CHILDREN'S HEALTH CARE
2021, VOL. 50, NO. 3, 278–292
https://doi.org/10.1080/02739615.2021.1890077

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Psychological outcomes after pediatric hospitalization: the role of trauma type

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ABSTRACT

Physical injury and illness are common potentially traumatic events during childhood and adolescence. Many children experience psychosocial difficulties after medical events. The sample consisted of 399 children aged 4 to 15 who had been hospitalized for physical illness or injury. Elevated psychological symptomatology (PTSS, depression, anxiety) was more frequent after multiple (type II) compared to single (type I) medical events, but only a few differences were statistically significant. The strongest risk factor of child PTSS was parental stress. Type II trauma and low parental education were significant risk factors only for parent report of child PTSS (not for child report). The analyzed risk factors did not differ for type I versus II trauma. We recommend standardized screening and monitoring for mental health in the standard pediatric health care. Furthermore, pediatricians should be trained in signaling stress signs of parents.

KEYWORDS

Pediatrics; psychological trauma; PTSD; depression; anxiety

Introduction

Events related to acute or chronic illness, injury, and medical treatment are among the most common potentially traumatic events during childhood and adolescence (Alisic, Van Der Schoot, Van Ginkel, & Kleber, 2008). Research has shown that being hospitalized for illness or injury can lead to posttraumatic stress, depression, anxiety, and other psychological difficulties (Kahana, Feeny, Youngstrom, & Drotar, 2006; Pinquart, 2018). Posttraumatic stress symptoms (PTSS) are considered one of the most common psychological

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consequences which can be experienced even years after illness or injury (Kassam-Adams, Marsac, Hildenbrand, & Winston, 2013; Meiser-Stedman, Smith, Yule, Glucksman, & Dalgleish, 2017; Van Meijel et al., 2019). These symptoms consist of reexperiencing the event, avoidance of trauma-related stimuli, negative thoughts or feelings, and alterations in arousal and reactivity (American Psychiatric Association, 2013). Approximately 25–38% of all ill or injured children experience some of these symptoms to some extent (Kahana et al., 2006). Next to PTSS, symptoms of depression and anxiety are also often reported, with prevalence rates of 7–13% and 7–40%, respectively (Davydow, Richardson, Zatzick, & Katon, 2010; Pao & Bosk, 2011). PTSS, depression, and anxiety are associated with reduced health-related quality of life (Rissanen, Berg, & Hasselberg, 2017), functional impairment (Zatzick et al., 2008), and increased health care service use (Marsac, Cirilli, Kassam-Adams, & Winston, 2011). Furthermore, comorbidity between PTSS, depression, and anxiety is common; also in a medical setting (Ratzer, Romano, & Elklit, 2014).

Illness and injury can encompass single, but also multiple potentially traumatic events (PTEs). Single PTEs in a medical setting are often seen at the emergency department (ED), such as sudden minor accidents or acute illnesses. Often, only one hospitalization is needed. The experience of multiple potentially traumatic medical events (PTMEs) is more common in children with a chronic illness (e.g. congenital or acquired heart disease) or severe injuries, who need repeated hospitalizations and/or medical procedures. Terr (1991) was the first to state that distress caused by single PTEs (type I trauma) might differ from distress caused by multiple PTEs (type II trauma). Several studies found that the experience of multiple traumatic events, compared to single events, seems to heighten the chance of developing PTSS (Copeland, Keeler, Angold, & Costello, 2007; Macdonald, Danielson, Resnick, Saunders, & Kilpatrick, 2010; Suliman et al., 2009). However, an overview of the prevalence of PTSS and its psychological comorbidity in both trauma types in a pediatric medical setting is still missing.

As there is reason to believe that type I and type II trauma differ in symptomatology, one might argue that this difference is based on distinct risk factors. Nevertheless, differential risk factors for developing PTSS after medically related type I versus type II trauma have not yet been investigated. In the general child trauma literature, the strongest support exists for parental risk factors. Parental stress, family functioning, and socioeconomic status were all found to be significant risk factors for the development of PTSS in the child in various studies (Bruce, 2006; Cox, Kenardy, & Hendrikz, 2008; Kahana et al., 2006). Findings regarding the role of child characteristics in predicting PTSS are inconsistent (Brosbe, Hoefling, & Faust, 2011; Ratzer et al., 2014). Aspects of the illness/injury itself as risk factors for PTSS also receive less support. A general belief is that the subjective perception rather than objective characteristics of the illness/injury are of importance in predicting PTSS in

children (Brosbe et al., 2011). However, there are studies that found number of operations (Faugli, Bjørnland, Emblem, Nøvik, & Diseth, 2009) and length of hospitalization (Kullgren, Sullivan, & Bravender, 2018) to be significantly associated with mental health problems of adolescents.

