et al., 1994). The LOT-R was rated on a 5 point scale, and after reverse-scoring several items, higher scores indicated greater optimism. We used ranges for low (0-13), moderate (14-18) and high (19-24) optimism (After Deployment, 2017).

Parent self-efficacy. The *Screeners for the Development of Response Posttrauma* (SDRP, Cirilli, 2012) was adapted for use in our study to measure coping self-efficacy beliefs

(e.g. “How confident are you that you can keep your emotions in check?”, p. 54) in the context of a child injury. We used 15 items from the “Coping Self-efficacy” subscale of a larger, 54-item survey of parents of hospitalised children and rated items on a 7-point, instead of 4-point Likert scale, i.e. “1 = not at all confident” to “7 = totally confident”, in order to allow more nuanced, scale responses with a mid-point (Dawes, 2008). Higher scores indicated greater confidence in parents’ ability to cope practically and emotionally with their child’s injury.

Parent wellbeing. The *Short-Form Health Survey* (SF-36, Ware & Sherbourne, 1992) is a 36-item measure of physical, emotional, social and general health and wellbeing. In the present paper, we used the Emotional Wellbeing (e.g. “Have you felt calm and peaceful?”) scale to describe parent wellbeing at 6-week and 3-month follow up points. The Emotional Wellbeing subscale has demonstrated excellent internal consistency and validity ($\alpha = .90$ for the Emotional Wellbeing scale; Research and Development, 2017). Following transformation of scores, higher scores indicated greater emotional wellbeing (Research and Development, 2017).

Analysis

Following transcription and behavioral coding of the audio files, we used an ethnographic method to describe and interpret data for the included families. The intention of the ethnographic method is to describe and interpret what is seen as the observer is immersed within the naturalistic setting and systematically “jotting” observations (Emerson, Fretz, & Shaw, 1995). While researchers were not physically present within the family home, the ethnographic method was adapted in this study by immersion in the details of the background, self-report and audio data, and was intended to thus mimic the process of integrating and interpreting clinical information.

Therefore, the following process was undertaken by two coders per family. First, scored hospital and questionnaire data were consulted for an overview of the injury, family circumstances and self-report data. For example, we read that a participant was a 10-year-old girl with a mild leg fracture who lives with both parents and that no one in the family reported traumatic stress symptoms. Next, we read each item response of each questionnaire, especially paying attention to very high or low item scores, as well as subtle differences between family members' responses (e.g., comparing child and parent reporting of specific trauma symptoms). Finally, we read all EAR transcripts and listened to the audio files unless the transcript noted the child was asleep or the snippet contained little speech (e.g. watching television). Throughout the process, coders were encouraged to note salient observations, themes and quotations for each family.

Coders involved were the first author (SNM), as well as two research assistants with at least an undergraduate-level major in Psychology. Each case was discussed until consensus on key themes and quotations was reached between the researchers who had examined the case. The entire process took several hours per family. SNM wrote a brief case report for each family, which was reviewed by the research team. Each case summary is followed by a short interpretation section. The four cases are discussed in combination within the Discussion. We have given all children aliases, and minor details have been omitted or altered to maintain anonymity.

Results

Here we present the cases of "George", "Anna", "Carmen", and "Holly". Table 2 shows summary statistics for demographic information and interaction characteristics for the full sample, as well as each case.

[insert Table 2 here]

“George”: case summary

George was a 10-year-old boy with a mild ankle fracture witnessed by his mother. George lived with both parents and reported high family social support. George admitted few traumatic stress symptoms, and his reported difficulties with concentration were longstanding prior to the injury. His mother reported a number of dissociative symptoms following the injury, but high optimism and high self-efficacy. George’s father was above the threshold for Acute Stress Disorder (ASD), and reported moderate optimism and high self-efficacy. George’s father had accessed mental health services in the past three years (less than 5 sessions) and endorsed the statement that the injury (that he had not witnessed) reminded him of a prior event. However, further details were not collected. Both parents rated their family as having balanced cohesion and flexibility and there was close agreement between the parents’ responses. George was too young to complete the measure of family functioning (FACES-IV).

