Factors Associated with Resilience After Paediatric Injury:

Working Towards a Systemic Model of Resilience

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Introductory Chapter: Thesis Overview

The overall aim of the current thesis was to improve understanding of what factors can help to support children and adolescents who have experienced severe physical trauma. Non-fatal injuries affect up to 30 million young people worldwide each year (World Health Organisation [WHO], 2005). Significant proportions of young people who have to attend Accident and Emergency (A&E) departments as a result of major injury are left with ongoing disabilities (WHO, 2008), which impact on their own and their families' physical, psychological, and social functioning and well-being. Despite these experiences, a number of young people 'bounce back' from such adversity (Le Brocque, Hendrikz, & Kenardy, 2010a, 2010b; Quezada, González, & Mecott, 2016; Windle, 2011).

In recent decades, research surrounding physical injury and disability has changed from a problem-focused emphasis to one of positive psychology and the 'bouncing back' from such trauma and adversity; a notion referred to as resilience (Masten, 2007; Windle, 2011; Rosenberg & Yi-Frazier, 2016). This shift in perspective has also been reflected in wider societal discourses, with mainstream and social media progressively reporting stories of resilience following injury. Government policies and agendas are also promoting resilience specifically as key to supporting the well-being of young people (Challen, Noden, West, & Machin 2011).

To the author's best knowledge, the factors associated with resilience in physical health samples have only been reviewed in adult injury populations or for children and young people with chronic illnesses or conditions. To date, there has not been a review examining resilience following paediatric injury. In order to address this, Chapter 1 of the current thesis outlines a systematic review of studies investigating the factors associated with resilience in children and adolescents following physical trauma. The review revealed a general paucity of

research exploring resilience in this population. The findings demonstrated a lack of consistent evidence for a relationship between a range of demographic and injury-related variables and young person resilience, but revealed a negative relationship between psychological difficulties and resilience. Notably, the review also highlighted the conceptual ambiguity that is apparent across the wider resilience literature (Zolkoski & Bullock, 2012), with a lack of consistency within which resilience was measured and conceptualised. Despite evidence implicating systemic variables (e.g., family, peers) in resilience in paediatric illness and adult injury samples, these factors were not consistently explored in the studies included in the review.

In summary, the review revealed gaps in the literature which related to the use of validated, resilience-specific tools that assess resilience on a continuum (Cosco et al., 2017), the need for multivariate analyses to control for confounding variables, and the systematic investigation of systemic variables that are prominent in other paediatric resilience studies. The need to ensure clarity in the conceptualisation of resilience within research was also highlighted (Rosenberg & Yi-Frazier, 2016).

In order to address some of the limitations documented within the review, Chapter 2 details an empirical study that examined demographic, injury-related, family, and social support variables in relation to resilience in young people who had experienced major physical trauma. The study utilised a validated, resilience-specific measure (Connor-Davidson Resilience Scale [CD-RISC]; Connor & Davidson, 2003) to assess self-reported resilience on a continuum in young people who had attended one of two Major Trauma Centres (MTCs) in the UK. It ran a multiple regression analysis to test the ability of social support factors (The Child and Adolescent Social Support Scale [CASSS]; Malecki, Demaray, & Elliott, 2000, 2014) to predict levels of resilience above and beyond the influence of family environment variables (The Family Relationship Index [FRI]; Holahan &

Moos, 1982; Moos & Moos, 2002, 2009), whilst controlling for the effects of associated demographic and injury factors. The need for further prospective research and clarity when defining and studying resilience is discussed. Clinical implications regarding the focus of assessment, support and intervention to foster resilience are presented.

It is planned that both chapters will be submitted to the Journal of Pediatric Psychology (see Appendix A for author guidelines).

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Chapter 1: Literature Review

Factors Associated with Resilience in Children and Adolescents who have Experienced Physical Trauma or Injury: A Systematic Review[1]

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Abstract

Objective To review the factors associated with resilience in children and adolescents following physical injury, and to review how resilience is measured in this population. **Methods** Electronic searches of four online publication databases were conducted using predefined search terms. Eight articles were selected for review according to predetermined criteria to identify quantitative studies investigating resilience after paediatric injury. An adapted version of the Agency for Research and Healthcare Quality assessment was used to evaluate risk of bias. The results were synthesised narratively. **Results** Findings regarding a number of demographic and pre-injury factors were inconsistent, though the majority found non-significant results. There were no statistically significant relationships between resilience and injury severity. Resilience was associated with lower levels of psychological difficulties. Findings regarding caregiver post-traumatic stress were also inconsistent, however, family and social factors more broadly were not consistently explored. Disparate conceptualisations of resilience were evident, with four studies defining the construct as a lack of post-traumatic stress symptoms whilst others utilised resilience-specific measures. **Conclusions** Supporting young people to build resilience following a physical injury may reduce the development and/or levels of psychological difficulties. The lack of consistent evidence for a relationship with demographic factors and injury severity may suggest that other influences are more pertinent to a young person's sense of resilience. The paucity of literature available, inconsistencies found and methodological limitations noted indicate that the results should be interpreted with caution. Future research exploring the role of family and social factors is recommended. Discussion regarding the conceptual ambiguity surrounding resilience is presented.

Keywords systematic review; resilience; children; adolescents; physical injury; paediatric

Introduction

Globally, 10 to 30 million children and adolescents experience non-fatal physical injuries each year (World Health Organisation [WHO], 2005), which often require hospitalisation and lead to some degree of disability (WHO, 2008). Though difficult to accurately classify, the vast majority of these injuries are thought to be unintentional; caused by accidents (i.e., falls, road traffic accidents, drowning, burns) rather than intentional violence or neglect (Harvey, Towner, Peden, Soori, & Bartolomeos, 2009). The most common injuries sustained by young people worldwide are head injuries, with fractures identified as the most common category of injury (WHO, 2008). The physical, psychological, and social impact of physical trauma on the lives of young people can be enduring, however many appear to 'manage well' despite the consequences of their injuries (Evans et al., 2003; Price, Kassam-Adams, Alderfer, Christofferson, & Kazak, 2016).

Defining and Researching Resilience

A focus on those who 'manage well', or 'bounce back' and show resilience following adversity, has become of increased interest to researchers (Windle, 2011). Resilience theory focuses on strengths rather than weaknesses, and the emergence of studies focusing on this construct over recent decades has represented a notable move away from purely deficit models of trauma and adversity (Fergus & Zimmerman, 2005; Southwick, Bonanno, Masten, Panter-Brick, & Yehuda, 2014).

In a recent review, Zolkoski and Bullock (2012) summarised three waves of resilience research and theory during the previous four decades. The first wave tended to focus on understanding and preventing 'psychopathology', with the explicit acknowledgment of children who progressed well despite risk. The second wave focussed on the identification of processes that account for the correlates of resilience (e.g., family interactions, self-

regulation), and third, a focus on how to promote resilience via prevention, intervention and policy. Masten (2007) proposed a fourth wave, focusing on multiple levels of analysis – "from the molecular to the global, over varying time scales" (p. 923).

Despite the increased prevalence of resilience research, complexities and inconsistencies within how the construct and its theory are conceptualised remain evident (Johnston et al., 2015; Luthar, Cicchetti, & Becker, 2000; Masten, 2007). However, following a review of 271 resilience articles, Windle (2011) proposed three key features of the construct: i) the experience of adversity or risk, ii) the presence of resources to offset the effects of adversity, and iii) positive adaptation or avoidance of negative outcomes. Windle ultimately summarised resilience as "the process of effectively negotiating, adapting to, or managing significant sources of stress or trauma. Assets and resources within the individual, their life and environment facilitate this capacity for adaptation and 'bouncing back' in the face of adversity" (Windle, 2011, p. 163). In this sense, many authors resist the notion of resilience as an unchangeable, inherent trait; rather denoting it as a dynamic construct that all children and young people can demonstrate if suitable systems are in place (Luthar & Cicchetti, 2000; Masten, 2001).

Resilience in Children and Adolescents

Earlier research with children and adolescents tended to identify 'internal' or individual characteristics and attributes that contribute to resilience, such as good problem-solving, an 'easy' temperament, social competence, positive self-esteem, self-efficacy, autonomy, and optimism (Masten, 2001; Masten, Best, & Garmezy, 1990; Rutter, 1985; Smith & Carlson, 1997). Subsequently, there has been increased focus on 'external' or systemic factors, often described in relation to the three systems surrounding a child: the family, the school, and the community (Howard, Dryden, & Johnson, 1999). The systemic

factors associated with resilience in youth include availability and interest of caregivers, family cohesion, structure and consistency at home, warmth, stability, low parental stress, positive peer relationships, and community support (Afifi & MacMillan, 2011; Howard et al., 1999; Joshi & Lewin, 2004; Rak & Patterson, 1996).

These findings predominantly originate from studies focussing on childhood maltreatment, disasters and social disadvantage. However, research examining resilience in paediatric (i.e., child and adolescent physical health) populations continues to increase.

Resilience and Paediatric Illness

To date, in paediatric samples, research has tended to focus on young people with chronic medical conditions, such as cancer, diabetes, and chronic pain (Hilliard, McQuaid, Nabors, & Hood, 2015), rather than physical trauma or injury. To the authors' knowledge, two systematic reviews (unpublished doctoral theses) exploring the factors associated with resilience in chronic health populations have been conducted (Cuddy, 2015a; McNulty, 2015). The reviews summarised certain individual factors, such as coping and academic attainment, and systemic factors, such as relationships with family and peers, as significantly associated with resilience. They also noted inconsistencies in findings regarding demographic and illness-related variables, such as age, duration, and pain. McNulty (2015) highlighted that all of the studies that examined family variables (e.g., cohesiveness) and peer factors (e.g., positive relationships) found some association with young person resilience, irrespective of medical condition. Negative associations with emotional problems and positive correlations with psychological well-being were also noted across multiple studies within the reviews.

Resilience and Adult Physical Illness and Injury

In a review of 52 studies, Stewart and Yuen (2011) identified a number of factors associated with resilience in adults with physical illness. They posited a number of

psychological variables (e.g., self-efficacy, self-esteem, optimism, mastery, acceptance of illness, hope) and coping strategies (e.g., positive cognitive appraisal, spirituality, active coping) associated with resilience. They also concluded that social support was highly predictive of resilience in this population.

In adult physical trauma, recent studies have posited task-oriented coping and perceived social support as predictive of resilience following brain injury; with injury severity, premorbid intelligence, and cognitive flexibility found not to be significant (Hanks, Rapport, Waldron Perrine, & Millis, 2016). Depression, anxiety and stress have also been negatively associated with resilience in adults following spinal cord injury and traumatic injury more generally, with no significant associations between resilience and the degree of pain, aetiology, type, or time since injury (Driver et al., 2016; Kilic, Dorstyn, & Guiver, 2013; Rainey, Petrey, Reynolds, Agtarap, & Warren, 2014). Similarly, Zarzaur, Bell, and Zanskas (2017) found no significant association between a number of demographic and injury-related factors (age, ethnicity, gender, mechanism of injury, mortality risk, injury severity, presence of hypotension on admission, and insurance status) and the probability of belonging to a high resilience group in adults who had sustained physical injuries.

Measuring Resilience

As a result of increasing empirical literature, a number of instruments and analysis procedures have been developed to operationalise resilience (Ahern, Kiehl, Sole, & Byers, 2006; Bonanno, 2005; Windle, Bennett, & Noyes, 2011) in order to quantitatively assess which “assets and resources” facilitate the capacity for “bouncing back” (Windle, 2011, p. 163). The current review will refer to studies that have operationalised resilience explicitly utilising quantitative measures in order to ascertain the factors associated with it. A summary of the measures utilised is included in the results.

Aims of the Current Review

Though the factors associated with resilience in young people with chronic medical conditions and adult traumatic injury could pertain to children and adolescents who have experienced physical trauma, the variables of significance are thought to differ according to the population and context studied (Fergus & Zimmerman, 2015; Stewart & Yuen, 2011). To the author's knowledge, there are no reviews to date exploring the factors associated with resilience in young people following paediatric injury. Therefore the aims of this current review were to: a) systematically review and synthesize available literature surrounding the factors associated with resilience in children and adolescents following physical trauma or injury, and b) review the way in which resilience is operationalised and measured in this area, considering implications for future research.

Method

Where appropriate, the following methodology was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA; Moher, Liberati, Tetzlaff, & Altman, 2009) and recommendations for systematic reviews in paediatric psychology (Palermo, 2013). The guidelines provide an evidence-based minimum set of items for the content of systematic reviews.

Pre-registration of Review Protocol

The review protocol was pre-registered with the International Prospective Register of Systematic Reviews (PROSPERO) with the registration number CRD42017074064.

Study Eligibility

Inclusion criteria included: a) quantitative studies using cross-sectional, correlational, case-control, or prospective study design, b) representing original research, c) full text written

in English or translation available, d) samples aged ≤ 18 years old (or mean age ≤ 18 years old with an upper age limit of 21), e) sampled participants who have experienced a physical trauma or physical injury requiring hospital/medical input, f) measure or explicitly conceptualise resilience quantitatively using scales(s) or subscale(s) that have been referenced for reliability and/or validity.

Exclusion criteria included: a) qualitative research, b) case studies, c) experimental designs or intervention studies, d) review, commentary, or discussion articles, e) adult samples, f) studies that focus on trauma that does not represent a primary physical injury (e.g., sexual trauma, trauma considered primarily in the context of physical violence), g) studies that sample participants with chronic medical conditions or illnesses, h) studies that measure or conceptualise resilience using a scale that lacks psychometric properties or measures it qualitatively, i) studies that measure only the resilience of family members, carers, peers or professionals of young people who have experienced physical trauma.

Studies that purported to focus on resilience but did not explicitly identify which quantitative measure(s) represented the construct were not included. Studies that measured concepts that may overlap with resilience (e.g., post-traumatic growth, adaptation, social competence), and were not explicitly operationalised by the authors as encompassing resilience within their methodology, were not included so as to ensure focus and consistency within the review. Studies that measured resilience as an absence of negative outcomes (e.g., an absence of post-traumatic stress disorder [PTSD]) were only included if authors explicitly conceptualised this outcome as representing resilience.

Data Sources and Search Strategy

The electronic publication databases PsycINFO, Medline, CINAHL Plus and Web of Science were searched from their date of inception by the first author (FW) for peer-reviewed

journal articles and unpublished dissertations. The following search terms combined with Boolean operators were used to search the title, abstract and keyword list of articles: resilien* **AND** child* OR pediat* OR paediat* OR adolesc* OR teen OR infant OR infancy OR "young people" **AND** "physical injury" OR "physical trauma" OR injur* OR "accident* injur*" OR "acute* injur*" OR "trauma* injur*" OR "road traffic accident" OR amput* OR orthoped* OR orthopaed* OR burn OR burns OR "spinal cord injur*".

Study Selection

The original database searches were undertaken on 14th October 2017. First, any duplicate records were identified and excluded. Second, titles, abstracts and keyword lists of all the papers generated from the database search were screened by the first author to determine whether they met the inclusion criteria (a sample of papers were screened by an independent reviewer to check for consistency in selection). Third, the full text of papers that met the inclusion criteria were read by the first author (FW) and reviewed for eligibility (a selection were read by the third author to ensure consistency). Should eligibility be unclear, a discussion was held with the third author (VG) and consensus reached.

Authors of eligible papers were contacted regarding any other relevant published or unpublished research to minimise the problem of publication bias. This contact resulted in seven additional papers though none were identified as eligible. References in eligible papers and key review articles were also hand-searched to ensure a thorough review of the literature. This provided one additional article, which did meet the inclusion criteria having been translated from Spanish. To ensure up-to-date results, the database search and process described above was undertaken again in February 2018. This identified 48 new articles; all of which were excluded either as duplications or as failing to meet eligibility at initial screening. Finally, the systematic study selection led to eight articles (seven peer-reviewed

articles and one dissertation) deemed eligible for review (Fig. 1). Figure 1 illustrates a flow diagram of the search and screening strategy used, based on PRISMA guidelines (Moher et al., 2009).

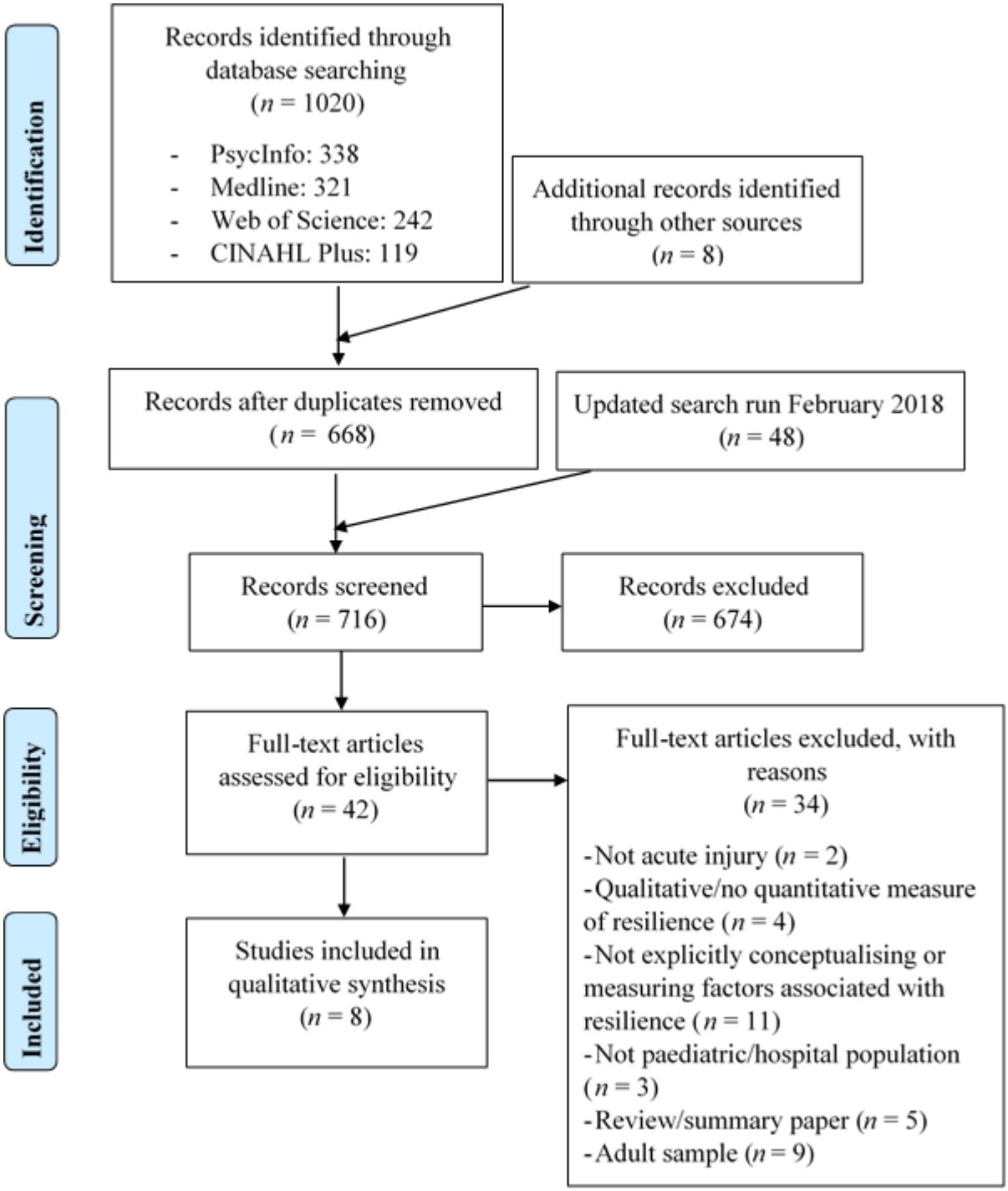

Figure 1. Flow diagram of study selection, based on the PRISMA guidelines.