Objectives

The main aim of the present study was to identify possible parental, child, and medical risk factors for PTSS after medically related type I versus type II trauma. The research questions were as follows: (1) what is the prevalence of PTSS, depression, and anxiety in hospitalized children after medically related type I versus type II trauma, and 2) what parental, child, and medical variables are risk factors for PTSS in medically related type I versus type II trauma? We hypothesized that type II trauma would show higher prevalence rates on all outcomes than type I trauma. Furthermore, we hypothesized that parental stress, family functioning, parental education, and other stressful life events would be significant risk factors for child PTSS. We also hypothesized that the associations of risk factors with PTSS would depend on trauma type.

Methods

The data were collected between July 2016 and May 2018 during the baseline screening for a randomized controlled trial studying the effectiveness of eye movement desensitization and reprocessing (EMDR) in children with elevated PTSS after medically related trauma (Meentken et al., 2018). Participants were mainly recruited from the Erasmus MC-Sophia Children's Hospital (pediatrics and pediatric cardiology divisions) and the Maasstad hospital (pediatric division) in Rotterdam, the Netherlands. In addition, participants were recruited nationally through the Dutch Association for patients with a congenital heart defect, the Dutch nonprofit organization Heartchild Foundation (*Stichting Hartekind*), and through the pediatric cardiology division of the Radboud UMC in Nijmegen, the Netherlands. Participation rate was 24%. See Figure 1 for more details.

Participants

Patients aged 4– 15 years who had been hospitalized for minimally one night in a Dutch hospital were included. The last hospitalization or additional invasive medical procedure needed to have taken place at least 4 weeks up to 5 years before recruitment. We included children who had been hospitalized after consultation at either 1) the emergency department (due to all types of injury or acute illness, mainly type I trauma) or 2) at the pediatric cardiology

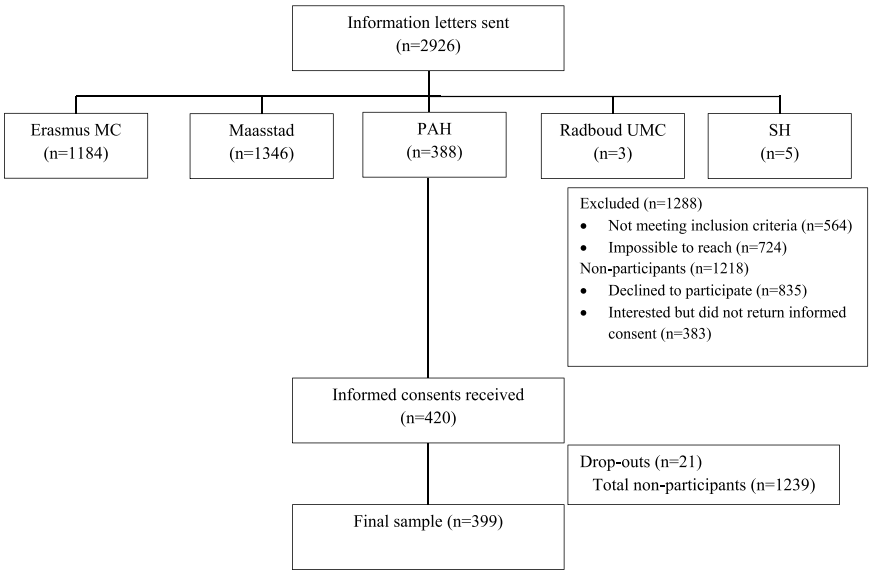

Figure 1. Flowchart of the study. MC, Medical Center; PAH, Dutch Association for patients with congenital heart defect; UMC, University Medical Center; SH, Stichting Hartekind (Dutch nonprofit organization supporting research into congenital heart disease). Participation rate = 100/(total non-participants + final sample)*final sample.

department (due to a congenital or acquired heart defect; mainly type II trauma).

Excluded were patients with (1) intellectual disability (IQ<70); (2) parental inability to read or write Dutch; (3) diagnosis of chronic illness within the ED subgroup (4) previous successful treatment for medically related posttraumatic stress disorder (PTSD); (5) current psychological treatment.

Procedure

All participating departments and organizations identified eligible patients who subsequently received an information letter. It was explained that participation was valuable regardless of whether or not the child experienced distress. By returning a response letter, patients could indicate if they were interested in participating. Then, during a telephone call, questions were answered and inclusion and exclusion criteria were checked. In total, 420 participants returned a signed informed consent.

Outcome variables

Participating children aged 6–15 and their parents were asked to fill out questionnaires. For 4–5 year old children, only parents were asked to fill out questionnaires. Questionnaires were filled out online via a secured website

after written informed consent was provided by parents/guardians and children ≥12 years. We categorized scores as elevated according to the cutoffs for above average scores provided in the relevant manuals. All questionnaires investigated current complaints.

Medically related PTSS of the child was measured by the self-reported and parent-reported PTSD total score of the Children's Responses to Trauma Inventory (CRTI; norms 4/8-18 years). Participants were asked to fill out the questionnaire specifically thinking about a medical event of the child. The PTSD total score was computed with the 24 PTSD-items. Furthermore, all children (for self-report only children ≥8 years) with a PTSD total score above the 60th percentile and/or fulfilling two or three of the three symptom criteria were categorized as showing "elevated PTSS".