Across the weekend of recording, George spent approximately 57% of his waking hours interacting with others. Most interactions were with family – his mother (51%), father (45%) or sibling (41%), and his injury was mentioned in 9% of interactions, mainly indirectly with parents. George’s parents did not differ greatly in the amount of time they were present in the recording, which was rare in our sample. The television was on for approximately a third of their day, as the family watched several movies across the weekend.

This family demonstrated a notable use of humor, which is illustrated by an example below:

FATHER: The advantages of [*George*]'s broken leg.
MOTHER: I know.
FATHER: When that one's finished we'll break the other one.
CHILD: Hey!
FATHER: So we can keep the handicapped card.
CHILD: Hey!
FATHER: I hope it's recording now.
MOTHER: He's joking, he's joking, he's joking!

During the recording, this family sounded respectful and polite in their communication. For example between parents, saying “thank you” and using a calm tone of voice was common. In one snippet, when George was instructed to go to bed instead of watching another movie, he cried and was told not to use his more negative tone of voice. It appeared that this family valued calm, assertive communication.

“George”: interpretation

George’s family demonstrated cohesion and both practical and emotional support. For example, this family frequently offered to help one another. Both parents offered to help George with daily tasks, and George, in turn, expressed a desire to help with dinner preparation, despite a lack of easy mobility. The family spent much time together, were able to bring up the injury in a non-threatening way, used humor and a calm, positive and reassuring tone throughout their interactions. These characteristics could easily be goals for family therapy, as modelling “approach” behaviors (Kassam-Adams, 2014), parental warmth (Asselmann, 2014) and generally responsive parenting (Alisic et al., 2012) may be protective against PTSD. These ideas were supported by the follow-up data, where George’s traumatic stress symptoms remained low and his mother gave very positive ratings of her own mood and emotional wellbeing.

Alternatively, while humor can be a buffer against stress (Kuiper & Martin, 1998), it could also be a defense against talking about difficult subjects. Of note, the recording did not appear to demonstrate the distress George’s father reported. Moderate to high parental optimism and self-efficacy appeared to partially explain these observations, as both parents acknowledged the life disruption of an injury but believed they possessed the skills to cope and be there for their child, likely impacting their consequent parenting behavior (Jones & Prinz, 2005). Also, given George’s father’s mental health history, it could be speculated that

the family has had some experience with coping with difficult emotions, although we do not know the context of these sessions. Nevertheless, the family's coping resources were well demonstrated within the recording.

“Anna”: case summary

Anna, a four year old girl, sustained a moderately severe head injury, witnessed by her mother. The family also reported a sequence of personal and health difficulties apart from Anna's injury. Anna was too young to complete the child self-report measures. Both parents reported a range of traumatic stress symptoms, including intrusion, avoidance, dissociation and hyperarousal. Anna's mother's score exceeded the threshold for ASD. Both parents reported a moderate level of self-efficacy and low optimism. Anna's parents reported very low levels of satisfaction with their family, but their perceived family flexibility and cohesion were within the normal range. More specifically, Anna's mother reported feeling less cohesive as a family than desired, and Anna's father expressed that their family life was chaotic.

In the EAR recording, Anna interacted with others for 39% of her wake time during the weekend, and the television was on 73% of the time. Of the interactions, 71% were with her mother, 37% with her father, 30% with extended family and 13% with her younger brother. Five percent of interactions were about the injury, and many of these interactions involved the parents explaining part of their experience of the injury, as well as their involvement in the study. The EAR recording demonstrated a mixture of light-hearted moments (e.g. mother and daughter singing a theme song together) and some evidence of marital discord and emotional avoidance (e.g. the father joking that Anna needed to tell her mother to “take a chill pill”). Anna's mother's reported high stress levels were upheld by the recording, where her own financial and health issues came to light, and she was heard crying and raising her voice in several snippets. Her distress was also discussed with Anna:

[Mother crying]

CHILD: What did they do to you?