Data Extraction

Extraction of study details, participant characteristics and main research findings was undertaken by the first author (FW) using a purposely developed data collection form (see Tables 1 and 2). This was independently checked for accuracy by the third author (VG). Any discrepancies in the information recorded were discussed and a consensus reached. Only aims and findings relevant to the current review were extracted.

Assessment of Quality and Risk of Bias

Guidelines stipulate that the validity of studies and the risk of bias in the results should be assessed as part of a systematic review (Moher et al., 2009). The PRISMA guidelines currently do not provide specific recommendations with regards to executing the assessment, but some authors increasingly promote the use of domain-based evaluation; focussing on selection bias, performance bias, detection bias, attrition bias, and reporting bias of included studies (Higgins & Green, 2011; Palermo, 2013).

To evaluate the risk of bias, the Agency for Research and Healthcare Quality assessment was used (Forrester, Jomar, Slater, Mitzman, & Taylor, 2017; Taylor, Hutton, & Wood, 2015; Williams, Plassman, Burke, Holsinger, & Benjamin, 2010) with items selected that were relevant to the methodologies included in the review (Appendix B). This measure considers factors associated with the aforementioned areas of bias and can be adapted to a specific context. It required a rating of: ‘yes’, ‘no’, ‘partially’, ‘cannot tell’, or ‘not applicable (n/a)’ with regards to meeting quality criteria in those specified areas. Independent assessments of included papers were undertaken by the first author (FW) and an independent reviewer. Quality ratings from the two assessors were combined, with disagreements resolved and consensus achieved through discussion. The assessment of quality was conducted only in

relation to the data and analyses extracted (i.e., the findings and analyses relevant to the review question).

Data Synthesis

Due to the heterogeneity of outcome measures used across the studies and the small number of papers included in the review, meta-analysis was not deemed to be appropriate. A narrative synthesis was therefore conducted.

Results

Characteristics of Included Studies

The participant and study characteristics of the included studies are displayed in Table 1. The eight studies were published between 2010 and 2016. The studies were conducted in various countries – two in the USA, three in Australia, two in Mexico, and one in the UK – between 2002 and 2013. Four studies did not report the dates of recruitment (Le Brocque, Hendrikz, & Kenardy, 2010a, 2010b; Tonks et al., 2011; Powers, 2011) and one study's recruitment and data collection occurred over 10 years prior to publication (Brown et al., 2016). The aims of each study varied.

Four studies were prospective in design, three were cross-sectional, and one was a case-control. Sample size varied from 20 to 205 young people and five of the studies recruited young person-caregiver dyads. The age of child and adolescent participants ranged between one to 19 years. Three studies recruited from medical inpatient samples (Brown et al., 2016; Le Brocque, Hendrikz, & Kenardy, 2010a, 2010b), two recruited from medical outpatient samples (Quezada, González, & Mecott, 2014, 2016), one study recruited from both an inpatient and outpatient sample (De Young, Kenardy, Cobham, & Kimble, 2012), one recruited from charity organisations and a community service (Tonks et al., 2011), and one recruited from a burns camp (Powers, 2011). The control group for the case-control study

Table 1

Main characteristics of included studies

Author[1]/ Origin	Design	Study *N* at recruitment	Sample characteristics[2]	Type of injury	Details of injuries reported within sample	Time since injury
Brown et al. (2016) USA	Prospective	204 (caregiver-young person dyads) (at acute assessment, at 3 months (n = 140), 6 months (n = 41), 12 months (n = 62) and 18 months (n = 47) post-injury) *151 completed both acute and at least one follow-up assessment over the 18-month follow-up period*	Age 7-18 years (*M* = 13.54, *SD* = 3.49) Male / female 74.3% / 25.7%	Severe injury (burn, violent, non-violent)	*Type of severe injury* Burn 20.1%, Nonviolent 57.4%, Violent 22.5%	range = acute-18 months
De Young et al. (2012) Australia	Prospective	130 (caregiver of young person) (at 1 month (n = 130) and 6 month (n=125) post-injury)	Age 1-6 years (*M* = 2.7, *SD* = 1.54) Male / female 52% / 48%	Burn injury	*%TBSA (data missing from 3 children)* *M* = 3.24, *SD* = 4.30 range = 1-27 *Burn type* Scald 41%, Contact 39%, Fire/flames 10%, Chemical/electrical 3%, Friction 7%	range = 1 month-6 months
Le Brocque, et al. (2010a)[a] Australia	Prospective	190 (caregiver-young person dyads) (at 3-14 days (n = 175), at 4-7 weeks (n = 169), up to 6 months (n = 158)	Age 6-16 years (*M* = 10.7, *SD* = 2.3) Male / female 63% / 37%	Traumatic accidental injury (not including head injury or injury following interpersonal violence)	*Type of accidental injury* Fracture/dislocation/laceration/other = 87% Burns/internal/multiple = 13%	range = 3 days-6 months
Le Brocque et al. (2010b)[a] Australia	Prospective	205 (caregiver-young person dyads) (at 3-14 days (n = 180), at 4-6 weeks (n = 172), up to 6 months (n = 160)	Age 7-16 years (*M* = 10.69, *SD* = 2.31) Male / female 64% / 36%	Traumatic accidental injury (not including head injury or injury following interpersonal violence)	*Type of accidental injury* Falls 39%, Bike accidents 19%, Sporting injuries 12%, Car/motor vehicle accident 11%	range = 3 days-6 months
Powers (2011) USA *unpublished*	Cross-sectional	20	Age 9-18 years (*M* = 13.3) Male / female 65% / 35%	Burn injury	*%TBSA* *M* = 18.79, range = 1-55	*M* = 5.84 years range = 10 months-16.03 years
Quezada et al. (2014)[b] Mexico	Cross-sectional	57	Age 7-19 years (*M* = 12.56, *SD* = 3.55) Male / female 56.1% / 43.9%	Burn injury	*%TBSA* *M* = 31.4, *SD* = 18.94 range = 1-83 *Cause of burn injury* Total sample: Scald or fire burn (80.7%), chemical, electrical or contact burn (19.3%) Males: fire (46.9%), scalds (31.3%), chemical (12.5%), electrical (9.4%) Females: scalds (60%), fire (24%), chemical (31.3%), electrical (4%), contact (4%)	Minimum three months
Quezada et al. (2016)[b]	Cross-sectional	51 (caregiver-young person dyads)	Age 7-18 years (*M* = 12, *SD* = 3)	Burn injury	*%TBSA* *M* = 31, *SD* =19	*M* = 6 years *SD* = 4

Mexico			Male / female 56.9% / 43.1%		range = 1-83 *Cause of burn injury* Males: fire (48.3%), scalds (34.5%), chemical (10.3%), electrical (6.9%) Females: scalds (59.1%), fire (27.3%), chemical (9.1%), electrical (4.5%)	range = 4 months-17 years
Tonks et al. (2011) UK	Case-control	91 (21 with ABI; 70 without ABI)	Age 9-15 years (ABI: *M* = 12.5, *SD* = 2.2) (Without ABI: *M* = 12.6, *SD* = 1.6) Male / female ABI: 61.9%/ 38.1% Without ABI: 40% / 60%	ABI	*ABI aetiology* TBI = 61.9%, Viral infection = 14.3%, Tumour = 9.5%, Haemorrhage = 4.8%, Stroke = 4.8%, Hypoxia = 4.8% *TBI estimates of length of post-traumatic amnesia* *M* = 4.9 days, range = 2 days-12 weeks (indicating moderate-to-severe brain injury)	*M* range for different ages = 3.5-9.6 years

Note: ABI = acquired brain injury, *M* = mean, *SD* = standard deviation, TBI = traumatic brain injury, TBSA = total body surface area, UK = United Kingdom, USA = United States of America
[1]Studies with the same superscript use samples that are not independent from each other.
[2]Age range reported refers to the age range of the child/adolescent samples within each study.

was recruited from school samples (Tonks et al., 2011). Four studies investigated young people with burn injuries, three studies sampled children and adolescents who had experienced severe or traumatic injuries more broadly, and one study explored young people with acquired brain injuries (ABI), of which the majority had occurred as a result of traumatic brain injury (TBI).

Two studies recruited from the same sample and investigated young person-caregiver dyads (Le Brocque et al., 2010a, 2010b). A further two studies also recruited from the same sample, with one focussing on the young person sample only (Quezada et al., 2014) and the other exploring young person-caregiver dyads (Quezada et al., 2016). All studies were treated as independent in analysis.

The four prospective studies had varying follow-up periods. One study collected data at one month and six months post-injury (De Young et al., 2012). Two studies (using the same sample) collected data at three to 14 days, four to six or four to seven weeks respectively, and up to six months post-admission (Le Brocque et al., 2010a, 2010b). One study collected data at acute assessment, three months, six months, 12 months, and 18 months post-injury (Brown et al., 2016). However, due to varying attrition levels at each time point in this latter study, the authors combined the follow-up periods for analysis, focussing on those who completed acute assessment and any one follow-up.

Measures of Resilience

A range of quantitative methods and tools were utilised to measure resilience across the studies. In each of the four prospective studies, participants were initially categorised into one of three or four recovery trajectories. Resilient participants (representing a resilient trajectory) were identified as those with an absence of acute stress and/or post-traumatic stress. One study used the clinician-rated Diagnostic Interview for Children and Adolescents

(DICA; Reich, 2000) to categorise participants, with resilience defined as an absence of acute stress disorder (ASD) and an absence of PTSD at any follow-up point (Brown et al., 2016). One study used the caregiver-rated Diagnostic Infant Preschool Assessment (DIPA – PTSD; Scheeringa & Haslett, 2010), with resilient trajectories conceptualised as an absence of PTSD diagnosis at both time points (De Young et al., 2012). Two studies (using the same sample) utilised the self-rated Total Subjective Distress (TSD) scores from the Child Impact of Event Scale (CIES; Dyregrov, Kuterovac, & Barath, 1996), defining resilience as low/non-clinical scores across all time points (Le Brocque et al., 2010a, 2010b).

Across the other four studies, two different resilience-specific measures were used. Two studies used the self-rated Resiliency Scales for Children and Adolescents (RSCA; Prince-Embury, 2007). The RSCA comprises three subscales: sense of mastery, sense of relatedness, and emotional reactivity, which consist of two index scores: resilience resourcefulness and resilience vulnerability. One study ran analyses according to the three subscales (Powers, 2011), whilst the other utilised the index scores of resourcefulness and vulnerability (Tonks et al., 2011). Internal consistency for the three subscales and the two indexes of the RSCA is reported to be good to excellent (α = .85 to .97) in children and adolescents (Prince-Embury, 2010).

The final two studies employed the self-rated Resilience Questionnaire for Children and Adolescents (RQCA; González-Arratia, 2011). One study ran analyses for all subscales of the measure (internal protective factors, external protective factors, empathy) and its total (Quezada et al., 2014), whereas the other utilised the total resilience score only (Quezada et al., 2016). The measure is reported to possess excellent internal validity (α = .91; Quezada et al., 2016).

Results of Assessment of Risk of Bias

The results of the assessment of risk of bias are presented in Table 2. Common methodological issues related to study design, justification of sample size, accounting or controlling for confounding variables, and the assessment of resilience.

First, the design and analysis within the studies meant that causality could not be inferred. Second, sampling and selection bias was apparent across the included studies. The convenience and self-selecting sampling used reduced the representativeness of samples and generalisability of the findings. For example, the high proportion of non-responders noted across the studies might represent the non-participation of those with more severe difficulties. Furthermore, four of the five studies looking at young person-caregiver dyads noted the higher proportion of female caregivers participating compared to male (93%, De Young et al., 2012; 84%, Le Brocque et al., 2010a, 2010b; 76.5% Quezada et al., 2016); the other did not report data regarding caregiver gender (Brown et al., 2011). Of these, only one considered gender within statistical analysis (Quezada et al., 2016). A sampling bias is possible and the findings may not generalise to other caregiver gender identities.

Third, all studies failed to conduct or report a priori power calculations to justify their sample size. Modest sample sizes were also evident for three of the studies (Powers, 2011; Quezada, 2014, 2016). The studies might have therefore been underpowered with increased probability of a Type-II error (i.e., a “false negative” result). The results must therefore be interpreted with caution.

Fourth, most studies did not fully control for potentially confounding variables. Three studies conducted analyses relevant to the current review question that did not control for confounding variables (correlational: Powers, 2011; Quezada et al., 2014, and dual trajectory: Le Brocque et al., 2010b). However, this was often deemed appropriate for their

Table 2

Risk of bias assessment of included studies

Author	Unbiased selection of cohort	Selection minimises baseline differences[a]	Sample size calculation/ justification	Adequate description of participant sample	Validated measure for assessing resilience	Validated measure for assessing other variables	Assessors blind to resilience/ clinical status	Adequate follow-up period[a]	Minimal missing data	Controls for confounders	Analytic methods appropriate
Brown et al. (2016)	Partially	n/a	No	Yes	Partially	Yes	Cannot tell	No	Partially	Yes	Partially
De Young et al. (2012)	Partially	n/a	No	Yes	Partially	Partially	No	Partially	Yes	Partially	Yes
Le Brocque et al. (2010a)[a]	Partially	n/a	No	Yes	Partially	Yes	n/a	Partially	Partially	Partially	Yes
Le Brocque et al. (2010b)[a]	Partially	n/a	No	Yes	Partially	Partially	n/a	Partially	Partially	No	Cannot tell
Powers (2011) *unpublished*	Partially	n/a	No	Yes	Yes	Yes	n/a	n/a	Yes	No	Yes
Quezada et al. (2014)[b]	Partially	n/a	No	Yes	Partially	Yes	n/a	n/a	Yes	No	Yes
Quezada et al. (2016)[b]	Partially	n/a	No	Yes	Partially	Partially	n/a	n/a	Yes	Partially	Partially
Tonks et al. (2011)	Partially	No	No	Yes	Yes	Partially	Yes	n/a	Yes	Partially	Yes

Note: n/a = not applicable
[a] Criteria only applicable to certain designs.

given sample size and/or study aim. Four studies (De Young et al., 2012; Le Brocque et al., 2010a; Quezada et al., 2016; Tonks et al., 2011) identified and controlled for some potentially confounding variables (e.g., injury-related, demographic), but most often failed to identify and control for the impact of other systemic factors noted in previous paediatric resilience literature. The relationships found with resilience may therefore be confounded by uncontrolled variables.

Finally, four of the studies failed to use a resilience-specific measure. Instead, these studies used measures of acute and/or post-traumatic stress, with an absence or lower levels of which being conceptualised as resilient (Brown et al., 2016; De Young et al., 2012; Le Brocque et al., 2010a, 2010b). The use of this approach in validly representing the construct of resilience is one of contention and debate, which is explored further in the discussion. The remaining four studies did utilise resilience-specific measures. However, two utilising the same sample did not report full psychometric details; referencing only its use in one other study and the internal validity (Quezada et al., 2014, 2016).

Factors Associated with Resilience

Table 3 summarises the main findings of the studies included in the review. Details of the measures utilised and variables investigated in relation to resilience are also included.

Demographic and pre-injury factors.