Child symptoms of depression were measured through the self-reported (28 items) and parent-reported (17 items) Children's Depressive Inventory (CDI-2; norms 8–21 years). A total score and a categorical score were computed. Children ≥8 years with a score above the 70th percentile were categorized as having "elevated symptoms of depression".

Anxiety symptoms of the child were measured with the Dutch Screen for Child Anxiety Related Emotional Disorder (SCARED-NL; norms 7–19 years). This questionnaire contains 69 items concerning 9 different anxiety disorders (subscales). We computed the total score, based on all items. Additionally, children ≥7 years that scored more than one standard deviation above the normative mean were categorized as having "elevated anxiety symptoms". The categorical scores could not be computed for SCARED-NL parent-report due to lack of normative data for parents.

Risk factors

Medically related trauma type was dichotomized: type I trauma was defined as a single hospitalization; type II trauma was defined as ≥2 hospitalizations or at least one additional invasive medical procedure in day-care/outpatient clinic next to a single hospitalization. Hospitalization was defined as a minimum stay of one night.

Other stressful life events were measured to control for the experience of other (not medical) stressful life events, by using the life events scale of the Cognitive Emotion Regulation Questionnaire (CERQ) (Garnefski, Kraaij, & Spinhoven, 2002; Garnefski, Rieffe, Jellesma, Terwogt, & Kraaij, 2007). We removed two questions about illness and injury of the child. Scores were dichotomized in "experienced other stressful life events: yes/no"

Parental risk factors included educational level, parental stress, and family functioning. *Parental education* (high, middle, and low) was based on the highest educational level of both parents (Centraal Bureau voor de Statistiek, 2017). *Parental stress* was measured by the total score of all problem domains

of the Distress Thermometer (LTO, 34 items) (Haverman et al., 2013). *Family functioning* was measured through the score on the general functioning scale of the Family Assessment Device (FAD, 12 items) (Wenniger, Van Loon, Benoist, & Moleman, 1995).

Child risk factors consisted of the child's age and gender. The *child's age* was defined as years between the date of birth and date of informed consent.

Medical risk factors included length of hospitalization, time since last hospitalization/invasive medical procedure, and type of hospital department. All medical variables were retrieved from the medical records of the child and/or asked to the parents by the research psychologist. *Length of hospitalization* was computed by adding up the number of days of all hospitalizations. To compute *time since the last hospitalization/medical procedure* the years that elapsed between the last hospitalization/invasive medical procedure (end date) and study-participation (date first questionnaire was filled out) were calculated. Invasive medical procedures were defined as any kind of operation (e.g. surgery, catheterization), magnetic resonance imaging (MRI), computed tomography (CT), or lung perfusion scans. Type of h*ospital department* was dichotomized into pediatric cardiology and emergency department.

Statistical analyses

Descriptive statistics were computed for the study variables and differences between both medically related trauma types were tested with χ^2 tests and t-tests. To investigate differences in prevalence rates of elevated psychological symptomatology (categorical scores) between trauma types, we used χ^2 tests.

To examine associations of risk factors with PTSS, we conducted a multiple regression analysis in four steps separately for parent- and child-reported PTSS (total scores). First, we wanted to test whether medically related trauma type is associated with PTSS. Therefore, a linear regression analysis was conducted with PTSS as outcome variable and medically related trauma type as an independent variable. Trauma type was only included in further analyses when significant. Second, we controlled for other stressful life events and parental factors as indicated by previous studies. To do this, stressful life events, parental stress, family functioning, and parental education were added to the model. Only factors that reached significance were included in the further analyses. Third, interactions of trauma type with factors that remained from the second step were tested to examine the hypothesis that the associations of risk factors with PTSS depend on trauma type. If significant, interaction terms were included in further analyses. Fourth, child and medical risk factors were selected by backward elimination as there is less consensus on the association between these factors and PTSS in literature. Missing data were imputed for the regression analyses using a fully conditional specification method with 20 imputations and continuous variables were

standardized into z-scores. *P*-values of <.05 were considered significant. All analyses were performed using SPSS 24.0.

Results

Baseline characteristics

The final sample consisted of 174 girls (44%) and 225 boys (56%) and the mean age was 9.33 (*SD* = 3.18, age range 4–15). Type I trauma was present in 115 children (29%) and type II trauma was present in 284 children (71%). Compared with the type I trauma group, the type II trauma patients were significantly older, more likely to be a male and a cardiology patient, had more hospitalizations, and had a longer total length of hospitalization. See Table 1 for more details.

Table 1. Child, parental and medical characteristics of the sample and differences between trauma type.