MOTHER: Nothing sweetie, no-one's done anything to mummy. Mummy's done something to someone to get this much bad luck.

Anna's mother reported below average emotional wellbeing at six weeks' post-discharge, which increased to average at the 3-month mark.

“Anna”: interpretation

Anna's family appeared to be experiencing high levels of stress prior to her injury. Therefore, it remains unclear how Anna's injury further precipitated distress within this family unit. The literature suggests that multiple traumas or stressors may accumulate risk for poor mental health (Breslau, Wilcox, Storr, Lucia, & Anthony, 2004). While the questionnaire data highlighted stress within the family and hinted at the stressors involved, the EAR illustrated the situation further, showing a range of family strengths and weaknesses, including conflict and times of closeness. It was easy to sense hostility between parents, which could have created an atmosphere of tension and emotional insecurity for Anna (Davies & Cummings, 1994).

Nevertheless, it is difficult to determine the impact of the injury and family situation on Anna, as we cannot obtain self-report measures for her at her age and she did not speak much in the recording. The low percentage of interactions during the day is of note, as young children tend to spend more time with parents than older children (Milkie, Nomaguchi & Denny, 2015), and Anna apparently spent much time alone during the recording. It could be hypothesised that the case demonstrated “withdrawn” parenting (Scheeringa & Zeanah, 2001), and that the unpredictable nature of the emotional climate in the house affected parent-child attachment and reduced Anna's perceived ability to disclose thoughts and feelings (Mikulincer, & Nachshon, 1991). The interactions that did occur likely provided Anna with

an opportunity to hear her parents appraise the injury, however, there were few opportunities for Anna to express her own emotions with her parents.

“Carmen”: case summary

Carmen was a 6-year-old girl who sustained a mild broken arm. Carmen lived with her mother and brother, and Carmen’s mother did not witness her injury. Carmen’s father lived interstate. Carmen was too young to complete the child self-report measures. Carmen’s mother reported a history of mental ill-health. At baseline, Carmen’s mother reported traumatic stress symptoms above the threshold for ASD, as well as moderate optimism and self-efficacy. She also reported low satisfaction with her family on the FACES-IV. At the 6-week follow up, Carmen’s mother reported below average emotional wellbeing, which increased to above average at the 3-month mark.

Carmen interacted with others for the majority (73%) of her time spent awake. These interactions occurred mainly with her mother (79% of interactions) and brother (69%). Other adults (8%) and her father (2%) were also heard in the recording (via online video call). There were no direct conversations about the injury, but the recording did include a few indirect references (2% of interactions) to the injury in terms of how it affected daily tasks like getting dressed (e.g. Mother: “You can wear your brace if you want to be a bit more comfortable, I don't mind”). Emotions were mentioned in 7% of interactions, often including expressions of love between family members.

During the recording, Carmen’s family was preparing for a holiday. It was also evident that they had recently bought a pet. Carmen and her brother interacted with their mother mainly by making requests and verbalizing their day, e.g. “Mummy, can I pat the dog?” and “I downloaded the game”. In the absence of her mother, Carmen took on a somewhat parental tone with the dog. Carmen and her brother, both under the age of 10, also conversed independently and supportively about which items they would pack for their

holiday. Across the two days, the mother was heard attending to her children's questions and comments and providing calm, but firm guidance while carrying out day-to-day tasks.

Carmen's mother sounded engaged, calm and reassuring.

At times the concept of who was in the family was brought up, as in the example below.

MOTHER: My girl, she is the only one I have, and I never want to let her go.

CHILD: [xxx] I love my Mum, she is the only Mum I have.