Gender. Four studies explored associations between gender and resilience; three prospective and one cross-sectional. Only one of the prospective studies found a significant association, with males more likely to be in the resilient trajectory group compared to the chronic trajectory group even after correcting for multiple comparisons (Brown et al., 2016). However, there were no significant gender differences between the resilient trajectory group and other trajectory groups. The other three studies also revealed no statistically significant

Table 3

Main findings of included studies

Author	Aim(s)	Measure of young person resilience	Variables investigated in relation to young person resilience (measures used)	Child versus parent/caregiver (cg) report	Analyses	Summary of main findings[a]	*p*	Effect size
Brown et al. (2016)	1 – To characterize the prevalence of paediatric injury patients into different trajectories 2 – To examine predictors of the four transition groups	DICA - *Resilient group conceptualised by an absence of ASD (DICA-ASD) and PTSD (DICA-PTSD) diagnosis at any time point* 4 trajectories: resilient (no ASD or PTSD), ASD Only, PTSD Only, and chronic (ASD and PTSD)	**Demographics**: gender, age **Injury related**: type (violent vs non-violent), pain (CAPS), morphine dose (no vs low vs high), days in hospital **Psychiatric**: peritraumatic dissociation (DICA-ASD peritraumatic items), internalising (CBCL-int), externalising (CBCL-ext), past PTSD (DICA) **Social context**: SES (parents' occupation), minority status (ethnicity classed as European vs American vs Minority), stressful life events (CLES), family strain (FSI), parental PTSS (PCL-C)	**Both and Other** Demographics = parent/cg Injury-rel = chart review by research staff Pain = child DICA = clinician CBCL = parent/cg CLES = not stated FSI = parent/cg PCL-C = parent/cg	4 MANOVAs for each variable set (univariate and multivariate analysis: pooled Roy's largest root) Post hoc comparisons with Sidak corrected p-values	Approximately half (51.7%, *n* = 78) of the sample was classified as resilient. **Demographics**: Gender significant association with trajectory type ($F(3, 147) = 3.266$) Age not significant **Injury**: Type, pain, morphine dose, days in hospital all not significant **Psychiatric**: Peritraumatic dissociation significant association with trajectory type (pooled $F(3, 147) = 11.890$) Externalising significant association with trajectory type (pooled $F(3, 147) = 2.850$) Internalising not significant Past PTSD not significant **Social**: SES (pooled $F(3, 147) = 2.888$) significant association with trajectory type Parental PTSS (pooled $F(3, 147) = 3.011$) significant association with trajectory type Minority status, stressful life events, FSI all not significant Absence of/lower peritraumatic dissociation (strongest predictor of trajectory) more likely to be in resilient group compared to ASD only (pooled $t = 4.233$), more likely to be in resilient group compared to chronic (pooled $t = 4.985$). Males more likely to be in resilient compared to chronic (pooled $t = 2.984$). All other post hoc comparisons were not significant after correcting for multiple comparisons.	$p = .02$ not sig. not sig. $p < .001$ $p = .04$ not sig. not sig. $p = .04$ $p = .03$ not sig. $p < .001$ $p < .001$ $p = .02$	partial $\eta 2 = .06$ n/a n/a partial $\eta 2 = .20$ partial $\eta 2 = .05$ n/a n/a partial $\eta 2 = .06$ partial $\eta 2 = .06$ n/a
De Young et al. (2012)	1 – To document prevalence and onset of psychological morbidity in young children at 1 and 6 months following burn injury	Diagnostic Infant Preschool Assessment (DIPA - PTSD) - *Resilient group conceptualised by an absence of PTSD diagnosis*	**Age, gender, child trauma hx** **Burn severity** - %TBSA **Psychological morbidity** – MDD, ADHD, ODD, SAD,	**Parent/cg and Other** DIPA = parent/cg Burn severity = child's medical record	Mixed ANOVAs and post hoc comparisons	The majority of children could be classed as having a resilient trajectory (72%, *n* = 90). **Age, gender, %TBSA and child trauma hx**: Entered as covariates: no significant main effects or interactions found therefore not included in final model. **PTSS over time**: Large significant interaction effect between time and group ($F(2, 119) = 30.36$)	not sig. $p < .001$	n/a $\eta 2 = .34$

	2 – To examine the comorbidity between PTSD and other concurrent and new onset psychological reactions 3 – To explore the course and patterns of recovery in children's post-trauma psychological reactions over 6 months	*(DIPA) at both time points (at 1 month and 6 months)* 4 groups classified: resilient (no PTSD), recovery (PTSD at 1 month but not 6 months), chronic (PTSD at 1 and 6 months), delayed-onset (PTSD at 6 months but not 1 month)	specific phobia (relevant modules of DIPA)			Children in resilient group had significantly less PTSS at 1 month than those in chronic group and recovery group. Children in the resilient group had a significantly lower mean number of symptoms at 6 months compared to the recovery group and chronic group. *These results support the validity of the trajectories.* **Psychological morbidity:** ODD, significant medium main effect for group ($F(2, 119) = 8.69$) SAD, significant large main effect for group ($F(2, 119) = 10.75$) Children in resilient group continued to have lower levels of ODD and SAD at 1 month and 6 months. MDD, significant large main effect for group ($F(2, 119) = 20.39$) Resilient group had significantly less depression symptoms at 1 month and 6 months compared to the chronic group. ADHD, significant medium main effect for group ($F(2, 119) = 18.39$) Children in the resilient group had significantly less ADHD symptoms at 1 month and 6 months than the chronic group.	*ps* < .001 *ps* < .001 $p < .001$ $p < .001$ $p < .001$ $p < .001$	 $\eta 2 = .12$ $\eta 2 = .15$ $\eta 2 = .2$ $\eta 2 = .12$
Le Brocque et al. (2010a)	1 – To identify probable trajectories of recovery in children following accidental injury 2 – To identify risk factors affecting the probability of trajectory group membership	CIES - *Resilient group conceptualised by 'well below' clinical levels of TSD for the entire period* 3 groups classified: resilient (low/non-clinical TSD throughout), recovery (initially high/clinical TSD in first 4-6 weeks, then low/non-clinical TSD), chronic high (high/clinical TSD throughout)	**Gender** **Age** **Injury type**: fracture/dislocation/laceration/other vs burns/internal injuries/multiple (complex) **Pre-injury child mental health/behaviour**: Internalising behaviour problems (CBCL-int) Externalising behaviour problems (CBCL-ext) (Non-clinical vs borderline vs clinical)	**Both** CIES = child CBCL = parent/cg Injury = not stated	Trajectory risk factor analyses (odds ratio) *univariate* Multiple risk factor analysis *multivariate*	The majority of children were most likely to belong to a resilient trajectory within normal clinical levels for the entire period (57%, *n* = 109). **Gender**: not significant for either group membership compared to resilient. **Age**: odds of belonging to resilient group compared to recovery group increases significantly if older in age (odds ratio .81 [.67–.97]) No significant difference in age for resilient vs chronic group. **Injury type:** odds of belonging to resilient group compared to chronic increases if have less complex injury type (odds ratio 6.54 [1.41–30.35]). No significant difference in injury type in resilient vs recovery group. **Pre-injury child mental health**: odds of belonging to resilient group increases if had lower levels of pre-injury internalising and externalising behaviour problems compared to both the recovery group (int. odds ratio 1.10 [1.04–1.16]; ext. odds ratio 1.05 [1.01–1.10]) and chronic group (int. odds ratio 1.12 [1.01–1.26]; ext. odds ratio 1.19 [1.01–1.40]). Odds on belonging to resilient group compared to recovery significantly affected by age (older age increasing membership odds) and pre-injury internalising behaviour problems (less internalising behaviour problems increase membership odds). Odds on belonging to resilient group compared to chronic significantly affected by pre-injury internalising behaviour problems (less internalising behaviour problems increase membership odds).All other variables became non-significant.	not sig. $p = .02$ $p = .02$ *ps* < .05	n/a
Le Brocque	1 – To differentiate	CIES - *Resilient group*	**Parental PTSS/resilience** –	**Both** CIES = child	Dual trajectory	74 % of parents with a trajectory of few symptoms (resilient) had children with a trajectory of few symptoms (parent resilient and child		

et al. (2010b)	patterns of PTSS in parents following child accidental injury 2 – To explore the relationship between parent and child recovery patterns	*conceptualised by 'well below' clinical levels of TSD for the entire period* 3 groups classified: resilient (low/non-clinical TSD throughout), recovery (initially high/clinical TSD in first 4-6 weeks, then low/non-clinical TSD), chronic high (high/clinical TSD throughout)	IES *Resilient group conceptualised by 'well below' clinical levels of TSD for the entire period*	IES = parent/cg	analysis using data from this study and Le Brocque et al (2010a)	resilient probability = .51) or with a recovery by 6 months (parent resilient and child recovery probability = .23).		
Powers (2011)	1 – How are resilience factors related to severity of PTSS? 2 – How are QOL outcomes related to resilience?	RSCA (three subscales - sense of mastery, sense of relatedness, and emotional reactivity)	**Demographics**: household income **PTSS** – UCLA PTSD-RI **QOL** – PedsQL 4.0 (psychosocial, physical, total health functioning)	**Both** Demographics = parent/cg UCLA PTSD-RI = child RSCA = child PedsQL = both	Pearson Correlation (*r*)	**Demographics:** <u>Higher household income</u> was significantly associated with higher mastery higher relatedness No significant association with emotional reactivity **PTSS:** <u>Lower levels of PTSS</u> significantly associated with higher relatedness lower emotional reactivity No significant association with mastery **QOL:** <u>Higher parent-rated QOL</u> significantly associated with higher mastery higher relatedness lower emotional reactivity <u>Higher self-rated QOL</u> significantly associated with higher mastery higher relatedness lower emotional reactivity	 $p < .05$ $p < .05$ not sig. $p < .05$ $p < .01$ not sig. $p < .01$ $p < .01$ $p < .05$ $p < .01$ $p < .01$ $p < .01$	 $r = .45$ $r = .47$ n/a $r = -.49$ $r = .67$ n/a $r = .76$ $r = .68$ $r = -.56$ $r = .81$ $r = .86$ $r = -.74$
Quezada et al. (2014)	1 – To identify the levels of resilience in a population of paediatric burn survivors. 2 – To explore differences in resilience levels according to	RQCA (internal protective factors, external protective factors, empathy, total resilience)	**Demographics**: gender, age **Medical**: %TBSA	**Child and Other** RQCA = child Medical = child's medical record	Mann Whitney U (*Z*) Spearman's Rank Correlation (Spearman's ρ)	**Gender:** No significant differences in total resilience scores between males and females. No significant differences in subscales: internal, external, and empathy. **Age:** No significant association between age and resilience across males and females. **%TBSA:** No significant association between TBSA and resilience across males and females.	not sig. not sig. not sig.	n/a n/a n/a

	demographic variables.							
Quezada et al. (2016)	To explore the relationship between patients' and caregivers' resilience and PTSS in paediatric burn survivor adjustment.	RQCA (total resilience score used)	**Burn injury variables: %**TBSA, time since injury, age at time of injury **Caregiver resilience** – RESI-M **Caregiver PTSD** – DTS (avoidance symptoms, intrusion symptoms, hyperarousal symptoms)	**Both** RQCA = child RESI-M = caregiver DTS = caregiver Medical = child's medical record	Spearman's Rank Correlation (Spearman's ρ)	**Burn injury, caregiver resilience, caregiver PTSD:** Sample of male and female caregivers (*N* = 51): Higher patient resilience significantly associated with longer time since injury younger age at time of injury %TBSA, caregiver resilience, caregiver PTSD all not significant Sample of male caregivers (*n* = 12): Higher patient resilience associated with higher levels of male caregiver PTSD intrusion symptoms avoidance symptoms hyperarousal symptoms %TBSA, time since injury, age at injury, caregiver resilience all not significant Sample of female caregivers (*n* = 39): Higher patient resilience significantly associated with longer time since injury younger age at time of injury lower intrusion symptoms in female caregivers %TBSA, caregiver resilience, caregiver avoidance and hyperarousal all not significant	 *p* < .01 *p* < .01 not sig. *p* < .05 *p* < .05 *p* < .05 not sig. *p* < .01 *p* < .01 *p* < .05 not sig.	 ρ = .46 ρ = -.41 n/a ρ = .58 ρ = .69 ρ = .68 n/a ρ = .61 ρ = -.52 ρ = -.39 n/a
					SEM	The main predictor of patient resilience was age at the time of burn (with higher resilience in younger survivors), followed by caregiver intrusion symptoms (with higher resilience for lower symptoms).		
Tonks et al. (2011)	1 – To differentiate the resiliency resources of a group of children with ABI from a sample of matched non-injured controls. 2 – To examine whether depression and anxiety levels were correlated with reported resiliency 'resources' and 'vulnerability' 3 – To determine whether potential relationships	RSCA (subscales used – resourcefulness and vulnerability)	**Psychological difficulties of young person:** Depression (BDI-Y) Anxiety (BAI-Y) **Socio-emotional behaviour of young person** – SDQ parent version (seven domains: overall stress experienced by the child, hyperactivity, peer problems, emotional symptoms, conduct problems, pro-social behaviour and impact of difficulties) **Executive functioning (EF)** – The dysexecutive	**Both** RSCA = child BDI-Y = child BAI-Y = child SDQ = parent/cg DEX-C = parent/cg	Independent t-tests Pearson Correlation (*r*) Mediation analysis (*z*)	Children with ABI had lower resilience scores than non-injured controls. **Psychological difficulties:** In young people with ABI Lower depression associated with higher resilience resourcefulness lower vulnerability Lower anxiety associated with higher resilience resourcefulness lower vulnerability **EF & SDQ:** There was a significant initial relationship between resilience resourcefulness and socio-emotional behaviour (*t*(91) = 4.6). But this became nonsignificant when EF was controlled for in the mediation. Level of EF abilities mediates the relationship between resilience and socio-emotional behavioural functioning (Sobel: *z* = 4.74).	*p* < .05. *p* = .05 *p* = .05 *p* = .05 *p* = .05 *p* < .001 *p* < .001	 *r* = -.5 *r* = .5 *r* = -.4 *r* = .5 *β* = .45

	between resilience and socio-emotional behaviour are mediated by EF.	questionnaire for children (DEX-C)

Note: data reported to two significant figures where possible; ABI = acquired brain injury, ADHD = attention deficit hyperactivity disorder, ANOVA = analysis of variance, ASD = acute stress disorder, BAI-Y = Beck Anxiety Inventory for Youth, BDI-Y = Beck Depression Inventory for Youth, CAPS = Coloured Analogue Pain Scale, CBCL = Child Behavior Checklist, CFQ = Culture Fair Test Quotient, CIES = Child Impact of Event Scale, DEX-C = The dysexecutive questionnaire for children, DICA = Diagnostic Interview for Children and Adolescents, DIPA = Diagnostic Infant Preschool Assessment, DTS = Davidson Trauma Scale, EF = executive functioning, FSI = Family Strain Index, hx = history, IES = Impact of Event Scale, CLES = Coddington Life Events Scale, MANOVA = multivariate analysis of variance, MDD = major depressive disorder, ODD = oppositional defiant disorder, PCL-C = PTSD Checklist-Civilian version, PedsQL 4.0 = Pediatric Quality of Life Inventory, Version 4.0, PTSD = post-traumatic stress disorder, PTSS = post-traumatic stress symptoms, QOL = quality of life, RESI-M = Mexican Resilience Scale, RQCA = Resilience Questionnaire for Children and Adolescents, RSCA = Resiliency Scales for Children and Adolescents, SAD = separation anxiety disorder, SD = standard deviation, SEM = structural equation modeling, TBSA = total body surface area burned, TSD = Total Subjective Distress, SDQ = Strengths and Difficulties Questionnaire, UCLA PTSD-RI = University of California at Los Angeles Posttraumatic Stress Disorder Reaction Index for Diagnostic and Statistical Manual—Fourth Edition.
[a] Factors significantly associated with resilience are underlined.

associations between gender and resilience (De Young et al., 2012; Le Brocque et al., 2010a; Quezada et al., 2014).

Age. The same four studies also investigated age and resilience. One study found that the odds of belonging to the resilient trajectory group (defined by low/non-clinical distress scores) increased if participants were older in age, but only in comparison to the recovery group (characterised by high/clinical acute distress scores, then low/non-clinical scores); there were no increased odds of resilient group membership according to age compared to the chronic group (with high/clinical distress scores throughout; Le Brocque et al., 2010a). In multivariate analysis, the linear effects of age on the odds of belonging to the recovery compared with the resilient trajectory retained significance. The other three studies, however, found no significant relationship (Brown et al., 2016; De Young et al., 2012; Quezada et al., 2014).

Socio-economic status (SES)/Household income. One prospective study calculated SES as a weighted average of parents' occupation as scored on the Child Behavior Checklist (CBCL; Achenbach, 1991). SES only differentiated significantly between acute stress only and chronic trajectory groups; there were no differences between groups in comparison to the resilient trajectory group (Brown et al., 2016). One cross-sectional study found significant positive correlations between household income and two aspects of resilience (mastery and relatedness), but no significant association with the emotional reactivity aspect (Powers, 2011). This study was correlational and did not control for potential confounding variables in the relationship.

Ethnicity. Only one prospective study explored the association between resilience and ethnicity, which was classified as 'European American' or 'Minority'. No significant association was found (Brown et al., 2016).

Child trauma history. Two prospective studies explored this construct in relation to resilience. There were no differences in child trauma history between the resilient and other trajectory groups of one study; though there was no description of how trauma history was measured (De Young et al., 2012). There were also no significant differences in trajectory group membership according to past PTSD (measured by DICA) or stressful life events, as measured by the Coddington Life Events Scale (CLES; Coddington, 1972; Brown et al., 2016).

Child pre-injury mental health. One prospective study explored pre-injury child mental health utilising the internalising and externalising behaviour problems scales of the Child Behavior Checklist (Achenbach, 1991). The odds of belonging to the resilient trajectory group compared to the recovery or chronic groups significantly increased if the child had lower levels of parent-reported pre-injury behaviour problems (Le Brocque et al., 2010a). In the study's multivariate model, the linear effects of the internalising score on the odds of belonging to the recovery or chronic trajectory groups compared with the resilient trajectory group retained significance. However, the effect of externalising score on chronic trajectory group membership compared with resilient became non-significant.

In summary, three out of four studies examining gender and age in relation to resilience did not find significant associations. There were inconsistent findings with regards to the relationship between SES and resilience, which was investigated by two studies. Child trauma history was not found to be significantly related to resilience in the two studies that explored this. However, one prospective study did find that children with lower pre-injury internalising problems were more likely to belong to a resilient trajectory group compared to a chronic or recovery trajectory group.

Injury-related factors.

Age at and time since injury. One cross-sectional study explored these variables. The research found that higher young person resilience was associated with younger age at time of injury and longer time since injury. This was apparent for the overall sample analysis (N = 51) and when only those with female caregivers were analysed (n = 39), but no significant association was found when analysing data from those with a male caregiver (n = 12; Quezada et al., 2016). Younger age at time of burn injury was reported to be a path to resilience in structural equation modelling.

Severity/type of injury. The severity/type of the injury was measured across five studies. Three studies of burn injury measured the total burn surface area (%TBSA) in relation to resilience, but all analyses revealed non-significant results (De Young et al., 2012; Quezada et al., 2014, 2016). Another study measured pain (Colored Analogue Pain Scale; McGrath et al., 1996), morphine dose (no vs low vs high), days in hospital, and type of injury (violent vs non-violent); all injury-related variables showed non-significant relationships with resilience (Brown et al., 2016). One further prospective study explored type of injury in relation to resilience: type was categorised as group 1 (fracture, dislocations, lacerations, and other injuries) or group 2 (burns, internal injuries, and multiple injuries), with the latter representing more complex injuries (Le Brocque et al., 2010a). The odds of belonging to the resilient group compared to the chronic group (but not the recovery group) increased if participants had a less complex injury type. However, in multivariate analyses, the relationship became non-significant.