	N	Total	Type I Trauma n = 115	Type II Trauma n = 284	*p*
Child					
Age in years, M (SD)	399	9.3 (3.2)	8.8 (3.3)	9.6 (3.1)	.026*
Gender, n (%)	399				.049*
Girls		174 (43.6)	59 (51.3)	115 (40.5)	
Boys		225 (56.4)	56 (48.7)	169 (59.5)	
Ethnicity, n (%)	377				.165
Dutch		305 (80.9)	82 (75.2)	223 (83.2)	
Other Western		21 (5.6)	9 (8.3)	12 (4.5)	
Non-Western		51 (13.5)	18 (16.5)	33 (12.3)	
Other stressful life events, n (%)	314	229 (72.9)	62 (72.9)	167 (72.9)	.998
Yes		85 (27.1)	23 (27.1)	62 (27.1)	
No					
PTSD score self-report, M (SD)	323	32.0 (12.3)	30.9 (11.6)	32.4 (12.6)	.347
PTSD score parent-report, M(SD)	396	31.0 (12.1)	28.7 (11.1)	31.9 (12.4)	.017*
Parental					
Informant gender, n (%)	392				.581
Female (mothers)		325 (82.9)	91 (81.3)	234 (83.6)	
Male (fathers)		67 (17.1)	21 (18.8)	46 (16.4)	
Education, n (%)	391				.334
High		231 (59.1)	71 (63.4)	160 (57.3)	
Medium		140 (35.8)	34 (30.4)	106 (38.0)	
Low		20 (5.1)	7 (6.3)	13 (4.7)	
Parental stress, M (SD)	390	5.2 (5.6)	4.9 (5.5)	5.4 (5.7)	.453
Family functioning, M (SD)	387	1.5 (.4)	1.5 (0.4)	1.5 (0.4)	.811
Medical					
Department, n (%);	399				<.001*
Cardiology		200 (50.1)	20 (17.4)	180 (63.4)	
Emergency unit		199 (49.9)	95 (82.6)	104 (36.6)	
No. of hospitalizations, M(SD)	388	3.1 (3.3)	1.0 (0)[a]	3.9 (3.6)	<.001*
Length of hospitalization(s) in days, M(SD)	340	23.1 (40.1)	4.3 (6.4)	32.6 (46.2)	<.001*
Time since hospitalization in years, M(SD)	390	1.9 (1.4)	2.0 (1.3)	1.9 (1.4)	.749

M, mean; SD, standard deviation; PTSD, posttraumatic stress disorder; no., number; p, p-value. χ2 tests were used for categorical variables. T-tests were used for continuous variables.
*significant.

Table 2. Prevalence rates of elevated PTSS, anxiety and depression in the total sample and each trauma type.

	N	Total		Type I Trauma		Type II Trauma		*p*
		n	%	n	%	n	%	
Elevated PTSS								
Child Report	249	54	21.7	10	16.7	44	23.3	.279
Parent report	398	85	21.3	17	14.9	68	23.9	.047*
Combined	399	103	25.8	20	17.4	83	29.2	.014*
Elevated depressive symptoms								
Child report	246	77	31.3	16	26.7	61	32.8	.373
Parent report	267	96	36.0	19	28.4	77	38.5	.134
Combined	399	122	30.6	25	21.7	97	34.2	.015*
Elevated anxiety symptoms								
Child report								
Total	280	20	7.1	2	2.8	18	8.7	.095
SAD	280	20	7.1	2	2.8	18	8.7	.095
Panic	280	26	9.3	5	6.9	21	10.1	.427
Animal phobia	280	0	0	0	0	0	0	
BII phobia	280	43	15.4	9	12.5	34	16.3	.435
Situational phobia	280	70	25.0	16	22.2	54	26.0	.528
Social phobia	280	58	20.7	11	15.3	47	22.6	.187
OCD	280	8	2.9	0	0	8	3.8	.091
GAD	280	25	8.9	4	5.6	21	10.1	.244
PTSD/ASD	280	43	15.4	13	18.1	30	14.4	.461

*n, number of children with elevated scores; SAD, separation anxiety disorder; Panic, panic disorder; BII phobia, Blood-injection-injury phobia; OCD, obsessive-compulsive disorder; GAD, generalized anxiety disorder; PTSD, posttraumatic stress disorder; ASD, acute stress disorder;p, *p*-value. Prevalence rates were analyzed using $\chi 2$ tests. *significant.

Prevalence of psychological outcomes

Prevalence rates are presented separately for child report, parent report and combined. See Table 2 for more details.

Child report

22% of the children reported elevated PTSS and 31% reported elevated symptoms of depression. Furthermore, 7% reported an elevated total anxiety score. The highest percentages found on the anxiety subscales where on situational phobia (25%), social phobia (21%), blood-injection-injury (BII) phobia (15%), and posttraumatic stress disorder/acute stress disorder (PTSD/ASD; 15%). Children did not report any significant differences between type I and type II trauma with regard to prevalence rates.

Parent report

21% of the children were categorized as having elevated PTSS by their parents. Parent-reported elevated PTSS of the child was significantly more present in type II trauma (24%) than type I trauma (15%). The prevalence rates of children that were reported to have elevated symptoms of depression was 36%. There was no significant difference between both trauma types on parent-reported elevated depressive symptoms of the child.