In another snippet, Carmen's brother reflected on who he considered part of their family during a "family cuddle", stating that their new pet, grandparents and father were missing. After including the pet, Carmen's mother replied "this is just our family who lives here" and had mentioned that the hug could be repeated with others present.

"Carmen": interpretation

This family seemed close-knit. The family spent much of their time together, engaged in every aspect of life together. We also saw the strengths of these relationships in how the siblings supported one another throughout the day. Love was expressed openly, and all family members appeared to be available to offer support to one another. Carmen also took responsibility within the family but maintained her childlike interaction style with her mother. The snippets about who made up the family were consistent with parent-child exploration of the family system, thought to especially occur in single-parent families (Poveda, Jociles & Rivas, 2014).

The self-report data and EAR data complemented one another by displaying differences between observed and reported emotion. Despite Carmen's mother's reported distress, we did not hear Carmen's mother articulating her concerns with her children or other adults. Rather, throughout the day she responded to her children's concerns. This "responsive" style of parenting is considered protective against child PTSD, as the mother's

symptoms were not evident in her interactions with Carmen, thus reducing the likelihood of shared stress (Alisic et al., 2012; Scheeringa & Zeanah, 2001). However, it is unknown whether Carmen's mother expressed her feelings with others when her children were not around, which could have been beneficial for her own mental health.

“Holly”: case summary

Holly, a 12-year-old girl, sustained a profoundly severe head injury that was witnessed by both parents. Holly and her parents reported many acute stress symptoms and both parents exceeded the threshold for diagnosis of ASD. Nevertheless, both parents reported being highly optimistic, with high self-efficacy about her recovery and their ability to help her. Holly's reported level of support from family and friends was also very high. Holly and her parents provided responses on the FACES-IV indicating balanced cohesion and flexibility. However, Holly's father reported being less satisfied with their family and level of communication than both Holly and her mother. Holly and her mother's scores were very close on all subscales of the FACES-IV. For example, regarding family communication, Holly's satisfaction level was “high”, her mother's was “very high” and her father's was “very low”.

Holly wore the EAR for one day, during which she spent 65% of her time interacting with others. Of these interactions, 58% included her mother, 41% included a sibling, 30% friends, 23% other adults and only 13% included her father. Holly attended a friend's party during the recording, which may explain the substantial time spent interacting with friends and adults outside the family. Below is an example snippet of a conversation between Holly and her mother about the party.

MOTHER: Were you inside the whole time?

CHILD: We went outside the backyard for a little bit.

MOTHER: Yep.

CHILD: But that's all really.

MOTHER: What did you play out there or?

CHILD: Oh nothing really. People were just jumping on the trampoline.

MOTHER: Yeah ok, you couldn't do that though. Were you just watching honey or?

CHILD: Yeah. No, not everyone was outside. It was only a couple of people outside.

MOTHER: Ok. Did you feel like you could join in with most things that were happening at the party?

CHILD: Yeah.

MOTHER: Oh that's good.

This transcript depicts Holly's mother enquiring about any risk-taking behaviors, as well as Holly's enjoyment of the party despite obvious limitations attributable to her injury. Holly's father was more directive in his approach to the party, as depicted in the interaction with Holly prior to the party, below.

FATHER: Just when you're at that party if they're playing games where they're jumping around each other just back off from it ok?

CHILD: Yep.

FATHER: Just sit down. You can talk to them but just -

SIBLING: Don't be running around and -

CHILD: [*Sibling's name*], [*Sibling's name*]. I know.

SIBLING: If they're playing basketball just -

CHILD: I know I know.

Overall, Holly spent 6% of all interactions talking about the injury or its consequences, e.g. talking about pain, and recounting the injury itself. On average, emotional tone was rated as neutral or slightly positive for Holly and her parents, and there was a trend towards injury conversations being more positive in tone than non-injury-related conversations.