In summary, being younger at the time of a burn injury was found to be a path to resilience in structural equation modelling within one study. Severity of injury was not found

to be associated with resilience in the four studies that explored this. Less complex injury types were initially found to be significantly linked to resilient trajectory group membership in one study. However, this relationship became non-significant in multivariate analysis.

Psychological well-being.

Four studies explored a number of psychological variables in relation to resilience. Most studies focussed on different constructs, with the exception of behavioural problems, depression, and PTSS, which were each investigated by two studies.

***Behaviour problems*.** To measure behavioural problems in young people with severe injuries, one prospective study used the parent-reported Child Behavior Checklist – externalising and internalising scales (Brown et al., 2016), whereas the case-control study of young people with and without brain injury (Tonks et al., 2011) utilised the parent-reported Strengths and Difficulties Questionnaire (SDQ; Goodman, 1999). The prospective study found that the different trajectory groups did not differ significantly according to internalising behaviour, but initially differed significantly according to externalising symptoms. However, after correcting for multiple comparisons, externalising became non-significant (Brown et al, 2016). The case-control study noted a significant initial relationship between socio-emotional behaviour and resilience resourcefulness, but this became non-significant when executive functioning (measured by the parent-reported Dysexecutive Questionnaire for Children; DEX-C; Emslie, Wilson, Burden, Nimmo-Smith, & Wilson, 2003) was controlled for in mediation analysis (Tonks et al., 2011).

***Depression*.** To explore depression, one prospective study of burn injury used the ‘major depressive disorder’ (MDD) modules of the DIPA, whereas the case-control study utilised Beck’s Depression Inventory for Youth (BDI-Y; Beck, Beck, Jolly, & Steer, 2005). The prospective study found a large main effect; with the resilient trajectory group having

significantly lower depression scores at one month and six months compared to the chronic group (De Young et al., 2012). Similarly, the case-control study also found that higher resilience resourcefulness and lower vulnerability were significantly associated with lower depression scores (Tonks et al., 2011).

PTSS. Using the DIPA-PTSD to measure PTSS, one prospective study of burn injury found that children in the resilient group had significantly lower levels of PTSS than those in the recovery and chronic groups at one month and six months post-injury (De Young et al., 2012). The authors used these results to support the validity of the recovery trajectories they proposed. Using the University of California at Los Angeles Posttraumatic Stress Reaction Index for Diagnostic and Statistical Manual-Fourth Edition (UCLA-PTSD Reaction Index for DSM-IV; Pynoos, Rodriguez, Steinberg, Stuber, & Frederick, 1998), one cross-sectional study of burn injury found that lower levels of PTSS severity were significantly associated with higher levels of two aspects of resilience (relatedness and lower emotional reactivity); but no significant association with the third aspect, mastery (Powers, 2011).

Other psychological factors. Higher resilience was associated with lower scores of ‘oppositional defiant disorder’ (ODD), ‘separation anxiety disorder’ (SAD) and ‘attention-deficit/hyperactivity disorder’ (ADHD) on the DIPA (De Young et al., 2012), lower anxiety on the BAI-Y (Beck et al., 2005; Tonks et al., 2011), and higher parent and self-rated quality of life on the PedsQL (Pediatric Quality of Life Inventory, Version 4.0, Varni, Seid, & Kurtin, 2001; Powers, 2011). Higher resilience was also associated with lower peritraumatic dissociation symptoms on the DICA-ASD (Brown et al., 2016). However the authors utilised the DICA-ASD to also define resilient trajectories (lower scores indicating higher resilience); therefore the result might be indicative of this and highlights the conceptual ambiguity surrounding resilience discussed later in the review.

In summary, lower levels of child behavioural problems were initially found to be linked to higher resilience in two studies, but not when multivariate or mediation analyses were conducted. Higher resilience was, however, found to be associated with lower levels of a number of other psychological factors, such as depression, PTSS, and anxiety.

Systemic factors.

Family strain. One prospective study measured family strain using the parent-reported Family Strains Index (FSI; McCubbin, Patterson, & Wilson, 1987) but found no significant differences in trajectory group membership according to this variable (Brown et al., 2016).

Parent/caregiver PTSS/resilience. Parental PTSS was explored by two prospective and one cross-sectional study. One study measured the construct utilising the PTSD Checklist (PCL-C; Weathers, Litz, Herman, Huska, & Keane, 1993) and found an initial significant difference in transition group membership according to parental PTSS (with mean levels lowest in the resilient group; Brown et al., 2016). However, this became non-significant after correcting for multiple comparisons. The other prospective study utilised dual trajectory analysis to explore the relationship between caregiver and young person PTSS/resilience group membership. It found that 74% of parents with a resilient trajectory had children with a resilient (51% low PTSS at both time points) or recovery trajectory (23% returning to low levels of PTSS by six months post-injury), concluding a strong relationship between parent and child trajectory patterns. (Le Brocque et al., 2010b).

Unlike the prospective studies which conceptualised resilience in the context of PTSS levels, the cross-sectional study explicitly measured caregiver PTSS and caregiver resilience separately (Quezada et al., 2016). In focussing on caregiver resilience (measured by the

Mexican Resilience Scale, RESI-M; Palomar Lever & Gómez Valdez, 2010), the study found that the correlation with young person resilience was not significant. In exploring caregiver PTSS avoidance, intrusion, and hyperarousal (measured by the Davidson Trauma Scale, DTS; Davidson et al., 1997), the study found different results according to the caregiver sample. Higher levels of male caregiver PTSS (avoidance, intrusion, and hyperarousal symptoms) were associated with higher resilience (n = 12). Lower levels of female caregiver PTSS (intrusion symptoms only) were associated with higher young person resilience (n = 39). When samples were combined (N = 51), the relationship was non-significant. Two structural equation models were conducted (one for female only caregivers, and one for male/female caregivers combined). Lower caregiver intrusion symptoms were reported to be a path to resilience in both models.

Overall, systemic factors were not consistently explored across the included studies. In those that did explore such variables, inconsistent findings were apparent with regards to the relationship between young person resilience and caregiver PTSS, caregiver resilience, and family strain.

Discussion

This systematic review investigated the factors associated with resilience in children and adolescents after physical trauma or injury. It also reviewed how resilience was conceptualised and measured in the eight included studies. Crucially, the evidence across all variables explored is not overwhelming. The implications are tentative and the results should be viewed with caution.

Main Findings

Demographic and pre-injury factors. Consistent with previous paediatric resilience reviews (Cuddy, 2015a; McNulty, 2015), narrative synthesis highlighted inconsistent findings for a number of demographic and pre-injury factors. For gender and age, three out of four studies found non-significant relationships with resilience. The study noting significance for gender had a notably higher proportion of males (74%), which could explain the inconsistency in findings. The study highlighting increased resilience in older children only found the difference between resilient and recovery trajectory groups, and not between resilient and chronic trajectory groups. One reason for this could be the difference in sample size of the groups, with the chronic group composing a smaller sample (n = 19) compared to the recovery (n = 62) and resilient groups (n = 109).

Inconsistencies were also evident for the results regarding the role of SES. However, this might be indicative of the different methods utilised to assess this construct. Child trauma history was not found to be significantly related to resilience in the two studies exploring this, but children of parents who rated their child's pre-injury internalising behaviour to be lower were more likely to demonstrate a resilient trajectory.

Injury-related factors. In line with studies of adult traumatic injury (e.g., Hanks et al., 2016; Kilic et al., 2013; Zarzaur et al., 2017), the review revealed no statistically significant relationship between resilience and injury severity (e.g., %TBSA, pain), potentially suggesting that these variables are less pertinent to one's sense of resilience across the lifespan. One study found significance in the relationship with injury 'type', which was categorised into two groups according to complexity. However, this became non-significant in multivariate analysis. One study found links between higher resilience and younger age at

time of [burn] injury and increased time since the injury. However, this was not investigated and therefore not replicated in any other study, preventing firm conclusions to be drawn.

Psychological well-being. Consistent with previous paediatric illness and adult injury research (e.g., Cuddy, 2015a; Driver et al., 2016; Hanks et al., 2016; McNulty, 2015), there were negative associations between resilience and a number of concurrent psychological factors (e.g., depression, anxiety, ADHD). However, most studies looked at different constructs therefore it was difficult to directly synthesise data. Two studies found initial associations between resilience and lower levels of parent-reported child behaviour problems, but these relationships became non-significant when multiple comparison or mediation analyses were conducted.

Systemic factors. Only one study measured a family variable (family strain) and found a non-significant result. The factor was not investigated, and therefore not replicated, in any other study. Three studies did explore parental resilience and/or PTSS in relation to young person resilience, with inconsistent findings highlighted. Contrary to expectations, one study found increased young person resilience associated with increased male caregiver PTSS (Quezada et al., 2016). This finding was not replicated in the female caregiver sample nor when more robust analysis was conducted, and could be indicative of the smaller male caregiver sample (n = 12). Inconsistencies in findings across the studies may be indicative of variations in how PTSS was measured. The relevance of this finding in relation to existing literature is explored further in the limitations.

Limitations of Included Studies

The risk of bias assessment raised a number of methodological issues within the included studies. It is important to consider these limitations before drawing firm conclusions regarding the significance or implications of the results. First, due to the study designs, the

direction of the relationship between various variables and resilience could not be inferred. Though four of the studies were longitudinal, this design was primarily used to initially categorise recovery trajectories, rather than to examine the dynamic nature of resilience and potentially associated variables.

Second, the review revealed an over-reliance on convenience and self-selecting sampling, with studies tending to recruit from single medical settings and where non-responders could represent the most stressed and least resilient (O'Donnell, Elliott, Lau, & Creamer, 2007; Powers, 2011). Such sampling biases may affect the extent to which the findings can be generalised to and/or represent all paediatric injury populations. Third, no study reported a priori power calculations. Small sample sizes and attrition were also evident and might have underpowered the studies included, prevented the use of more sophisticated statistical analysis, and increased the likelihood of Type-II errors.

Fourth, the control for potential confounding factors was variable across studies. Consistent with reviews of resilience in other health samples (e.g., Cuddy, 2015a; Stewart & Yuen, 2011), a number of studies failed to conduct multivariate analyses, such as multiple regression, to examine the relationship between the variables of interest and resilience whilst controlling for potential confounders. The influence of family on resilience, and increasingly peers and school, is highlighted throughout research with children and adolescents (Howard et al.,1999), specifically young people with chronic illness (McNulty, 2015; Ross, Simons, Feinstein, Yoon, & Bhandari, 2017) and visible difference (Cuddy, 2015b), and in qualitative research of paediatric injury (Holaday & McPhearson, 1997; Ogilvie, Foster, McCloughen, & Curtis, 2015). Despite adaptation during childhood and adolescence being characterised to varying extents as dependent on those systemic systems (Steinberg, 1999), no study comprehensively looked at the relationship between social and/or familial factors and resilience nor considered them as potential confounders of the results reported.

Finally, with regards to measuring resilience, all studies with the exception of one (De Young et al., 2012, who sampled children under six years of age) utilised self-report tools. Typically self-report measures tend to have lower reliability and validity than a clinical interview. However, it could be argued that this is less pertinent to the current research question, which focuses on one's personal sense of resilience and capacity to 'bounce back' (Windle, 2011). Assessing the child's perspective could therefore represent a strength of the literature (Brosbe, Hoefling, & Faust, 2011). Despite this, multiple perspectives (e.g., parent, teachers) could be of interest to facilitate comparison and improve understanding of the construct from different viewpoints since, typically, differences between perspectives are noted in paediatric injury research (Landolt, Vollrath, Ribi, Gnehm, & Sennhauser, 2003; Shemesh et al., 2005).

A further limitation regarding the conceptualisation and measurement of resilience requires additional discussion. The conceptualisation of the construct is disparate within this single review, which appears to represent the conceptual ambiguity in the wider field of resilience (Windle et al., 2011; Rosenberg & Yi-Frazier, 2016). Half of the studies (Brown et al., 2016; De Young et al., 2012; Le Brocque et al., 2010a, 2010b) conceptualised resilience as an absence or lack of post-traumatic stress. This seems contentious in the context of resilience theory, which attempts to move away from conceptualising health in purely deficit terms, such as a lack of mental health difficulties (Southwick et al., 2014). Moreover, the mechanisms and factors associated with constructs such as resilience are likely to differ from those associated with post-traumatic stress (Layne et al., 2009). Consequently, in their own meta-analysis of child post-traumatic stress trajectories, Alisic, Jongmans, van Wesel, and Kleber (2011) highlighted that their findings should not be generalised to psychological outcomes other than post-traumatic stress.

Furthermore, the use of thresholds to identify resilient individuals could be criticised in relation to resilience being generally understood on a continuum (Cosco et al. 2017). In highlighting the limitations of this conceptualisation, it is important to also consider the significant lack of appropriate tools to specifically assess and measure resilience beyond that of a 'lack of PTSS' (Hilliard et al., 2015; Windle et al., 2011). Hilliard et al. (2015) posit that, although the studies that have utilised alternative variables (e.g., PTSS) to conceptualise resilience have advanced this research area, they have also "contributed to divergent definitions and difficulty synthesizing findings across studies" (p. 836).

Strengths and Limitations of the Current Review

To the author's knowledge, this is the first systematic review to explore the factors associated with resilience in young people following paediatric injury, and to review how this has been measured. It utilised a range of databases in addition to grey literature to ensure a robust search was conducted. The review conducted risk of bias assessments in order to report on study quality (Uman et al., 2010) with ratings for all studies completed independently by two assessors in order to increase reliability.

Crucially, the review has revealed gaps in the literature (e.g., lack of exploration into the impact of social support and familial variables) in addition to methodological and conceptual issues, which can inform future research (Palermo, 2013). Despite its strengths, the review has a number of limitations.

First, only eight studies met criteria for inclusion in the review. The small number of studies included could be indicative of the eligibility criteria employed. For example, a number of authors define resilience as achieving one or more positive outcomes despite significant risk (Hilliard, Harris, & Weissberg-Benchell, 2012; Van Schoors, Caes, Verhofstadt, Goubert, & Alderfer, 2015). A number of studies that were seriously considered

for inclusion in the review potentially fulfilled this definition. Constructs that may constitute a “positive outcome”, such as social competence, adjustment, less problem behaviour, or less post-traumatic stress symptoms (as measured in studies within the current review), were often measured but with limited or lack of reference to how they linked to or represented resilience. As a result, it was frequently unclear within the literature as to whether these factors were conceptualised as integral parts of resilience, were outcomes that were “necessary or sufficient for identifying resilience” (Rosenberg & Yi-Frazier, 2016, p. 507), or were influences that could impact on resilience as a process/outcome in itself. In order to maintain focus and clarity within the review, these studies were therefore not included. Consequently, many papers that might have been relevant to the review question could have been excluded. However, inclusion could have compromised the validity of the concept of resilience and the definition adopted.

Second, heterogeneity across the study methodologies precluded meta-analysis. This could have provided more comprehensive analysis of data and a more robust means of estimating the size of the relationships. The heterogeneity of participants included in the review with regards to type of injury and time since injury may also affect the results.

Third, there is a risk of publication bias in the studies reviewed. For instance, studies that found negative results may not have been published. Despite attempts to limit this (e.g., by not excluding on the basis of publication status), some unpublished literature might not have been identified. Papers were also excluded on the basis of qualitative design.

Fourth, the review included only one paper that sampled children aged between one and six years of age (De Young et al., 2012), with all other studies sampling between the ages of six and 19 years. Developmentally, this sample would represent a different stage to the other studies and also a different perspective for measuring resilience (parent report). Windle

(2011) suggests that “across the life course, the experience of resilience will vary” (p. 163). The samples in this review span a number of different developmental stages and therefore it is possible that the factors associated with resilience in younger children (e.g., aged six to nine) may differ to older children (e.g., aged 10-15) and older adolescents (e.g., aged 16-19). Despite this, consistent with most other studies in the review, De Young et al. (2012) found non-significant associations between age, gender, severity (%TBSA) and child trauma history in relation to resilience, and negative associations with psychological difficulties. Due to the heterogeneity of variables and measures utilised, it was not possible to comprehensively explore similarities and differences across the age span within the current review.

Clinical Implications and Future Research

All studies exploring psychological difficulties (pre-injury and concurrent) suggested that young people with higher resilience are likely to have lower levels of psychological difficulties such as anxiety and depression. Supporting young people to build resilience following a physical injury may reduce the development of such difficulties. Furthermore, the results could support clinicians working in this area to identify young people who may find it more difficult to ‘bounce back’ and may require more support to build resilience. Screening tools that ask about the young person’s experience of low mood or anxiety prior to and since injury could facilitate this.

Crucially, all studies measuring injury severity found no significant association with resilience. Support, in terms of resilience, should therefore not necessarily be offered on the basis of severity. Furthermore, most studies exploring age and gender also found non-significant results, suggesting that other factors may be more instrumental to a young person’s sense of resilience. Due to the overall paucity of literature available, the

inconsistencies found, and limitations highlighted, it would be difficult to draw further precise conclusions regarding the clinical utility of the findings.

Future research should therefore attempt to address the aforementioned limitations by: i) conducting longitudinal research to explore the factors associated with resilience at different developmental/life span stages (Rutter, 2006), to help to establish causal relationships, and to explore the process and changes in resilience over time (Luthar & Cicchetti, 2000; Rosenberg & Yi-Frazier, 2016; Windle, 2011), ii) developing a clear, consistent definition and conceptualisation of resilience in order to develop a more coherent theory within paediatric injury (qualitative research to inform this conceptualisation may be beneficial), iii) developing and using validated tools (appropriate for different ages and perspectives) to ensure data quality and to facilitate the quantitative measure of resilience at different life stages to inform developing theories, iv) conducting multiple regression or path analyses to control for confounders and ascertain relationships between pertinent factors, v) conducting a priori power analysis to ensure adequate power, vi) utilising multiple sites to improve representativeness and reduce the risk of selection bias, and vii) investigating the role of familial and social support factors which have been shown to be key in other paediatric resilience research.