Combined

Combined scores of child and parent report were computed for elevated PTSS and symptoms of depression. It has been argued that a combined symptom report is valuable when identifying posttraumatic reactions (Meiser-Stedman, Smith, Glucksman, Yule, & Dalgleish, 2008). Combined means that a child was categorized as having elevated symptoms when either the child and/or the parent score was categorized as elevated. When child and parent report were combined into one score, 26% of the children had elevated PTSS. The combined elevated PTSS score was significantly higher after type II trauma (29%) than type I trauma (17%). The combined prevalence rate of elevated depressive symptoms of the child was 31%, which also differed significantly between type I trauma (22%) and type II trauma (34%).

Risk factors for child PTSS

Child report

Trauma type was not associated with PTSS reported by the child (see Table 3). Only parental stress was significantly related to child-reported PTSS. The interaction between parental stress and trauma type was not significantly

Table 3. Results of the linear multiple regression analyses.

	Self-report			Parent-report		
Risk factors	*b*	*CI*	*p*	*b*	*CI*	*p*
Step 1						
(Constant)	.042	−.088, .172	.526	.071	−.045, .188	.231
Trauma Type (I vs II)*	−.126	−.366, .115	.306	−.245	−.463, −.026	.028*
Step 2						
(Constant)	−.058	−.282, .166	.610	.069	−.138, .276	.512
Trauma Type (I vs II)*	–	–	–	−.216	−.412, −.020	.030*
Stressful life events (yes vs no)*	.077	−.168, .322	.538	.080	−.296, .136	.468
Parental stress	.278	.165, .391	.000*	.402	.304, .500	<.001*
Family functioning	.071	−.041, .184	.213	.086	−.013, .184	.088
Parental education (medium vs high)*	−.027	−.249, .195	.810	.087	−.101, .274	.365
Parental education (low vs high)*	.256	−.208, .720	.279	.431	.024, .838	.038*
Step 3						
(Constant)	.005	−.101, .110	.932	−.007	−.145, .132	.925
Trauma Type (I vs II)*	–	–	–	−.183	−.435, .069	.156
Parental stress	.286	.165, .406	.000*	.429	.325, .532	<.001*
Parental education (medium vs high)*	–	–	–	.146	−.074, .365	.194
Parental education (low vs high)*	–	–	–	.292	−.212, .796	.256
Trauma Type*Parental stress	.089	−.139, .317	.443	.002	−.199, .203	.984
Trauma Type*Parental education (medium vs high)*	–	–	–	−.178	−.606, .250	.415
Trauma Type*Parental education (low vs high)*	–	–	–	.471	−.385, 1.328	.281
Step 4 (final model)						
(Constant)	.004	−.102, .109	.944	.003	−.127, .132	.965
Trauma Type (I vs II)*	–	–	–	−.213	−.410, −.017	.033*
Parental stress	.310	.208, .413	.000*	.429	.341, .518	<.001*
Parental education (medium vs high)*	–	–	–	.100	−.088, .287	.296
Parental education (low vs high)*	–	–	–	.460	.054, .866	.027*

M, mean; SD, standard deviation; PTSD, posttraumatic stress disorder; no., number; p, p-value. $\chi 2$ tests were used for categorical variables. T-tests were used for continuous variables.

*Reference values were type II trauma, no stressful life events, and high parental education). R2 = .10 for Step 4 self-report. R2 = .21 for Step 4 parent-report.

associated with PTSS. There were no significant child and medical risk factors. In the final model, parental stress was the only significant risk factor for child-reported PTSS.

Parent report

Trauma type was significantly associated with child PTSS reported by parents in the first step of the regression analyses. Furthermore, we found parental stress and parental education (low versus high) to be significantly associated with child PTSS. However, the interactions of trauma type with parental stress, respectively, parental education were not significant. Besides, no child or medical risk factors were significant. The final model showed trauma type, parental stress, and parental education to be significantly related to child PTSS reported by parents.

Discussion

The main findings of this study were that 1) we only found very few significant differences (i.e., elevated PTSS and depressive symptoms) between type II trauma (mostly ConHD patients) and type I trauma (mostly ED patients) and 2) the strongest risk factor for PTSS in children was parental stress followed by low parental education and trauma type.

Prevalence rates of elevated PTSS and elevated symptoms of depression and anxiety were higher in our sample of hospitalized children compared to the normal population (Brancu et al., 2016; Lewinsohn, Shankman, Gau, & Klein, 2004; Wesselhoeft, Sørensen, Heiervang, & Bilenberg, 2013), but comparable to earlier research in ill/injured children (Davydow et al., 2010; Kahana et al., 2006; Pao & Bosk, 2011). Our study supports that psychological difficulties can be present even years after a hospitalization and/or medical procedure. Elevated symptoms of depression were most frequently reported. A general belief is that symptoms of depression might be overestimated in a medical setting because of the overlap between symptoms of the illness/injury itself and symptoms of depression (e.g., fatigue, loss of energy, reduction of physical movement) (Shemesh, Bartell, & Newcorn, 2002). However, the high percentage might also be due to the fact that more than two thirds of the participants have experienced repeated hospitalizations, which might worsen symptoms of depression due to school absence and consequent isolation from peers. Furthermore, methodological choices (e.g., questionnaires and cutoffs) could account for differences in prevalence rates between studies.