Six weeks later, Holly's traumatic stress symptoms had increased to a mild level, which could have been partially attributed to her head injury (e.g. difficulty concentrating). Three months later, Holly's traumatic stress symptoms were minimal. At both follow-up points, Holly's mother self-reported average emotional wellbeing, with fewer difficulties reported at three months. We did not obtain follow up data from Holly's father.

“Holly”: interpretation

Holly and her parents reported many traumatic stress symptoms following her injury, and it was an event witnessed by both parents. Despite their concurrent exposure to a

potentially traumatic event, their cohesion as a family, Holly's perception of social support, and the outlook of both parents indicated that their psychological resources were rich. The EAR recordings corresponded with the questionnaire data, as Holly reported feeling well supported and the EAR data provided a snapshot of the supportive environment around Holly. The recordings showed how Holly had opportunities to discuss her injury with a range of family and friends and that others generally took a curious and supportive approach, again modelling "approach" behaviors (Kassam-Adams, 2014).

Holly's parents also demonstrated their caution, optimism and care. Overprotection can increase risk of PTSD (Scheeringa & Zeanah, 2001; Williamson et al., 2017), and Holly's interactions with her parents about the party indicated their concerns for her safety. However, Holly's parents demonstrated a parenting style that provided her with a degree of independence and choice. For example, despite their concerns for her safety at the party, they did not prevent her from participating in the party and Holly's mother in particular appeared equally concerned that Holly was able to join in with her friends.

It is of note that Holly's father was highly distressed following the injury and also appeared to spend the least time with Holly out of the potential conversation partners. Certainly, taken together with the discrepant scores on the FACES-IV, the EAR data raise, rather than answer questions. These findings raise the question of whether the recordings represented a reduction in father-daughter communication following the injury, potentially indicating avoidance, or whether Holly's father was an example of the broader finding of fathers interacting less with their children than mothers (Alisic et al., 2017; Mangelsdorf, Mehl, Qiu, & Alisic, 2019; see Table 2).

Discussion

To our knowledge this is the first study to use a combination of sampled naturalistic ambient audio recordings (via the EAR), self-report measures and background data to

describe families post-trauma. We aimed to identify ways in which this mixed method approach might enhance existing family interventions. We also aimed to illustrate naturally unfolding social processes within the family post-trauma. In keeping with our aims, we described four cases: George, a 10-year-old boy with a broken ankle, Anna, a 4-year-old girl with a head injury, Carmen, a 6-year-old girl with a broken arm, and Holly, a 12-year-old girl with a head injury.

Within the presented cases, parents modelled emotional expression, advised caution against further injury and encouraged independence in the aftermath of a potentially traumatic injury. These findings suggested that parents were responsive to their children's needs. Additionally, there were many examples of parental warmth (Asselmann, 2014) and more general approach behaviors, rather than avoidance (Alisic et al., 2012; Kassam-Adams, 2014). Our data supported parents, particularly mothers, as key providers of support, lending support for research and interventions focused on parent-child relationships post-trauma (e.g. Marsac et al., 2013). Siblings also often spent a considerable amount of time with the injured child, indicating they may be an overlooked resource.

During the recordings, each family's context was noticeably different. Families differed in activities, outings, television use, and conversation topics. This variability highlighted the importance of considering families individually and lends support for single case research (Cohen, Feinstein, Masuda, & Vowles, 2014), and case formulation within therapy (Lundkvist-Houndoumadi, Thastum, & Hougaard, 2016), so that interventions are targeted for each family's particular needs and trauma symptom trajectory (Hiller et al., 2016).

Turning to the implications for a mixed-method approach, overall, the EAR data exposed the observer to information that would be difficult to obtain using self-report alone (Mehl et al., 2012). For example, we were able to determine how much time the children

spent with each family member, how the family naturally interacted and especially discussed the injury event, and listen to tone of voice. The mere frequency of interactions between family members demonstrated who spent the most time in the child's vicinity and therefore who might be best positioned to offer support to the child.