Conclusions

This review has revealed a paucity of research that quantitatively assesses resilience and the factors associated with it in children and adolescents who have experienced significant physical injury. The studies that have been conducted elicited inconsistent findings with regards to what the key factors are within this population. However, the lack of evidence for a relationship between injury-related variables (e.g., severity, pain) and

resilience was more consistent, in addition to the negative relationship found between psychological difficulties and young person resilience.

Lack of consistency within which resilience is measured and conceptualised across the studies significantly limits the conclusions that can be drawn, and represents the conceptual ambiguity surrounding resilience within current literature. Clarity regarding the conceptualisation and measurement of resilience as a distinct construct in future research is recommended. Despite evidence in other paediatric samples, the influence of systemic variables (e.g., family, school, peers) was not consistently explored in the studies included in the review. It is recommended that future research explores the association between these factors and resilience after paediatric injury in order to inform the focus of interventions to foster resilience and improve recovery.

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Chapter 2: Empirical Paper

Predictors of Resilience in Children and Adolescents who have Experienced Major Physical Trauma: Working towards a Systemic Model of Resilience[1]

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[1] To be submitted to the Journal of Pediatric Psychology (25 page limit for original research articles; Appendix A)

Abstract

Objectives To investigate which factors are associated with and predictive of resilience in children and adolescents who have experienced major physical trauma. To specifically explore whether social support can predict resilience over and above the effects of family relationships and injury-related variables in this population. **Methods** A total of 98 young people aged 11 to 19 years who had accessed one of two major trauma centres (MTCs) in the UK were recruited into the cross-sectional study. To measure the outcome variable, participants completed a self-report measure of resilience (Connor-Davidson Resilience Scale). To measure predictor variables, participants completed self-report measures of the impact of the injury event (Children's Revised Impact of Event Scale), family relationships (Family Relationship Index), and social support (Child and Adolescent Social Support Scale) on a secure online system. Age of respondents and other injury-related predictor variables were collated from the MTCs' databases. **Results** Correlational analysis and multiple hierarchical regression were used. In step 1 of the regression, the psychological impact of the injury event was not found to be predictive of resilience. In step 2, family cohesion was the only family variable found to be predictive of resilience; family conflict, family expressiveness, and the injury event's psychological impact were not significant. In the final model, which entered social support variables, only classmate and close friend support were predictive; all family factors, teacher support, and the injury event's psychological impact were not significant. **Conclusions** Interventions that incorporate peer support may help to foster resilience in young people who have experienced severe physical trauma. The need for further prospective research and clarity when defining and studying resilience is discussed.

Keywords resilience; paediatric; physical injury; major trauma; children; adolescents

Introduction

For young people under 15 in the United Kingdom (UK), it is estimated that over 108,000 hospital admissions and approximately two million Accident and Emergency (A&E) attendances each year are due to unintentional injury (Child Accident Prevention Trust, 2013). If a young person is suspected of having a serious physical injury (either numerous wounds or serious injuries that result in serious disability or death), then they are admitted to Major Trauma Centres (MTCs) within specific National Health Service (NHS) hospitals, where they receive specialised trauma care and rehabilitation. Major trauma includes head injuries, severe wounds, and multiple fractures sustained as a result of falls, road traffic accidents (RTAs), other accidents, or assaults. The Trauma Audit and Research Network (TARN) collects data on patients who have sustained severe trauma in England and Wales and who i) are admitted to hospital for over 72 hours, ii) require critical care resources, or iii) sustain fatal injuries.

Data from England and Wales' TARN reported that over 4700 children under 16 sustained major injuries in 2012 (TARN, 2012). Of those children, 737 were considered to have sustained the most severe types of major physical trauma (e.g., burns, brain injuries, orthopaedic injuries). Many go on to develop complex neurological and physical problems which often require long-term care.

The MTCs assess injury severity utilising the Injury Severity Score (ISS), as recorded by TARN. This is an internationally recognised anatomical score ranging from one to 75 that assesses the combined effects of the multiple injuries sustained (to the head, neck, spine, chest, limbs, abdomen, pelvis or skin), with higher scores indicating higher severity (Association of Advancement of Automotive Medicine, 2005). Though different thresholds of the ISS for categorising 'major trauma' in patients attending MTCs have been proposed,

they have tended to be in the context of mortality and therefore may lack utility in wider clinical evaluation (Palmer, 2007). Considering this, the current paper conceptualises major physical trauma in the context of the spectrum of all patients referred onto major trauma pathways, with ISS scores ranging from one to 75.

The Impact of Physical Trauma in Childhood and the Role of Resilience

A person who has acquired a severe physical injury has to confront not only the trauma that caused their injury, but also any subsequent change and/or loss of physical function (Quale & Schanke, 2010, p.12). This can present a number of stressors, which have been shown to impact on the mood, functioning and well-being of young people (Atala & Carter, 1992; Evans et al., 2003; Landolt, Vollrath, Gnehm, & Sennhauser, 2009) and their families (e.g., Muscara et al., 2015; Ogilvie, Foster, McCloughen, & Curtis, 2015), including post-traumatic stress symptoms (PTSS; Dainty, 2014; Landolt et al., 2009). In contrast, a number of recent studies demonstrate that high proportions of young people and their families do not experience high levels of PTSS, instead showing resilience to their injuries and trauma (Brown et al., 2016; Le Brocque, Hendrikz, & Kenardy, 2010a, 2010b; Quezada, González, & Mecott, 2016).

Recent research has seen a notable shift away from previously dominant ‘deficit models’ and theories of illness towards more positive aspects of adjustment and ‘bouncing back’ from major trauma or adversity; a notion referred to as resilience (Masten, 2001; Rutter, 2012; Windle, 2011). Focussing on what is necessary to build resilience is considered essential in preventing psychological difficulties and promoting the psychological well-being of young people (Kobau et al, 2011; Seligman & Csikszentmihalyi, 2000), including paediatric populations (Edwards & Titman, 2010) .

Though receiving increased attention in paediatric psychology literature, the concept of resilience is not well defined and the complexity in doing so is increasingly recognised (Knight, 2007a; Windle, 2011; Zolkoski & Bullock, 2012). In a conceptual review, Knight (2007a) proposed a three-dimensional framework to conceptualise resilience in young people as a *state* (i.e., internal/personal attributes of emotional competence, social competence, and futures-orientation), a *condition* (i.e., protective factors that can mitigate life event risk factors, such as family, school, community), and a *practice* (i.e., how families, schools and communities can enable and promote resilience in young people). Similarly, Olsson, Bond, Burns, Vella-Brodrick and Sawyer (2003) posited a specific association between adolescent resilience and three levels of resources: individual (e.g., coping style, intelligence), family (e.g., support), and social environment (e.g., school support).

A number of authors recognise the role of individual attributes in indicating "an individual's potential for resilience" (Knight, 2007b, p. 70), but increasingly emphasise the role of social and environmental contexts and relationships (e.g., family, peers, school, community, and wider society) as pivotal to the process (Knight, 2007a; Masten, 2001; Masten & Reed, 2002; Rutter, 1993; Ungar, 2012a; Windle, 2011). Many argue that resilience is not a trait that someone either does or does not have, rather it constitutes thoughts and behaviours that can be learned and reinforced at a number of different levels (Knight, 2007a; Luthar, 2003).

For the purpose of the current study, resilience is researched in line with the aforementioned theories and the definition posited by Windle (2011) following a review of 271 peer-reviewed resilience articles, that is, "the process of effectively negotiating, adapting to, or managing significant sources of stress or trauma… resources within the individual, their life and environment facilitate this capacity for adaptation and 'bouncing back' in the face of adversity" (Windle, 2011, p. 163). In a commentary on paediatric resilience research,

Rosenberg and Yi-Frazier (2016) proposed that such resources can be considered both static and dynamic, and that research should involve "identifying and harnessing *new* and *existing* resources to maintain well-being during and after any stressor" (p. 507).

The current research employs a psychometrically driven operationalisation of resilience across a continuum (Cosco et al., 2017) in order to measure one's capacity to 'bounce back', using a tool representing the salient, modifiable features of resilience as identified across the literature (Connor & Davidson, 2003). In doing so, the study aims to identify which resources are most predictive of a young person's sense of resilience following paediatric injury, and therefore inform which resources to "harness" in order to maintain well-being and improve one's capacity to 'bounce back'.

Resilience and Paediatric Chronic Illness: Individual, Demographic, and Illness-related Factors

In recent years, there has been an increased focus on investigating resilience in paediatric populations, specifically young people with chronic medical conditions such as cancer, diabetes, and chronic pain (Hilliard, McQuaid, Nabors, & Hood, 2015; McNulty, 2015a). In young people with cancer, some studies have identified the role of increased courageous coping, increased cognitive coping (i.e., strategies including 'accepting' the illness, seeing the 'good side'), and lower defensive coping (i.e., strategies including not talking to anyone, keeping busy, distraction) in resilience (Haase, Kintner, Monahan, & Robb, 2014; Haase et al., 2017; Wu, Sheen, Shu, Chang, & Hsiao, 2013). However, significant associations with coping style are not consistently found (Cuddy, 2015a; Smorti, 2012).

Demographic variables such as gender and economic status have not been significantly associated with resilience in young people with chronic conditions (Cuddy,

2015b; Im & Kim, 2012; McNulty 2015b). However, there are inconsistencies in the results regarding associations with age (e.g., Kim & Yoo, 2010; McNulty, 2015b) and illness-related variables, such as condition severity, type, and time since diagnosis (Cuddy, 2015a).

Resilience and Paediatric Chronic Illness: Systemic Factors

More recent research has demonstrated the integral role of the family environment and wider support systems on young people's resilience (Landau, 2010; Newland, 2014). Significant associations have been found between child resilience and parental warmth and acceptance (Im & Kim, 2012; McCubbin, Balling, Possin, Frierdich, & Byrne, 2002), family functioning, adaptability and cohesion, and lower family conflict (Cuddy, 2015b; Kim & Yoo, 2010; McNulty, 2015b; Ross, Simons, Feinstein, Yoon, & Bhandari, 2017) in young people with chronic medical conditions and adolescents with a cleft lip and/or palate. Initial evidence has also identified significant relationships between paediatric resilience and positive peer relationships, and between resilience and positive relationships with teachers (Im & Kim, 2012; Kim & Yoo, 2010; Ross et al, 2017).

Severe physical trauma may lead to some of the same challenges faced by young people with a chronic medical condition, such as changes in psychological, social and physical functioning (Pinquart & Teubert, 2012) and physical appearance (Cuddy, 2015b). Though common themes might be apparent, the protective factors that can support children and adolescents to 'bounce back' from adversity are thought to vary according to the population and context studied (Fergus & Zimmerman, 2005). Due to the paucity of research measuring resilience *per se* in paediatric physical trauma, detailed in Chapter 1, the following sections review the literature pertaining to not only resilience, but also other associated constructs, including adjustment, in this population.

Resilience and Adjustment after Paediatric Physical Trauma: Demographic, Injury-related, and Individual Factors

In reviewing the literature on young people who have been "disfigured" by physical trauma, Blakeney, Robert and Meyer (1998) summarised that neither age nor injury-related variables (e.g., depth of burn, injury severity, area of body) determined psychological and social adjustment. Research specifically exploring resilience following paediatric injury also found non-significant results for these variables (Brown et al., 2016; De Young, Kenardy, Cobham, & Kimble, 2012; Quezada, González, & Mecott 2014, 2016). However, a recent study with paediatric burn survivors found that age at the time of burn injury was the main predictor of resilience, with higher resilience associated with younger age at injury (Quezada et al., 2016). This study also found that time since injury was correlated with resilience, but was not found to be a predictor in multivariate analysis when other variables were controlled for. The authors note, however, that the vast majority of their sample (over 86%) participated over two years following their injury, at which point adjustment is thought to stabilise.

Emotional problems were found to be negatively correlated with resilience in children who had acquired brain injury (ABI; Tonks et al., 2011). It is still unclear as to whether this finding could be explained by young people being less able to reach out for emotional support and resources after an ABI, or whether increased emotional distress directly impacts on the child's sense of resiliency following ABI (Tonks et al., 2011).

Individual cognitive skills (i.e., intelligence, coping style, assignment of meaning) have also been posited as factors that can influence resilience in young people following physical trauma (Holaday & McPhearson, 1997). However, there is little evidence that 'higher' intelligence alone, for example, predicts coping (Werner, 2000, p. 122).

It is acknowledged in the current paper that the individual ‘attributes’ (e.g., coping styles, cognitive skills) that have been studied by others may contribute to resilience in young people following physical trauma. However, multicollinearity amongst the constructs has been noted (e.g., Newton-John, Mason, & Hunter, 2014), with coping often conceptualised as a fundamental part of an individual’s sense of resilience. For this reason, coping was not measured as a distinct predictor within the current study, and rather was considered a factor of resilience that can be affected by other variables measured (Connor & Davidson, 2003). With regards to other individual factors (e.g., social competence), similarly authors have often conceptualised these as “characteristics” of resilient children (Howard, Dryden, & Johnson, 1999; Portman, 1989). Therefore, for the purpose of this study, such individual factors will not be measured as potential predictors.

Resilience and Adjustment after Paediatric Physical Trauma: Systemic Factors

Research has demonstrated the significance of familial and peer variables in adjustment following physical trauma (Landolt, Grubenmann, & Meuli, 2002). Parental pain catastrophizing has been implicated in child pain and anxiety following major surgery (Rabbitts, Groenewald, Tai, & Palermo, 2015); family functioning has been shown to be predictive of positive outcomes in children who had suffered severe dental injuries (Porritt, Rodd, & Baker, 2015); and associations have also been found between coping assistance from peers and children’s coping following traumatic traffic accident injuries (Marsac, Donlon, Hildenbrand, Winston, & Kassam-Adams, 2014).

Specifically focussing on resilience, qualitative research has also reinforced the importance of the family environment and social support from peers and school in promoting resilience in young people following severe burns (Holaday & McPhearson, 1997) and spinal cord injury (Stanton, 2006). Having one close relationship outside the family with someone

who displays unconditional positive regard and who supports any adaptation required contributes strongly to resilience (Holaday & McPhearson, 1997). Caregivers who model strength, are open to talking about the trauma and its physical and psychological impact, visited hospital regularly, and maintained stability and previous family rituals foster resilience in their children following burn injury (Holaday & McPhearson, 1997). The significance of parental factors have also been found in recent quantitative research; with high caregiver resilience and low caregiver PTSS found to be significant predictors of child resilience following child accidental injury (Le Brocque et al., 2010b) and burns (Quezada et al., 2016) respectively.

Crucially, a review of the literature on family resilience following a physical trauma concluded that there is a considerable lack of research in the area overall (Gauvin-Lepage, Malo, & Lefebvre, 2015). It highlights that the research conducted has tended to be qualitative and/or has failed to measure the child's perception, instead relying on parental or family member perspectives. Furthermore, many studies in this area have failed to measure resilience explicitly and using validated tools, instead utilising a range of measures which authors variably use to conceptualise resilience (e.g., social competence, behaviour, a lack of PTSS), as highlighted in Chapter 1.

In being able to provide further understanding of the impact of demographic, injury-related, family environment, and social support variables on resilience in this population, it was hoped that the results of the current study could inform psychological interventions by ascertaining the key resources that foster resilience in young people (Rosenberg & Yi-Frazier, 2016). In doing so it could inform how to support those who do experience more difficulties after a major physical trauma. Current evidence-based rehabilitation strategies that could be informed further by this research are thought to reduce lengths of stay in

hospital, minimise readmission rates, and reduce the use of primary care resources (National Institute for Health and Clinical Excellence, 2009).

Aims and Hypotheses

The current study aimed to:

1. Systematically explore which variables were most strongly associated with and predictive of resilience in children and adolescents following major physical trauma. It aimed to extend the literature by investigating resilience across multiple types of physical trauma, whilst also overcoming criticisms of previous studies, including a lack of quantitative investigation and absence of validated resilience scales measuring the young person's perspective.
2. Discern the impact of family environment across a paediatric major physical trauma setting since this factor has been associated with resilience in young people with chronic medical conditions, and in initial findings regarding specific physical injuries. It also aimed to extend the literature by quantitatively assessing the influence of peer and school support specifically on resilience in a paediatric injury population.
3. Ascertain the association of demographic and injury-related factors with resilience within this population in order to clarify previous inconsistent findings.

It was hypothesised that:

1. Young people's perception of their social support (teachers, classmates, and close friends) would be positively correlated with resilience.
2. Young people's perception of their family environment (cohesion, expressiveness) would be positively correlated with resilience.
3. Young people's perception of family conflict within the environment would be negatively correlated with resilience.

4. Social support variables would account for unique variance in resilience scores when controlling for the potential effects of family relationship variables, age, psychological impact of the injury event, and injury-related characteristics that are associated with resilience (physical severity, cause of injury, type of injury, and time since acquisition).

Methods

Participants

Since the research aimed to represent the severe paediatric injury population as a whole, children and adolescents who experienced different types of trauma were invited to participate. This was ensured by approaching all individuals who came through the Major Trauma Pathways at the participating centres. A sample of 98 children and adolescents aged 11 – 19 years (M = 14.08, SD = 2.07), accessing two MTCs in England, were recruited via self-selecting sampling between June 2017 and March 2018. Other demographic and injury characteristics of the sample are shown in Table 1.

Young people were eligible to participate in the research if they met the following criteria: the young person was i) 11-18 years old at time of invitation to the study (in line with the questionnaires' age recommendations), ii) an inpatient/outpatient of the Major Trauma Centre, iii) could understand written English, iv) their injury was acquired a minimum of one month prior to completion of questionnaires considering the acute stress responses that can present in the first month following a traumatic injury (Winston et al., 2002), v) the injury was not in the context of safeguarding (i.e., neglect, abuse), self-harm, or suicide attempt.

Burn injuries are sometimes categorised as major trauma. However, the clinical pathways established within the participating hospitals had a separate burn injury pathway to that of major trauma, therefore young people with burn injuries were not recruited.

Design

The study adopted a cross-sectional design using an online survey, which was made accessible through postal invite.

Measures

Participants completed self-report questionnaires (see Appendix C) via a secure online system, Qualtrics. The order of the questionnaires was randomised to prevent order effects.

Predictor variables.

***Demographic and injury-related characteristics*.** Information regarding the child's age, cause of injury (fall/other or RTA), type of injury (orthopaedic/other or head/polytrauma), severity of injury (ISS), and time since acquisition (in days) was collected from the MTCs' databases. Cause and type of injury were categorised according to details provided on the MTCs' databases and based on anecdotal observations regarding homogeneity of the categories.