Children did not report any significant differences in prevalence rates between both trauma types. Parents reported elevated PTSS of the child significantly more often after type II than type I trauma. It might be possible that recurrent hospitalizations are experienced as especially traumatic by parents. It has been found earlier that parents' mental health influences their

report of the child's wellbeing (Shemesh et al., 2005). Parents' mental health (such as parental PTSS) was not measured in this study so we couldn't control for possible bias. Future research should investigate this.

Parental stress predicted child and parent reported PTSS of the child. This is in line with earlier studies (Cox et al., 2008; Daviss et al., 2000). Against our expectations, family functioning was not found to be a significant risk factor for child PTSS after hospitalization. However, this is in line with a study of Coakley et al. who found that family functioning was associated with parental PTSS, but not child PTSS after unintentional pediatric injury of the child (2010). Type II trauma and low parental education were also associated with higher child PTSS, but only for parent report. Child and medical predictors were not significantly associated with PTSS of the child. Earlier research found ambiguous outcomes regarding these factors (Brosbe et al., 2011). The current study presents more evidence for the assumption that gender and age of the child and objective medical factors do not seem to be associated with child PTSS after potentially traumatic medical events, controlled for other stressful life events.

Strengths & limitations

The strengths of this study include a large sample size of an underrepresented group in trauma research. Furthermore, we compared medically related type I and type II trauma and therefore add important information to the literature. Lastly, we used a multi-informant approach and measured parent and child information on all outcomes.

When interpreting the results of this study, some limitations should be kept in mind. First, no judgments can be made about causality as this study used a baseline cohort sample. Second, we focused on elevated symptomatology and not psychiatric disorders. Prevalence rates of subthreshold symptomatology are higher than those of psychiatric disorders (Lewinsohn et al., 2004). Third, parent-reported prevalence rates of child anxiety symptoms could not be analyzed due to the lack of Dutch normative data for the parent version of the SCARED-NL. Future research should provide these norm data. Furthermore, young children might have had assistance of their parents when filling out the questionnaires which could have biased their answers. Moreover, generalizability of the findings may be influenced by the low participation rate and the overrepresentation of highly educated parents. However, this phenomenon is seen frequently in scientific research (Heinrichs, Bertram, Kuschel, & Hahlweg, 2005). Additionally, we defined medically related type I and type II trauma mainly based on the number of hospitalizations. One might argue that hospitalizations differ in terms of length, amount of invasive medical procedures, and other factors. However, we did measure those

objective factors and they were not associated with PTSS in our sample. Another limitation is that medical risk factors of the participants recruited through the RUMC and both nonprofit organizations had to be collected through parent report due to no access to the medical record. Faulty memory might have biased their report. However, we asked parents to check data with the treating physician before reporting. Finally, medically related trauma type and other stressful life experiences of the child were measured dichotomous. For future research, it would be interesting to investigate cumulative effects of medical and other stressful life events using continuous scores.

Implications for practice

The results of this study show that children who have experienced one or more hospitalizations experience high levels of PTSD, depression, and anxiety symptoms. Implementation of a trauma-informed health care approach and early identification of symptoms could be crucial to reduce the emotional and psychological impact of medical events. We recommend to integrate routinely mental health screening after pediatric hospitalizations.

Furthermore, our analyses of possible risk factors for child PTSS made clear that sources of parental stress within pediatric health care settings should be limited as much as possible. Especially parents with a low educational level and parents of children who experienced multiple medical events should be monitored closely and should receive adequate support if needed.

Acknowledgments

We gratefully acknowledge the co-operation of all patients who participated in the study. Furthermore, we acknowledge Suzanne Hofman & Linda Bot from the Maasstad hospital, the Dutch Association for patients with congenital heart defect (*Patiëntenvereniging Aangeboren Hartafwijkingen*; PAH), and Zina Fejzic, MD from the Radboud UMC (pediatric cardiology) for their efforts in recruiting participants.

Disclosure statement

The authors have no conflicts of interest relevant to this article to disclose.

Funding

This work was supported by Innovatiefonds Zorgverzekeraars, Stichting Hartekind, and Vereniging EMDR Nederland.

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Data accessibility

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

Alisic, E., Van Der Schoot, T. A., Van Ginkel, J. R., & Kleber, R. J. (2008). Looking beyond posttraumatic stress disorder in children: Posttraumatic stress reactions, posttraumatic growth, and quality of life in a general population sample. *Journal of Clinical Psychiatry*, *69*(9), 1455–1461. doi:10.4088/JCP.v69n0913

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Washington, DC: American Psychiatric Publishing.