The self-report measures, taken together with audio recordings, enabled comparison between reported and observed phenomena. For Anna's family, the EAR recordings expanded upon self-reports by depicting an atmosphere of distress. We also saw family dynamics that may evade self-report, like members of a family forming a stronger alliance with one another compared to other members of the family. As each family may have a perception of how "normal" their family is (Alisic, Barrett, Bowles, Conroy, & Mehl, 2016), Anna's significant amount of time alone may have been overlooked if we asked the family to report how much time they spend together.

The frequency and nature of injury talk highlighted the opportunities for emotional processing of the event, and showed how it was handled by the family. In Holly's family, in particular, we were able to hear how she explained her injury to others and how others responded, thereby inferring her social resources. We sampled many interactions that her parents would not have been aware of (e.g. with friends at a party). By contrast, Anna's case demonstrated a potential lack of opportunity to discuss her own emotions about the injury event, which was also the case for Carmen's mother.

With the exception of Anna, each case with a parent who exceeded the threshold for ASD demonstrated marked differences in reported and expressed emotion, highlighting that while the parent was stressed, the child was unlikely to sense their stress in conversation. Parents were observed to regulate their emotions around their child as a support and model. Alternatively, parent stress may have been difficult to detect using objectively-coded verbal interaction characteristics. Stress may be more obvious to family members with more in-

depth knowledge of their own typical interaction styles or non-verbal cues, and might be thus more likely to sense a shift or change in behavior.

The main strengths of the approach we used might be explained in terms of the potential utility of the information gained, especially within clinical settings. To address our first aim, we suggest that naturalistic data may enhance existing therapeutic interventions in a number of direct and indirect ways. Directly, naturalistic data on tone of voice, parenting strengths and time spent together may provide additional information for case formulation, thereby informing treatment planning. Audio recordings may also enable checking of the family's progress in treatment and application of skills learnt in therapy. Listening to recordings with the family may even increase client self-awareness within therapy. Recordings may also enable the perspective of young children to be involved. For example, Anna and Carmen were too young to complete self-report measures, but the EAR enabled the observer to "hear what they heard".

More indirectly, the discrepancies between self-report measures and recordings raised questions that may be appropriate for therapy. For example, we wished to know how Holly's time spent with each parent, mainly her father, linked to reported satisfaction and communication. In therapy, it may have been appropriate to ask the family how typical the recording was. We also saw how Carmen's interaction styles differed in the presence or absence of her mother – being more childlike with her mother and taking more responsibility in her absence. This difference in styles may have also been worth exploring in a therapeutic context.

Nevertheless, there were some limitations to this research. First, none of the children that we presented reported low social support or exceeded the threshold for ASD at the time of the recording, and we could not obtain reports from children under eight years. Therefore, the information obtained and openness to recordings may be different for families presenting

to a clinic with a traumatized child. It would be interesting to explore reasons for parents' willingness or unwillingness to participate in naturalistic audio recordings in research and clinical settings.

Secondly, the recordings we obtained were short de-contextualized "snippets". These snippets are usually used to aggregate data across families, and lack context to protect the privacy of participants (Mehl et al., 2012). Therefore, some clinical judgement was used to piece together a picture of the family, but we found that even these snapshots gave the observer a "sense" of the family and there were more similarities than differences between coders' perspectives. The final cases we presented were brief, but we aimed to present a variety of families, injury severities and contexts through the cases, which made it necessary to balance depth and meeting space requirements.

In addition, we mimicked clinical integration of information without a clinical interview or direct observation of the family within the clinic, which are generally present in any therapeutic context with families. Furthermore, the time use and interaction frequency percentages provided by the EAR were interpreted with limited "normative" information. However, these interpretations would undergo natural calibration if these kinds of data were to become more common in a clinical context. Lastly, our method took several hours per family. It has been suggested that it is only a matter of time before technological advances overcome the time associated with transcription and coding (Reblin et al., 2018). It is also possible that within clinical practice, audio files could be selectively reviewed within sessions to maximise efficiency.