Psychological impact of the injury event. The Children's Revised Impact of Event Scale (CRIES-8; Yule, 1997) is a widely used eight-item self-report measure of post-traumatic stress (including items such as "Do you try to remove it [the event] from your memory?") rated on Likert scales from 'not at all' (0) to 'often' (5). The measure is reported to have good psychometric properties within a number of populations, including paediatric samples (Perrin, Meiser-Steadman, & Smith, 2005). It demonstrates good internal consistency (α =.75 to .84; Smith, Perrin, Dyregrov, & Yule, 2003) and good test-retest reliability (r = .75; Deeba, Rapee, & Prvan, 2014). In the current study, the Cronbach alpha coefficient was .88.

Family environment. The Family Relationship Index (FRI; Holahan & Moos, 1982) is a subset of three 9-item subscales (cohesion, expressiveness and conflict) from the Family Environment Scale (FES; Moos & Moos, 2002, 2009). Participants have to indicate which of the item statements are true of their family and which are false. The FRI has been widely used in paediatric research. It is considered a 'well-established' measure (Alderfer et al., 2008) with each subscale possessing acceptable internal consistency (α = .69 to .78; Moos & Moos, 2009). In the current study, the Cronbach alpha coefficient ranged from .53 to .67 across the three subscales.

Social support. The Child and Adolescent Social Support Scale (CASSS; Malecki, Demaray, & Elliott, 2000, 2014) is a widely used 60-item scale measuring perceived social support on five 12-item subscales: from parents, teachers, classmates, a close friend and overall school support. The most recent version of the CASSS is suitable for 8 to 18 year-olds. The measure has been shown to have excellent internal reliability (α = .84 to .97) and good test-re-test reliability (r = .45 to .77) for its overall score and for individual subscales (Malecki et al., 2000, 2014). In the current study, to prevent repetition in measuring variables, only the teachers, classmates and close friend subscales were used (constituting 36 items in total, e.g., "My teacher…explains things I do not understand"). Each subscale rates perceived support frequency and support importance separately. The frequency component was analysed in the present study, based on items rated on 6-point Likert scales from 'never' (0) to 'always' (6). In the current study, the Cronbach alpha coefficient was .94, .95 and .96 for teacher, classmate and friend subscales respectively.

Outcome variable.

Resilience. The Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003) is a 25-item self-report measure of resilience (e.g., "I can deal with whatever comes my

way”) rated on 5-point Likert scales from ‘not at all true’ (0) to ‘true nearly all of the time’ (4). The measure has demonstrated good reliability (r = .88) in paediatric populations (Vetter et al., 2010) and good internal consistency (α = .89; Connor & Davidson, 2003). In the current study, the Cronbach alpha coefficient was .92.

Procedure

Ethical approval for the study was acquired from the National Research Ethics Service (NRES). Approval documents can be found in Appendices D, E, F and G. Confirmation of capacity and capability to support the research from each trust can be found in Appendix H.

Children and adolescents who met inclusion criteria for the study were identified from the MTC databases. For children and adolescents under the age of 16 years who were eligible to participate, an invite letter and age-appropriate information sheets for the young person and parent/caregiver were posted to their parents/guardians. Parents/guardians provided consent by electing to share the invite with the young person. For adolescents aged 16 years or over, a letter and information sheet were posted directly to them. Letters and information sheets (Appendix I) provided details of the research and confirmed confidentiality, consent/assent, and the right to withdraw. They provided details of the online link and unique participant code (utilised to preserve anonymity) required to access the study questionnaires via the secure online system. Within the information sheets, participants were made aware that they could arrange to complete the questionnaires with support from the researcher if this was preferred. One participant requested this support and this was provided during a visit to their school. Questionnaires took approximately 15-30 minutes in total to complete.

Consistent with ethical guidelines (Boddy et al., 2010), participants under 16 years had to indicate on the online system that they had sought parental consent to take part in the

research prior to completing the online assent form (Appendix J) and the study questionnaires. Those aged 16 years and above had to complete an online consent form (Appendix J) before proceeding to the questionnaires. A prompt letter (Appendix K) was sent approximately one to three months following the initial invite to remind those who had not yet participated that they could still take part in the research. As a way of thanking those who took part, all participants had the opportunity to opt into a prize draw for the chance to win a high street voucher.

Figure 1 displays the process from recruitment to analysis. Within the online system, 109 participants assented/consented to completing the study. Eleven participants did not complete the subsequently presented questionnaires. A total of 98 participants (representing a response rate of 12.3%) were therefore included in the final analysis. Demographic and injury-related details for these participants were then acquired from the MTCs' databases.

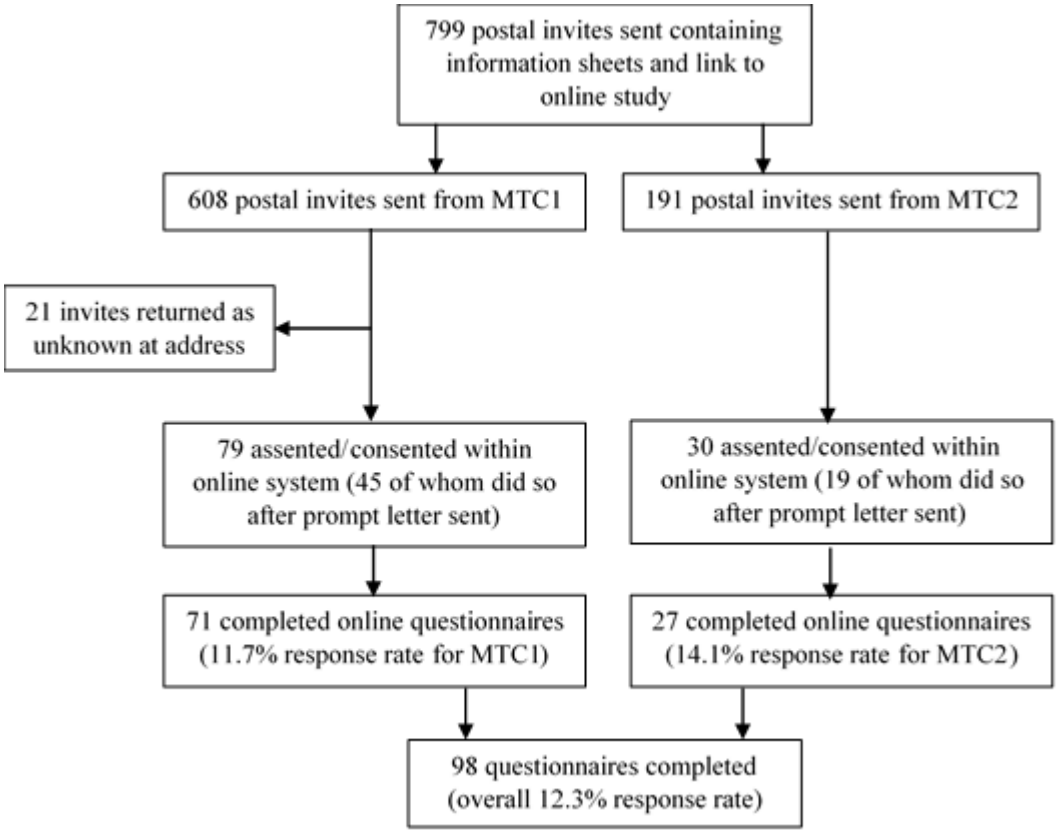

Figure 1. Flow diagram of recruitment and participation rates

Service User/Carer Consultation

Liverpool University Experts by Experience group were consulted in April 2016 with regards to the project's utility and feasibility. The group indicated approval for the study. The project was also presented to the children's hospital research advisory group in December 2016. The group reviewed and offered suggestions for changes to patient information sheets that were subsequently made. The group also approved the study's methodology.

Data Analyses

G*power software (Faul, Erdfelder, Lang, & Buchner, 2007) was utilised to estimate the minimum number of participants required to detect a medium effect size with .80 power and a critical alpha level of .05 for a multiple regression. This effect size was selected in line with previous research into paediatric resilience which has typically yielded small to medium effect sizes (e.g., De Young et al., 2012; Im & Kim, 2012; Tonks et al., 2011). The results indicated that between 98-127 participants would be required for a proposed hierarchical multiple regression based on a potential 6-12 predictor variables (age, time since trauma [days], physical severity of injury, cause of injury, type of injury, family environment – cohesion, psychological impact of the injury event, family environment –expressiveness, family environment – conflict, social support – teachers, social support – classmates, social support – close friend) depending on the results of initial bivariate analyses (see below).

Data were analysed using IBM® Statistical Package for the Social Sciences (SPSS version 22.0) for Windows (IBM_Corp, 2010). The binary variables of cause of injury (fall/other or RTA) and type of injury (orthopaedic/other or head) were coded as zero or one. Prior to performing statistical analyses, data were screened for missing values (see Table 2 in the Results section for proportions of missing data before and after imputation), normality, linearity, and homoscedasticity (Appendix L). Little's Missing Completely at Random

(MCAR) test was conducted to assess the pattern of missing data (Tabachnick & Fidell, 2013). The result was non-significant, indicating that data were missing completely at random (X^2 = 125.1, *df* = 133, *p* = .68). In order to address missing data, person-mean imputation and pairwise deletion (available-case analysis) were utilised (see Hawthorne & Elliott, 2005; Pallant, 2010). Appendix M provides further details regarding missing data and how this was addressed.

Prior to bivariate analysis, in order to assess the distribution of continuous data, inspection of histograms and normal probability plots was undertaken in addition to calculations of skewness and kurtosis scores and a statistical test of normality (Appendix L; see also Ghasemi & Zahediasl, 2012; Pallant, 2010). The assumptions of normality were not met by a number of predictor variables and the outcome variable, therefore parametric analyses could not be utilised. Spearman's rank coefficient was used for correlational analyses and Mann-Whitney U tests were conducted to explore associations between resilience and dichotomous variables (injury cause and injury type). A Mann-Whitney U test was also conducted to check that there were no differences in resilience scores between the two MTC recruitment sites.

For the multiple regression analysis, inspection of regression residuals revealed that the assumptions for normality, linearity and homoscedasticity were met (Appendix N). Collinearity statistics also indicated that multicollinearity was not a problem (Appendix N).

Descriptive statistics were used to summarise the demographic and injury characteristics of the total sample. In order to identify variables that should be controlled for in the regression, bivariate analyses (Spearman's rank coefficient correlations for continuous variables and Mann-Whitney U tests for categorical variables) were conducted to investigate

the statistical significance of the relationship between resilience and the 12 independent variables (hypotheses one, two, and three).

Hierarchical multiple regression was conducted to establish the unique variance in resilience scores accounted for by family environment and social support when controlling for other variables associated with resilience (hypothesis four). Of the demographic, psychological impact, and injury-related variables, only psychological impact of the injury event was found to be significant, therefore this was entered into step 1 of the model. Most research has implicated the role of family factors in paediatric resilience, therefore social support variables were entered in the final step of the model to ascertain their impact above and beyond familial influences. The following order of predictor variables was therefore used: step 1: psychological impact of the injury event; step 2: family environment (all three relationship subscales: cohesion, expressiveness, conflict); step 3: social support (all three subscales: teacher[s], classmate[s], close friend[s]). For all analyses, significance values less than or equal to .05 were considered significant.

Results

Sample Characteristics

The primary demographic and injury characteristics of the sample are presented in Table 1. Missing data from each of the characteristics represents the same respondent whose demographic/injury details could not be ascertained. Falls were the most common cause of injury and orthopaedic injuries were the most common type within the sample. Over half of the respondents were male.

Table 1

Demographic and injury characteristics of the sample (N = 98)

Demographic and injury characteristics	*n* (%)
Age	
11	4 (4.1)
12	10 (10.2)
13	13 (13.3)
14	20 (20.4)
15	14 (14.3)
16	15 (15.3)
17	10 (10.2)
18	6 (6.1)
19	5 (5.1)
Missing	1 (1.0)
Gender	
Female	40 (40.8)
Male	57 (58.2)
Missing	1 (1.0)
Cause of injury[a]	
Fall	51 (52.0)
RTA[b]	40 (40.8)
Other	6 (6.1)
Missing	1 (1.0)
Type of injury[c]	
Head	24 (24.5)
Polytrauma[d]	6 (6.1)
Orthopaedic	48 (49.0)
Other – facial	5 (5.1)
Other – abdomen	11 (11.2)
Other – limb	2 (2.0)
Other – nerve	1 (1.0)
Missing	1 (1.0)

Note: Percentage totals are not 100 for every characteristic because of rounding; RTA = road traffic accident

[a] For subsequent analysis, causes of injury were combined to create two categories (fall/other or RTA)
[b] RTA included all types of road accidents (e.g., car, motorbike, bicycle)
[c] For subsequent analysis, types of injury were combined to create two categories (orthopaedic/other or head/polytrauma)
[d] Polytrauma refers to head injuries with orthopaedic/other injuries

Descriptive Statistics and Missing Data

Descriptive statistics, normative data, and missing data proportions for each study variable are presented in Table 2. Mean scores for the CDRISC, CRIES-8, FRI cohesion subscale, and all three subscales of the CASSS were within or similar to normative data ranges. Mean scores for the FRI expressiveness and conflict subscales were higher than expected norms for adolescents in non-distressed families (Moos & Moos, 2009).

Table 2

Descriptive statistics, normative data, and missing data within the sample (N = 98)

Variable	*Mdn*[a]	*M* (*SD*) [a]	Range[a]	*M* normative data	Missing *n* before person-mean imputation[b] (%)	Missing *n* after person-mean imputation[b] (%)
CDRISC	71.5	67.37 (16.54)	25 – 100	63.7 – 71.3[d]	8 (8.2)	6 (6.1)
Age (years)	15.0	14.80 (2.07)	11 – 19	n/a	1 (1.02)	n/a
Cause of injury	n/a	n/a	n/a	n/a	1 (1.02)	n/a
Type of injury	n/a	n/a	n/a	n/a	1 (1.02)	n/a
ISS	9.00	- [c]	1 – 35	n/a	11 (11.2)	n/a
Time (days)	869.0	996.72 (533.61)	169 – 1924	n/a	1 (1.02)	n/a
CRIES-8	13.0	14.76 (10.85)	0 – 40	12.9 – 23.9[d]	5 (5.1)	n/a
CASSS-T	56.0	54.60 (12.43)	13 – 72	51 – 56.4 [d]	7 (7.1)	6 (6.1)
CASSS-C	51.0	49.79 (13.86)	12 – 72	48.2 – 48.6 [d]	10 (10.2)	6 (6.1)
CASSS-F	61.0	58.78 (12.24)	12 – 72	58.2 – 60.5 [d]	9 (9.2)	8 (8.2)
FRIcoh	59.0	54.99 (9.99)	18 – 65	54.8 – 56.1 [d]	5 (5.1)	n/a
FRIexp	53.0	49.06 (12.78)	22 – 71	40.4 – 42.8[d]	5 (5.1)	n/a
FRIcon	44.0	46.53 (10.49)	33 – 75	33.5 – 38.7 [d]	6 (6.1)	n/a

Note: CASSS-C = Child and Adolescent Social Support Scale-Classmate subscale, CASSS-F = Child and Adolescent Social Support Scale-Close friend subscale, CASSS-T = Child and Adolescent Social Support Scale-Teacher subscale, CDRISC = Connor-Davidson Resilience Scale, CRIES = Children's Revised Impact of Event Scale-8 item version, FRIcoh = Family Relationship Index-Cohesion subscale, FRIexp = Family Relationship Index-Expressiveness subscale, FRIcon = Family Relationship Index-Conflict subscale, , ISS = Injury Severity Score, *M* = mean, *Mdn* = median, SD = standard deviation.

[a] The post-imputation descriptive statistics reported in the table are equivalent to pre-imputation figures to 1 decimal point.
[b] Person-mean imputation was conducted for CDRISC (*n* = 2), CASSS teacher (*n* = 1), CASSS classmate (*n* = 4) and CASSS close friend (*n* = 1) only; each with only one item missing per subscale.
[c] As per TARN guidance, only the median for ISS is reported rather than the mean
[d] Norms reported for CDRISC are based on samples of non-injured adolescent school samples (Davidson & Connor, 2017)
Norms reported for CRIES-8 are based on samples of children exposed to a traumatic event (Perrin et al., 2005)
Norms reported for CASSS subscales are based on school students aged 11 – 18 years (Malecki et al., 2014)
Norms reported for the FRI subscales are based on samples of adolescents from non-distressed families (see Tables C2 and C3 in Moos & Moos, 2009)

Bivariate Analyses

Initial Mann-Whitney U tests confirmed no significant difference between the resilience scores of respondents from MTC1 (*Mdn* = 68.5, *n* = 66) and those from MTC2 (*Mdn* = 74, *n* = 26), $U = 684$, $z = -1.51$, $p = .13$, $r = 0.16$.

For the continuous independent variables, the results of the Spearman's correlation analyses are presented in Table 3. The findings indicated that there were no statistically significant correlations between resilience and the demographic and injury-related variables of age, injury severity, and time since injury. The relationship between resilience and the injury event's psychological impact was significant and indicated a small negative correlation

(r_s = -.21, n = 91, p = .045), with higher levels of resilience associated with lower levels of self-reported psychological impact (or post-traumatic stress).

For family variables, there was a small positive correlation between resilience and family cohesion (r_s = .26, n = 90, p = .01), with higher resilience associated with higher levels of perceived cohesion. The relationship between resilience and other family variables (family expressiveness and family conflict) was not significant. There were statistically significant associations found between resilience and all aspects of social support; revealing medium positive correlations for all variables (r_s = .35 – .47, n = 88 – 90, ps < .001). Higher levels of resilience were associated with higher perceived frequency of teacher, classmate and close friend support.