Brancu, M., Mann-Wrobel, M., Beckham, J. C., Wagner, H. R., Elliott, A., Robbins, A. T., … Runnals, J. J. (2016). Subthreshold posttraumatic stress disorder: A meta-analytic review of DSM-IV prevalence and a proposed DSM-5 approach to measurement. *Psychological Trauma*, *8*(2), 222–232. doi:10.1037/tra0000078

Brosbe, M. S., Hoefling, K., & Faust, J. (2011). Predicting posttraumatic stress following pediatric injury: A systematic review. *Journal of Pediatric Psychology*, *36*(6), 718–729. doi:10.1093/jpepsy/jsq115

Bruce, M. (2006). A systematic and conceptual review of posttraumatic stress in childhood cancer survivors and their parents. *Clinical Psychology Review*, *26*(3), 233–256. doi:10.1016/j.cpr.2005.10.002

Centraal Bureau voor de Statistiek. (2017). *Standaard onderwijsindeling* (Vol. Editie 2016/'17). Den Haag/Heerlen: Author.

Coakley, R. M., Forbes, P. W., Kelley, S. D., LeBovidge, J., Beasley, P., DeMaso, D. R., & Waber, D. P. (2010). Family functioning and posttraumatic stress symptoms in youth and their parents after unintentional pediatric injury. *Journal of Traumatic Stress*, *23*(6), 807–810. doi:10.1002/jts.20586

Copeland, W. E., Keeler, G., Angold, A., & Costello, E. J. (2007). Traumatic events and posttraumatic stress in childhood. *Archives of General Psychiatry*, *64*(5), 577–584. doi:10.1001/archpsyc.64.5.577

Cox, C. M., Kenardy, J. A., & Hendrikz, J. K. (2008). A meta-analysis of risk factors that predict psychopathology following accidental trauma. *Journal for Specialists in Pediatric Nursing*, *13*(2), 98–110. doi:10.1111/j.1744-6155.2008.00141.x

Daviss, W. B., Mooney, D., Racusin, R., Ford, J. D., Fleischer, A., & McHugo, G. J. (2000). Predicting posttraumatic stress after hospitalization for pediatric injury. *Journal of the American Academy of Child and Adolescent Psychiatry*, *39*(5), 576–583. doi:10.1097/00004583-200005000-00011

Davydow, D. S., Richardson, L. P., Zatzick, D. F., & Katon, W. J. (2010). Psychiatric morbidity in pediatric critical illness survivors: A comprehensive review of the literature. *Archives of Pediatrics & Adolescent Medicine*, *164*(4), 377–385. doi:10.1001/archpediatrics.2010.10

Faugli, A., Bjørnland, K., Emblem, R., Nøvik, T. S., & Diseth, T. H. (2009). Mental health and psychosocial functioning in adolescents with esophageal atresia. *Journal of Pediatric Surgery*, *44*(4), 729–737. doi:10.1016/j.jpedsurg.2008.09.027

Garnefski, N., Kraaij, V., & Spinhoven, P. (2002). *Manual for the use of the cognitive emotion regulation questionnaire*. Leiderdorp, The Netherlands: DATEC.

Garnefski, N., Rieffe, C., Jellesma, F., Terwogt, M. M., & Kraaij, V. (2007). Cognitive emotion regulation strategies and emotional problems in 9–11-year-old children. *European Child & Adolescent Psychiatry*, *16*(1), 1. doi:10.1007/s00787-006-0562-3

Haverman, L., Van Oers, H. A., Limperg, P. F., Houtzager, B. A., Huisman, J., Darlington, A.-S., … Grootenhuis, M. A. (2013). Development and validation of the distress thermometer for parents of a chronically ill child. *The Journal of Pediatrics*, *163*(4), 1140–1146. e1142. doi:10.1016/j.jpeds.2013.06.011

Heinrichs, N., Bertram, H., Kuschel, A., & Hahlweg, K. (2005). Parent recruitment and retention in a universal prevention program for child behavior and emotional problems: Barriers to research and program participation. *Prevention Science*, *6*(4), 275–286. doi:10.1007/s11121-005-0006-1

Kahana, S. Y., Feeny, N. C., Youngstrom, E. A., & Drotar, D. (2006). Posttraumatic stress in youth experiencing illnesses and injuries: An exploratory meta-analysis. *Traumatology*, *12*(2), 148–161. doi:10.1177/1534765606294562

Kassam-Adams, N., Marsac, M. L., Hildenbrand, A., & Winston, F. (2013). Posttraumatic stress following pediatric injury. Update on diagnosis, risk factors, and intervention. *JAMA Pediatrics*, *167*(12), 1158–1165. doi:10.1001/jamapediatrics.2013.2741

Kullgren, K. A., Sullivan, S. K., & Bravender, T. (2018). Understanding the unique needs of hospitalized adolescents and young adults referred for psychology consults. *Clinical Pediatrics*, 57(11), 0009922818774339.