Nevertheless, both the practical (e.g. time to review recordings) and ethical concerns (e.g. privacy) of using such a recording device for therapy require further exploration prior to adoption within a clinical setting. We suggest that future research might explore the openness of both families and clinicians to using naturalistic observational techniques within therapy,

as well as how much these types of techniques are already used and perceived as important. It is important to note that the utility of the EAR might best be seen in a multi-method approach, incorporating observations within therapy, self-reports and naturalistic observations (Janssens, De Bruyn, Manders & Scholte, 2005). We also suggest that trauma research might consider observations of family interactions over time, in order to better understand the role of parent-child interactions in longitudinal trauma symptom trajectories. More specifically, trauma researchers could dive into fine-grained analysis of expressed cognitions and emotions within parent-child interactions.

Finally, this article is both exploratory and descriptive, preventing strong generalizations from being made. It seems that naturalistic observations may be a useful addition to existing family interventions, however more research needs to be done before use of the EAR within therapy can be ethically and practically realized. We hope that these cases inspire research questions using naturalistic data with families, especially as consideration of the influence of the family is common to many therapies (Josephson, 2008). We suggest that future research employs ecological momentary assessment methods like the EAR to explore family communication, support and strengths within a therapeutic context to better understand the needs and gaps within clinical practice for families.

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Tables

Table 1

Timing of Self-Report Measures

Questionnaire	Construct	Respondent	Time 1 (baseline)	Time 2 (6 weeks post- discharge)	Time 3 (3 months post- discharge)
CPSS ^a	Child traumatic stress symptoms	Child > 8 years	Yes	Yes	Yes
CRIES-13 ^b	Child traumatic stress symptoms	Child > 8 years	Yes		
MSPSS ^c	Child perceived social support	Child > 8 years	Yes		
FACES-IV ^d	Family functioning	Child > 12 years; Parents	Yes		
ASDS ^e	Parent acute stress	Parents	Yes		
LOT-R ^f	Parent optimism	Parents	Yes		
SDRP ^g	Parent self- efficacy	Parents	Yes		
SF-36 ^h	Parent wellbeing	Parents		Yes	Yes

Note. ^aCPSS = Child Posttraumatic Stress Scale, ^bCRIES-13 = Children's Impact of Event Scale-Revised, ^cMSPSS = Multidimensional Scale of Perceived Social Support, ^dFACES-IV = Family Adaptability and Cohesion Evaluation Scale IV, ^eASDS = Acute Stress Disorder Scale, ^fLOT-R = Life Orientation Test – Revised, ^gSDRP = Screener for the Development of Response Posttrauma, ^hSF-36 = Short-Form Health Survey.

Table 2

Demographics and Interaction Characteristics for the Full Sample and Cases

	Full sample ^a	Anna	Carmen	George	Holly
Age	10.41 (3.60)	4	6	10	12
Sex	59.20% male	female	female	male	female
Total interaction time ^b	46.78 (17.98)	39.23	73.08	56.80	65.44
Mother interaction time ^c	44.22 (22.07)	71.43	78.70	50.70	58.43
Father interaction time ^c	22.78 (22.80)	37.05	1.75	44.72	13.48
Sibling interaction time ^c	36.59 (28.74)	12.50	68.92	41.20	41.01
Interaction time with other adults ^c	15.81 (16.05)	30.36	7.77	5.63	23.03
Interaction time with other children ^c	20.57 (23.71)	0.00	0.00	21.48	29.78
Interactions about the injury ^c	10.96 (13.22)	4.91	2.01	9.15	5.62
Interactions about emotions ^c	10.82 (6.94)	9.82	7.27	8.45	10.11
Television on ^b	38.62 (22.21)	72.85	19.78	33.00	18.01

Note. ^aFor the full sample ($N = 71$), mean percentages are presented for all variables except sex, with standard deviations in brackets. ^bPercentages of wake time. ^cPercentages of interactions.