Table 3

Spearman's correlations of continuous study variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Resilience (CDRISC)	-										
2. Age (years)	-.068 *n* = 91	-									
3. Severity (ISS)	-.15 *n* = 81	.07 *n* = 87	-								
4. Time (days)	.019 *n* = 91	.34** *n* = 97	.01 *n* = 87	-							
5. Psy. impact (CRIES-8)	-.21* *n* = 91	.07 *n* = 92	.07 *n* = 92	-.09 *n* = 92	-						
6. Teacher support (CASSS-T)	.35** *n* = 90	-.21 *n* = 91	-.08 *n* = 81	-.05 *n* = 91	-.13 *n* = 89	-					
7. Classmate support (CASSS-C)	.47*** *n* = 90	-.24* *n* = 91	-.15 *n* = 81	-.14 *n* = 91	-.16 *n* = 89	.58*** *n* = 92	-				
8. Friend support (CASSS-F)	.37*** *n* = 88	-.04 *n* = 89	-.27* *n* = 79	-.07 *n* = 89	.09 *n* = 87	.54*** *n* = 90	.58*** *n* = 90	-			
9. Family cohesion (FRIcoh)	.26* *n* = 90	-.08 *n* = 92	-.15 *n* = 83	-.06 *n* = 92	-.09 *n* = 89	.17 *n* = 89	.22* *n* = 89	.17 *n* = 87	-		
10. Family expression (FRIexp)	.17 *n* = 90	-.15 *n* = 92	.10 *n* = 82	-.13 *n* = 92	-.12 *n* = 89	.06 *n* = 90	.23* *n* = 90	.16 *n* = 88	.45*** *n* = 91	-	
11. Family conflict (FRIcon)	.04 *n* = 89	.13 *n* = 91	.11 *n* = 81	.07 *n* = 91	.05 *n* = 88	.01 *n* = 89	-.02 *n* = 89	-.11 *n* = 87	-.36*** *n* = 90	-.32*** *n* = 91	-

Note: CASSS-C = Child and Adolescent Social Support Scale-Classmate subscale, CASSS-F = Child and Adolescent Social Support Scale-Close friend subscale, CASSS-T = Child and Adolescent Social Support Scale-Teacher subscale, CDRISC = Connor-Davidson Resilience Scale, ISS = Injury Severity Score, CRIES = Children's Revised Impact of Event Scale-8 item version, FRIcoh = Family Relationship Index-Cohesion subscale, FRIexp = Family Relationship Index-Expression subscale, FRIcon = Family Relationship Index-Conflict subscale, SD = standard deviation.

*p <0.05; **p <0.01, ***p <0.001

As shown in Table 3, there were also significant correlations between some subscales of the CASSS and FRI. As expected, subscales within these two measures were correlated. Other significant correlations showed small negative relationships between age and classmate support, and between severity and close friend support.

For the categorical independent variables of injury cause and type, Mann-Whitney U tests revealed no significant difference in the resilience scores of respondents who had

sustained their injury as a result of a fall/other cause (*Mdn* = 72.0, *n* = 53) and those who had sustained their injury as a result of a RTA (*Mdn* = 71.5, *n* = 38), *U* = 985, *z* = -.18, *p* = .86, *r* = .02. There was also no significant difference in the resilience scores of respondents who had orthopaedic/other injuries (*Mdn* = 74.0, *n* = 63) and respondents who had experienced head injuries/polytrauma (*Mdn* = 68.5, *n* = 28), *U* = 733, *z* = -1.28, *p* = .20, *r* = .13.

Multiple Hierarchical Regression

A hierarchical multiple regression analysis was used to test the ability of social support factors (CASSS subscales) to predict levels of resilience above and beyond the influence of family environment factors (FRI subscales), whilst controlling for the effect of variables found to be significantly associated with resilience in initial bivariate analyses (i.e., the injury event's psychological impact [CRIES-8]). The overall regression model accounted for approximately 30% of variance in resilience (R^2-*adjusted* = .30, $F(7, 79) = 6.29$, $p < .001$).

As displayed in Table 4, the model in step 1 showed a non-significant influence of the psychological impact of the injury event on resilience. In step 2, family environment variables of cohesion, expressiveness, and conflict explained an additional 10% of the variance in resilience when controlling for psychological impact ($\Delta R^2 = .10$, *F-change*$(3, 82) = 2.99$, $p = .04$). Only the family cohesion variable of the FRI was a significant predictor, with higher ratings of family cohesion predicting higher resilience ($\beta = .30$, $p = .02$). As per initial correlational analysis, family expressiveness and family conflict were not significant.

In step 3, social support from teacher(s), classmate(s) and close friend(s) explained a further 23% of the variance ($\Delta R^2 = .23$, *F-change*$(3, 79) = 9.27$, $p < .001$). In this final model, only CASSS variables of classmate(s) and close friend(s) support were reported as statistically significant predictors of resilience; the highest beta value was recorded for

classmate support (β = .31, *p* = .02) then close friend (β = .28, *p* = .03). The teacher subscale was not significant, despite significant medium effects found in initial correlational analysis.

Table 4

Multiple hierarchical regression R^2, beta values (B), confidence intervals (CI), standardised beta values (β), t values, and semi-partial correlations (sr)

Model	R^2	B	95% CI for *B*	β	*t*	*sr*
Step 1	.04					
CRIES-8		-.29	-.61, .03	-.19	-1.81	-.19
Step 2	.13					
CRIES-8		-.24	-.56, .08	-.16	-1.52	-.16
FRIcoh		.49	.08, .91	**.30***	2.38	.25*
FRIexp		.13	-.18, .43	.10	.83	.09
FRIcon		.32	-.05, .69	.20	1.71	.18
Step 3	.36					
CRIES-8		-.19	-.49, .10	-.13	-1.29	-.12
FRIcoh		.20	-.18, .58	.12	1.06	.10
FRIexp		.07	-.21, .34	.05	.49	.04
FRIcon		.28	-.06, .62	.18	1.64	.15
CASSS-T		.01	-.31, .32	.01	.05	.01
CASSS-C		.37	.06, .67	**.31***	2.40	.22*
CASSS-F		.38	.05, .70	**.28***	2.29	.21*

Note: CASSS-C = Child and Adolescent Social Support Scale-Classmate subscale, CASSS-F = Child and Adolescent Social Support Scale-Close friend subscale, CASSS-T = Child and Adolescent Social Support Scale-Teacher subscale, CDRISC = Connor-Davidson Resilience Scale, ISS = Injury Severity Score, CRIES = Children's Revised Impact of Event Scale-8 item version, FRIcoh = Family Relationship Index-Cohesion subscale, FRIexp = Family Relationship Index-Expression subscale, FRIcon = Family Relationship Index-Conflict subscale

*p <0.05

In order to ascertain the potential impact of missing data within the severity variable (11.2% missing), all analyses were re-run with these cases excluded. All bivariate results remained unchanged. In multivariate analysis, family conflict became a significant predictor

at step two, but the results were unchanged in the final model, with classmate and close friend support the only significant predictors of resilience.

Discussion

The current cross-sectional study aimed to ascertain what factors were associated with and most predictive of resilience in young people who had experienced major physical trauma, in particular the influence of family environment and social support. To the author's knowledge, this was the first study to quantitatively and systematically explore these systemic factors within this population using a validated measure of resilience.

In bivariate analyses, there were no statistically significant associations between resilience and the demographic and injury-related variables of age, time since injury, severity, cause, and type of injury. However, there was a significant correlation between resilience and the injury event's psychological impact. Partly consistent with hypotheses one and two, resilience was significantly associated with family cohesion and all aspects of social support. Aspects of hypotheses two and three, which predicted that family expressiveness and conflict would be associated with resilience, were not supported.

In multivariate analysis, consistent with hypothesis four, family cohesion explained significant variance in resilience when controlling for injury-related characteristics. In the final step, however, only classmate and close friend support were found to be statistically significant predictors of resilience when controlling for all other variables in the model.

Main Findings

Demographic and injury-related variables. The lack of significant association found between resilience and the variables of age, cause, type, severity, and time since injury reflects previous findings in both paediatric injury (Brown et al., 2016; De Young et al., 2012; Quezada et al., 2014) and adult physical trauma (Driver et al., 2016; Hanks, Rapport,

Waldron Perrine, & Millis, 2016; Zarzaur, Bell, & Zanskas, 2017) that indicate that these factors do not consistently relate to or explain resilience. Notably, the significance of the psychological impact of the injury event became non-significant when systemic variables were accounted for. This suggests that such factors are less pertinent to one's sense of resilience, supporting the theory that other modifiable resources can be identified and harnessed in order to support resilience and well-being among young people following severe injury (Rosenberg & Yi-Frazier, 2016).

Resilience scores were lower in young people who had more severe injuries, however these results were not statistically significant. Severity was, however, negatively associated with support from close friends. This finding is consistent with research exploring resilience in young people with a cleft lip/palate, which similarly found that adolescents who had additional conditions reported less positive peer relationships and experiences (Cuddy, 2016b). One explanation for these results could relate to increased social isolation following more severe injuries (e.g., Pell, Donnan, Fowkes, & Ruckley, 1993; Salas, Casassus, Flanagan, Rowlands, & Pimm, 2016), resulting in less contact with friends. It is possible that the impact of this on resilience could however be 'buffered' by other forms of social support (e.g., Wade et al., 2004), such as classmates. Findings from the current study regarding the prominent role of close friends and classmates in resilience (discussed subsequently) could have implications for those with more severe injuries, however the study's relatively modest sample size precluded more sophisticated analysis to test any dynamic interaction between these factors.

Family environment. Higher levels of family cohesion were associated with higher resilience. This result is consistent with previous research and supports the growing literature that posits the role of the family environment – specifically cohesion, support, warmth and acceptance – in relation to promoting resilience in paediatric populations (Holaday &

McPhearson, 1997; Im & Kim, 2012; Kim & Yoo, 2010; Le Brocque et al., 2010b; McCubbin et al., 2002; McNulty, 2015b; Quezada et al., 2016).

Contrary to the study hypotheses, family expressiveness and conflict were not found to be associated with resilience. Although family cohesion remained a significant predictor of resilience when controlling for these family variables in addition to the psychological impact of the injury event, these effects were no longer significant when social support was included in the final step of the regression. Only social support variables were considered significant predictors in the final model. However, limitations regarding the measure of family environment are apparent and discussed subsequently with implications for future research.

Social support. Consistent with proposed hypotheses, initial correlations indicated that higher perceived support from teachers, classmates, and close friends was associated with higher levels of resilience. Importantly, when controlling for the impact of other family, social support, and psychological impact variables, classmate and close friend support remained the only significant predictors. The results provide support for the growing evidence base that implicates peer support as integral to a young person's sense of resilience following severe injury (Holaday & McPhearson, 1997; Stanton, 2006), chronic illness (Im & Kim, 2012; Ross et al., 2017) and to paediatric coping and adjustment more broadly (Marsac et al., 2014; Porritt et al., 2015).

Social support from peers is thought to benefit all adolescents and contributes significantly to well-being (Helsen, Vollebergh, & Meeus, 2000), but is considered particularly pertinent to those who experience adversity as it can 'buffer' the impact of such trauma (Lantagne et al., 2018; Wade et al., 2004). One possible explanation for the results of the current study could be the tendency young people have to become less dependent on parents – and arguably adults more generally – for support during adolescence (Ainsworth,

1989), with peers potentially becoming an increasingly key source of support. In adolescent physical health populations, research has found increased reliance on peers over parents, and direct relationships between peer support and well-being (Kef & Dekovic, 2004; La Greca et al., 1995; Oris et al., 2016). The small negative association found between age and classmate support may also be indicative of how peer support changes throughout adolescence, with classmate interactions becoming less prevalent as adolescents leave full time education.

The results suggest that resilience interventions offered for this population, the majority of which currently focus solely on parent/caregiver and family involvement (e.g., Cox, Kenardy, & Hendrikz, 2010; Saltzman, 2016), could benefit from incorporating the identification and development of peer resources. More broadly, they support a definition and theory of resilience that increasingly accounts for "the influence of environments that facilitate or inhibit resilience-promoting processes" (Ungar, 2012b, p. 1).

Limitations

Several limitations are of note. Many pertain to the methodological confines of the study but also to the definition of resilience, reinforcing the conceptual ambiguity that remains within the field (Windle, 2011; Zolkoski & Bullock, 2012).

First, the current study was cross-sectional and therefore causality and the directional nature of the variables relative to resilience cannot be inferred. Resilience, and the assets and resources associated with it, is increasingly considered a process and a dynamic construct that changes across the life span, with new vulnerabilities and strengths developing from different life experiences (Luthar, 2006; Rutter, 2006; Windle, 2011). Measuring a single time point precludes the ability to explore the dynamic process of resilience in young people following major physical trauma. In the present study, the author emphasises the nature of resilience as

dynamic and how the current findings, measured psychometrically, represent just one time point for this population.

Second, due the conceptual ambiguity surrounding the definition of resilience (Zolkoski & Bullock, 2012), it cannot be suggested that the findings of the current study be generalised to all conceptualisations. In the context of paediatric psychology, Hilliard et al. (2015, p. 837) posit resilience as the "demonstration of emotional, behavioral, or health outcomes that match or surpass normative developmental milestones, behavioural functioning, or emotional well-being" despite the challenge of illness or injury. By this definition, resilient outcomes could be conceptualised relatively diversely (e.g., by positive experiences, maintaining a typical trajectory, and/or the absence of negative experiences), which the current study arguably neglects. However, Rosenberg & Yi-Frazier (2016) have suggested limitations in defining resilience solely in terms of such heterogeneous outcomes within paediatric psychology. They discuss the difficulty that arises in consistently identifying resilience across varied populations and settings, especially evident since not all authors explicitly label their outcome(s) as definitive of resilience. The authors instead suggest a greater focus on resilience resources, which the current study has aimed to fulfil, alongside an explicit, operationalised measure of the construct.

Third, the study only measured resilience from the perspective of the young person. This was considered a strength since much of the earlier resilience research with children and adolescents relied solely on parental or family accounts (Brosbe, Hoefling, & Faust, 2011; Gauvin-Lepage et al., 2015). However, it has only highlighted resilience in the context of a young person's sense of personal resilience and the systemic factors that are predictive of this, rather than young person resilience from the perspective of others (e.g., family, teachers) and/or the interaction between those factors. The author appreciates other diverse perspectives surrounding resilience, specifically in paediatric populations, such as the family

resiliency model posited by McCubbin and McCubbin (1993), which accounts for interactions between parent/caregiver factors and those of the young person.

Fourth, though the study recruited from multiple sites, selection bias from the recruitment strategy cannot be ruled out. Due to the clinical pathways within recruitment sites, young people with burn injuries were not included. Non-accidental injuries were also not sampled and might have yielded different results. Respondents who did complete questionnaires did so a minimum of five months post-injury, therefore the results cannot be generalised to inpatients or those in the earlier periods of adjustment. It could also be hypothesised that those not completing the questionnaires (over 87% of young people invited) may be more distressed and less resilient than those who did complete the research (O'Donnell, Elliott, Lau, & Creamer, 2007; Powers, 2011). These issues highlight potential limits in the representativeness of the sample and the generalisability of the findings.

Finally, the results should be interpreted with caution given the relatively small sample size. Due to missing data, regression analysis (n = 82) lacked optimal power (optimal n = 103 for seven predictor variables), increasing the probability of a Type-II error. This also precluded more sophisticated statistical analysis to explore potential interactions in the relationships found.

Future Considerations and Directions

First, prospective research with larger samples and greater power is required to corroborate the findings of the current study. Investigating potential mediation and moderation relationships across the variables and whether influential factors vary according to age could be considered. Exploring the continuity or change in resilience and the factors that predict it over time would also be valuable (Cosco et al., 2017), particularly in the context of significant milestones following major injury (e.g., discharge from intensive care

units, further surgical procedures, returning home) and different developmental stages of childhood and adolescence.

Second, it remains unclear as to which factors constitute resilience or a resilient journey in this population and therefore how to measure what predicts it. Further prospective studies should continue to ascertain which resources (or processes; see Yi, Smith, & Vitaliano, 2005) and outcomes are most important (e.g., areas of social, academic and/or emotional resilience; Luthar, Cicchetti, & Becker, 2000) and to which group of people in order to inform how to foster them in specific paediatric populations (Rosenberg & Yi-Frazier, 2016). The current study has contributed to understanding the systemic resources that may be key to resilience following major paediatric injury. However, further qualitative research could serve to improve our understanding of resilience in terms of what specific outcomes are most important and also the process of how best to harness those [peer and familial] resources to facilitate a positive journey. This could also aid further development of quantitative measures that validly assess the construct of resilience in this younger population.

Third, future research looking at multiple perspectives and impacts on and of a system (e.g., individual, parents, siblings, peers, schools, communities, cultures, spiritualties, societies) following major injury could serve to increase the understanding of the interaction and interdependence of these multiple levels of resilience on one another (Masten, 2007). This would extend the current literature and theory by ascertaining the influence of the wider social context (i.e., social and physical ecologies beyond that of family, peer, and school environments) in paediatric populations, as noted in broader resilience research with young people and families (Ungar, 2012a).

Fourth, the use of the TARN ISS as an indicator of severity may also represent an area of consideration for future research. Though standardised and representative of how severity is classified in major trauma services globally, the ISS does not specifically account for the functional impairment caused by the injury, which anecdotally is thought to be most indicative of those requiring increased support from services, including psychological support. As a result of the TARN recording specifications (i.e., particular body locations, admission for a minimum of 72 hours), trauma injuries that may still cause significant impairment are not rated. Despite this, the ISS is widely used throughout international medical and health research and is considered the gold standard measure of trauma severity (Palmer, 2007). Its use within the current study therefore enables direct comparison across the wider literature, though assessing the influence of functional impairment in addition to ISS may be beneficial in future paediatric resilience research.

Finally, though the measures utilised have been widely used in paediatric populations, only two (the CASSS and CRIES-8) were specifically designed for children and young people. The age restriction of the sample was a consequence of not all questionnaires being validated in younger age groups (i.e., below 11 years). As Tonks et al. (2011) suggest, though the questionnaires are believed to have been age-appropriate, more detailed checking of measures and the items within them could be beneficial in future research. In order to develop an understanding of younger children's sense of their resilience and the factors that may predict it, validated measures must be developed for this age group.