Lewinsohn, P. M., Shankman, S. A., Gau, J. M., & Klein, D. N. (2004). The prevalence and co-morbidity of subthreshold psychiatric conditions. *Psychological Medicine*, *34*(4), 613–622. doi:10.1017/S0033291703001466

Macdonald, A., Danielson, C. K., Resnick, H. S., Saunders, B. E., & Kilpatrick, D. G. (2010). PTSD and comorbid disorders in a representative sample of adolescents: The risk associated with multiple exposures to potentially traumatic events. *Child Abuse & Neglect*, *34*(10), 773–783. doi:10.1016/j.chiabu.2010.03.006

Marsac, M. L., Cirilli, C., Kassam-Adams, N., & Winston, F. K. (2011). Post-injury medical and psychosocial care in children: Impact of traumatic stress symptoms. *Children's Health Care*, *40*(2), 116–129. doi:10.1080/02739615.2011.564564

Meentken, M. G., Van Beynum, I. M., Aendekerk, E. W. C., Legerstee, J. S., El Marroun, H., Van Der Ende, J., … Utens, E. M. W. J. (2018). Eye movement desensitization and reprocessing (EMDR) in children and adolescents with subthreshold PTSD after medically related trauma: Design of a randomized controlled trial. *European Journal of Psychotraumatology*, *9*(1), 1536287. doi:10.1080/20008198.2018.1536287

Meiser-Stedman, R., Smith, P., Glucksman, E., Yule, W., & Dalgleish, T. (2008). The posttraumatic stress disorder diagnosis in preschool-and elementary school-age children exposed to motor vehicle accidents. *American Journal of Psychiatry*, *165*(10), 1326–1337. doi:10.1176/appi.ajp.2008.07081282

Meiser-Stedman, R., Smith, P., Yule, W., Glucksman, E., & Dalgleish, T. (2017). Posttraumatic stress disorder in young children three years post-trauma: Prevalence and longitudinal predictors. *The Journal of Clinical Psychiatry*, *78*(3), 334. doi:10.4088/JCP.15m10002

Pao, M., & Bosk, A. (2011). Anxiety in medically ill children/adolescents. *Depression and Anxiety*, *28*(1), 40–49. doi:10.1002/da.20727

Pinquart, M. (2018). Posttraumatic stress Symptoms and disorders in children and adolescents with chronic physical illnesses: A meta-analysis. *Journal of Child & Adolescent Trauma*, *13,* 1–10.

Ratzer, M., Romano, E., & Elklit, A. (2014). Posttraumatic stress disorder in patients following intensive care unit treatment: A review of studies regarding prevalence and risk factors. *J Trauma Treat*, *3*(190), 2167. 1222 doi:10.4172/2167-1222.1000190

Rissanen, R., Berg, H.-Y., & Hasselberg, M. (2017). Quality of life following road traffic injury: A systematic literature review. *Accident Analysis & Prevention*, *108*, 308–320. doi:10.1016/j.aap.2017.09.013

Shemesh, E., Bartell, A., & Newcorn, J. H. (2002). Assessment and treatment of depression in medically ill children. *Current Psychiatry Reports*, *4*(2), 88–92. doi:10.1007/s11920-002-0040-7

Shemesh, E., Newcorn, J. H., Rockmore, L., Shneider, B. L., Emre, S., Gelb, B. D., . . . Yehuda, R. (2005). Comparison of parent and child reports of emotional trauma symptoms in pediatric outpatient settings. *Pediatrics*, *115*(5), e582–e589. doi:10.1542/peds.2004-2201

Suliman, S., Mkabile, S. G., Fincham, D. S., Ahmed, R., Stein, D. J., & Seedat, S. (2009). Cumulative effect of multiple trauma on symptoms of posttraumatic stress disorder, anxiety, and depression in adolescents. *Comprehensive Psychiatry*, *50*(2), 121–127. doi:10.1016/j.comppsych.2008.06.006

Terr, L. C. (1991). Childhood traumas: An outline and overview. *American Journal of Psychiatry*, *148*(1), 10–20.

Van Meijel, E. P. M., Gigengack, M. R., Verlinden, E., Van Der Steeg, A. F. W., Goslings, J. C., Bloemers, F. W., & Lindauer, R. J. L. (2019). Long-term posttraumatic stress following accidental injury in children and adolescents: Results of a 2–4-year follow-up study. *Journal of Clinical Psychology in Medical Settings*, *26*(1), 1–11. doi:10.1007/s10880-018-9566-7

Wenniger, W. F. M., Van Loon, A. J. J. M., Benoist, R. H. I., & Moleman, N. (1995). De Nederlandse vertaling van de McMaster family assessment device. *Tijdschrift Voor Psychiatrie*, *9*, 746–749.

Wesselhoeft, R., Sørensen, M. J., Heiervang, E. R., & Bilenberg, N. (2013). Subthreshold depression in children and adolescents–a systematic review. *Journal of Affective Disorders*, *151*(1), 7–22. doi:10.1016/j.jad.2013.06.010

Zatzick, D. F., Jurkovich, G. J., Fan, M.-Y., Grossman, D., Russo, J., Katon, W., & Rivara, F. P. (2008). Association between posttraumatic stress and depressive symptoms and functional outcomes in adolescents followed up longitudinally after injury hospitalization. *Archives of Pediatrics and Adolescent Medicine*, *162*(7), 642–648. doi:10.1001/archpedi.162.7.642