Specific attention should be paid to the measure of family environment (Van Schoors et al., 2017). Notably, the FRI demonstrated low internal consistency in the current study and in similar paediatric research (e.g., McNulty, 2015b), indicating specific issues regarding reliability. Furthermore, since only the index of family relationships was used, pertinent aspects of the family environment and family functioning that may uniquely foster resilience

in paediatric populations might not have been measured (Van Schoors et al., 2017). Initial research has suggested, for instance, that parents who support children to engage in 'injury talk', where they can talk openly about their injury and its impact, could foster resilience (Alisic et al., 2017). Maintaining stability at home and previous family rituals has also been implicated in qualitative resilience research with young people following burn injuries (Holaday & McPhearson, 1997). Such aspects of the family environment may uniquely promote resilience in this population, but were not necessarily examined within the measure used in the current study. The development of age-appropriate, reliable and valid measures of multiple aspects of the family environment is recommended.

Crucially, this is the first and therefore the only study to establish the role of peer support over and above family relationships in predicting resilience in young people following traumatic injury. Further research is required to corroborate the findings and to assess the utility and impact of peer-based compared to family-based interventions, which currently dominate clinical practice.

Clinical Implications

To the author's knowledge, this is the first study to systematically explore the influence of systemic factors on self-reported resilience in young people following major physical trauma. In doing so it has enhanced the understanding of which factors may be most pertinent to this population, thus indicating areas in which to focus assessment, support and intervention.

Firstly, the results may help clinicians working in major physical trauma to identify young people who may experience increased difficulties in building resilience, such as those reporting lower levels of support from friends and/or classmates. The findings suggest that it may be important to ask about current levels of peer support, social interaction and, inversely,

social withdrawal, in order to identify those at risk of having greater difficulties. Furthermore, it informs clinicians of the factors to highlight to young people and their families with regards to what can support them in the process of 'bouncing back' from injury (i.e., positive, supportive peer relationships). It may be beneficial to help young people to think about how to facilitate conversations with peers about their injury that feel helpful to them, and how best to provide information to schools to support their reintegration.

Secondly, existing recommendations for resilience-building interventions in paediatric and wider trauma fields have often promoted a systems approach, however this has tended to focus on and involve only the individuals and their families (e.g., Cox, et al., 2010; Saltzman, 2016; Traub & Boynton-Jarrett, 2017). Interventions that focus on identifying and harnessing new and existing peer 'resources' could be beneficial for fostering resilience in young people following major injury (Rosenberg & Yi-Frazier, 2016). Involving schools as well as families may also serve to facilitate this (Joshi & Lewin, 2004).

Conclusions

The results indicated that support from friends and classmates is most predictive of resilience in children and adolescents who have experienced major physical trauma. Assessment and intervention that incorporates peer support may therefore be beneficial in identifying and fostering resilience resources in this population. The current study extends previous research exploring resilience in paediatric injury populations by systematically examining the impact of wider systemic factors.

Resilience theory and research in paediatric injury is still in its infancy. It is hoped that the results of this study will contribute to developing a unifying theoretical framework considered necessary to fully understand and effectively research resilience following paediatric trauma (Hilliard et al., 2015). However, further prospective research exploring

multiple perspectives and levels of resilience is necessary (Southwick et al., 2014). Evaluation of interventions informed by this is also required.

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Appendix A

Author Guidelines for the Journal of Pediatric Psychology

Instructions to Authors

The *Journal of Pediatric Psychology* is an official publication of the Society of Pediatric Psychology, Division 54 of the American Psychological Association. JPP publishes articles related to theory, research, and professional practice in pediatric psychology.

Types of Manuscripts

- Original research, including case studies
- Review articles
- Invited commentaries

Organization of manuscripts

Manuscript Central will guide authors through the submission steps, including: Abstract, Keyword selection, and the Manuscript. The manuscript must contain an Introduction, Methods, Results, Discussion, Acknowledgements and Reference List.

Length of manuscript: Original research articles should not exceed 25 pages, in total, including title page, references, figures, tables, etc. In the case of papers that report on multiple studies or those with methodologies that necessitate detailed explanation, the authors should justify longer manuscript length to the Editor in the cover letter. Case reports should not exceed 20 pages. Review articles should not exceed 30 pages. Invited commentaries should not exceed 4 pages. The Journal of Pediatric Psychology no longer accepts brief reports but will accept manuscripts that are shorter in length than the 25 page manuscripts.

Manuscripts (text, references, tables, figures, etc.) should be prepared in detailed accord with the Publication Manual of the American Psychological Association (6th ed.). There are two exceptions:
(a) The academic degrees of authors should be placed on the title page following their names, and
(b) a structured abstract of not more than 250 words should be included. The abstract should include the following parts:
(1) Objective (brief statement of the purpose of the study);
(2) Methods (summary of the participants, design, measures, procedure);
(3) Results (the primary findings of this work); and
(4) Conclusions (statement of implications of these data).

Key words should be included, consistent with APA style. Submissions should be double-spaced throughout, with margins of at least 1 inch and font size of 12 points (or 26 lines per page, 12-15 characters per inch). Authors should remove all identifying information from the body of the manuscript so that peer reviewers will be unable to recognize the authors and their affiliations. E-mail addresses, whenever possible, should be included in the author note.

Informed consent and ethical treatment of study participants: Authors should indicate in the Method section of relevant manuscripts how informed consent was obtained and report the approval of the study by the appropriate Institutional Review Board(s). Authors will also be asked to sign a statement, provided by the Editor that they have complied with the American Psychological Association Ethical Principles with regard to the treatment of their sample.

Clinical relevance of the research should be incorporated into the manuscripts. There is no special section on clinical implications, but authors should integrate implications for practice, as appropriate, into papers.

Terminology should be sensitive to the individual who has a disease or disability. The Editors endorse the concept of "people first, not their disability." Terminology should reflect the "person with a disability" (e.g., children with diabetes, persons with HIV infection, families of children with cancer) rather than the condition as an adjective (e.g., diabetic children, HIV patients, cancer families). Nonsexist language should be used.

Updated March 2017

Appendix B

Agency for Research and Healthcare Quality Assessment

General instructions: Grade each criterion as ‘yes’, ‘no’, ‘partially’, or ‘cannot tell’. Factors to consider when making an assessment are listed under each criterion. Note that some criteria will only apply to specify types of study; where this is the case, the design it applies to is stated in italics. Studies where the criterion does not apply, grade as ‘not applicable (n/a)’.

1. Unbiased selection of cohort?
Factors that help reduce selection bias:
a. Inclusion/exclusion criteria
- Is it clearly described?

b. Recruitment strategy
- Is it clearly described?
- Is the sample representative of the population of interest: How representative of the general population is the study sample (i.e. young people who have experienced physical trauma/injury sampled represents all young people who have experienced physical trauma/injury)? Is there potential for selection bias in the recruitment method (e.g. convenience sampling from specific medical settings, are response rates reported – responders vs non-responders)?
- Are different recruitment strategies used? If so, are there differences in results according to the strategy? Are these accounted for?

2. Selection minimises baseline differences in demographic factors? (*For controlled studies only – i.e. case control study*)
Factors to consider:
a. Was selection of the comparison group appropriate?
- Is the sample size of each group appropriate?
- Are these two sources likely to differ on factors related to the outcome (i.e. resilience)? Differences in clinical characteristics would be expected, but matching on key demographics (age, gender, ethnicity, education, etc.) would still be required to minimize bias.

3. Sample size calculated?
Factors to consider:
a. Did the authors report conducting a power analysis or describe some other basis for determining the adequacy of study group/sample sizes for the primary outcome(s) of interest?
b. Did the eventual sample size deviate by < 10% of the sample size suggested by the power calculation?

4. Adequate description of the participant sample?
Consider whether the participants are well-characterised in terms of baseline demographics?
a. Consider key demographic information such as age and gender
b. Information regarding ethnicity, education or socio-economic characteristics is also important. Injury characteristics are specifically relevant for this review.

5. Reliable, valid, and validated assessment of resilience?
Factors to consider:
a. Was the method used to assess/conceptualise resilience clearly described? (Details should be sufficient to permit replication in new studies).
b. Was a valid and reliable measure used to assess resilience (according to their definition)? If authors have developed their own study tool: did they use factor analysis to test the validity of the tool? Has the measure been used in other studies? Is it age-appropriate? (Note that measures consisting of single

items of scales taken from larger measures are likely to lack content validity and reliability. Typically self-report measures tend to have lower reliability and validity than clinical interview; however, this is less relevant to the current review as interest is regarding perception of one's own resilience).
c. Was a resilience-specific measure used, i.e. a tool specifically designed to measure the construct of resilience (e.g. CD-RISC, RSCA)?

6. Reliable, valid, and validated method for assessing other variables of interest?
Factors to consider:
a. Were the methods used to assess other constructs clearly described? (Details should be sufficient to permit replication in new studies)
b. Were valid and reliable measures used to assess other constructs? If authors have developed their own study tool: did they use factor analysis to test the validity of the tool? Has the measure been used in other studies? (Note that measures consisting of single items of scales taken from larger measures are likely to lack content validity and reliability. Self-report measures tend to have lower reliability and validity than clinical interview). Were medical records (rather than self-report) used to ascertain injury-related factors?

7. Assessors blind to resilience/clinical status? (*For group comparison studies only – i.e. longitudinal and case control*)
a. Were the study investigators who assessed outcomes blind to the clinical status of participants? (Note that even in single-arm studies some degree of blinding is possible, for example using external interviewers with no knowledge of participants' clinical status. In studies where researcher effects are not likely due to method [e.g., online questionnaire or mailed questionnaire where there is no contact with researcher] there is unlikely to be bias here and blinding will not be needed.).

8. Adequate follow-up period? *(For longitudinal studies only)*
Factors to consider:
a. A justification of the follow-up period length is preferable.
b. Follow-up period should be the same for all groups, where applicable.

9. Missing data
Factors to consider:
a. Did missing data from any group exceed 20%? In longitudinal studies consider attrition over time as a form of missing data. Note that the criteria of < 20% missing data may be unrealistic over longer follow-up periods.
b. If missing data is present and substantial, were steps taken to minimize bias (e.g., sensitivity analysis or imputation)?

10. Analysis controls for confounders?
Factors to consider:
a. Does the study identify and control for important confounding variables? For example, using multiple regression to adjust for demographic or clinical factors likely to be correlated with predictor and outcome. For controlled studies (case control), does the study identify and control for important confounding variables and effect modifiers? Confounding variables are risk factors that are correlated with resilience and other variables of interest and may therefore bias the estimation of the effect of those variables of interest on resilience if unmeasured. These may include demographic, injury-related, systemic/familial/parental, and clinical variables (e.g. co-morbidity).

11. Analytic methods appropriate?
Factors to consider:
a. Was the type of analysis done appropriate for the type of outcome data (categorical, continuous, etc.)?
b. Was the number of variables used in the analysis appropriate for the sample size? (The statistical techniques used must be appropriate to the data and take into account issues such as controlling for

small sample size, clustering, rare outcomes, multiple comparison, and number of covariates for a given sample size)

c. Where appropriate, do they check the distribution of variables, and use assessments relevant to this (e.g. parametric vs non-parametric)? Do they check for normality, homoscedasticity, linearity etc.? Do they check multicollinearity? Do they check if any cases have influential or unusual values that might skew the analysis?

Appendix C

Online Questionnaires

Children's Revised Impact of Event Scale (CRIES-8; Yule, 1997)

C-IES-8

Revised Child Impact of Events Scale

Below is a list of comments made by people after stressful life events. Please tick each item showing how frequently these comments were true for you *during the past seven days*. If they did not occur during that time please tick the 'not at all' box.

Name: ..... Date: .....

		Not at all	Rarely	Some-times	Often	In	Av
1.	Do you think about it even when you don't mean to?	[ ]	[ ]	[ ]	[ ]		
2.	Do you try to remove it from your memory	[ ]	[ ]	[ ]	[ ]		
3.	Do you have waves of strong feelings about it	[ ]	[ ]	[ ]	[ ]		
4.	Do you stay away from reminders of it (e.g. places or situations)	[ ]	[ ]	[ ]	[ ]		
5.	Do you try not talk about it	[ ]	[ ]	[ ]	[ ]		
6.	Do pictures about it pop into your mind?	[ ]	[ ]	[ ]	[ ]		
7.	Do other things keep making you think about it?	[ ]	[ ]	[ ]	[ ]		
8.	Do you try not to think about it?	[ ]	[ ]	[ ]	[ ]		

Family Relationship Index (FRI; Holahan & Moos, 1982; Moos & Moos, 2002, 2009)

Sample items provided only for copyright reasons:

Family members really help and support one another.	True	False
We fight a lot in our family.	True	False

The Child and Adolescent Social Support Scale (CASSS; Malecki, Demaray, & Elliott, 2000, 2014)

CHILD AND ADOLESCENT SOCIAL SUPPORT SCALE - CASSS

Grades 3 – 12

Christine Kerres Malecki, Michelle Kilpatrick Demaray, and Stephen Elliott

NAME: _____ AGE: _____ GRADE: _____

TEACHER: _____ SCHOOL: _____

MALE or FEMALE (circle one) DATE: _____

RACE (circle one)

1 – African-American
2 – Asian
3 – White
4 – Hispanic
5 – Native American
6 – Other

For Research Purposes: ID Number _____

Does this student have a disability? ☐ Yes ☐ No
If yes, what type of disability?
☐ Learning Disability
☐ Behavior Disorder
☐ Cognitive Disability
☐ Other Disability (specify) _____

On the next two pages, you will be asked to respond to sentences about some form of support or help that you might get from either a parent, a teacher, a classmate, or a close friend. Read each sentence carefully and respond to them honestly. There are no right or wrong answers.

For each sentence you are asked to provide two responses. First, rate how often you receive the support described and then rate how important the support is to you. Below is an example. Please read it carefully before starting your own ratings.

	HOW OFTEN?						IMPORTANT?		
	NEVER	ALMOST NEVER	SOME OF THE TIME	MOST OF THE TIME	ALMOST ALWAYS	ALWAYS	NOT IMPORTANT	IMPORTANT	VERY IMPORTANT
1. My teacher(s) helps me solve problems.	1	2	(3)	4	5	6	1	(2)	3

In this example, the student describes her 'teacher helps me solve problems' as something that happens 'some of the time' and that is 'important' to her.

Please ask for help if you have a question or don't understand something. Do not skip any sentences. Please turn to the next page and answer the questions. Thank you!

My Teacher(s)...	How Often?						Important?		
	Never	Almost Never	Some of the Time	Most of the Time	Almost Always	Always	Not Important	Important	Very Important
13...cares about me.	1	2	3	4	5	6	7	8	9
14...treats me fairly.	1	2	3	4	5	6	7	8	9
15...makes it okay to ask questions.	1	2	3	4	5	6	7	8	9
16...explains things that I don't understand.	1	2	3	4	5	6	7	8	9
17...shows me how to do things.	1	2	3	4	5	6	7	8	9
18...helps me solve problems by giving me information.	1	2	3	4	5	6	7	8	9
19...tells me I did a good job when I've done something well.	1	2	3	4	5	6	7	8	9
20...nicely tells me when I make mistakes.	1	2	3	4	5	6	7	8	9
21...tells me how well I do on tasks.	1	2	3	4	5	6	7	8	9
22...makes sure I have what I need for school.	1	2	3	4	5	6	7	8	9
23...takes time to help me learn to do something well.	1	2	3	4	5	6	7	8	9
24...spends time with me when I need help.	1	2	3	4	5	6	7	8	9

My Classmates…	How Often?						Important?		
	Never	Almost Never	Some of the Time	Most of the Time	Almost Always	Always	Not Important	Important	Very Important
25…treat me nicely.	1	2	3	4	5	6	7	8	9
26…like most of my ideas and opinions.	1	2	3	4	5	6	7	8	9
27…pay attention to me.	1	2	3	4	5	6	7	8	9
28…give me ideas when I don't know what to do.	1	2	3	4	5	6	7	8	9
29…give me information so I can learn new things.	1	2	3	4	5	6	7	8	9
30…give me good advice.	1	2	3	4	5	6	7	8	9
31…tell me I did a good job when I've done something well.	1	2	3	4	5	6	7	8	9
32…nicely tell me when I make mistakes.	1	2	3	4	5	6	7	8	9
33…notice when I have worked hard.	1	2	3	4	5	6	7	8	9
34…ask me to join activities.	1	2	3	4	5	6	7	8	9
35…spend time doing things with me.	1	2	3	4	5	6	7	8	9
36…help me with projects in class.	1	2	3	4	5	6	7	8	9

My Close Friend…	How Often?						Important?		
	Never	Almost Never	Some of the Time	Most of the Time	Almost Always	Always	Not Important	Important	Very Important
37…understands my feelings.	1	2	3	4	5	6	7	8	9
38… sticks up for me if others are treating me badly.	1	2	3	4	5	6	7	8	9
39… spends time with me when I'm lonely.	1	2	3	4	5	6	7	8	9
40…gives me ideas when I don't know what to do.	1	2	3	4	5	6	7	8	9
41…gives me good advice.	1	2	3	4	5	6	7	8	9
42…explains things that I don't understand.	1	2	3	4	5	6	7	8	9
43…tells me he or she likes what I do.	1	2	3	4	5	6	7	8	9
44…nicely tells me when I make mistakes.	1	2	3	4	5	6	7	8	9
45…nicely tells me the truth about how I do on things.	1	2	3	4	5	6	7	8	9
46…helps me when I need it.	1	2	3	4	5	6	7	8	9
47…shares his or her things with me.	1	2	3	4	5	6	7	8	9
48…takes time to help me solve my problems.	1	2	3	4	5	6	7	8	9

Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003)

Removed for copyright reasons

Appendix D

Doctorate in Clinical Psychology Research Review Committee (RRC) Approval

RRC Approval sent to Sponsor, Research Ethics Committee and Health Research Authority

UNIVERSITY OF LIVERPOOL

D.Clin.Psychology Programme
Division of Clinical Psychology
Whelan Building, Quadrangle
Brownlow Hill
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L69 3GB

Tel: 0151 794 5530/5534/5877
Fax: 0151 794 5537
www.liv.ac.uk/dclinpsychol

Francine Washington
Clinical Psychology Trainee
Doctorate of Clinical Psychology Doctorate Programme
University of Liverpool
L69 3GB

14th December 2016

RE: Predictors of resilience in children and adolescents who have experienced major physical trauma: Working towards a systemic model of resilience

Trainee: Francine Washington
Supervisors: Julie Van Vuuren, Victoria Gray

Dear Francine,

Thank you for your notification of minor amendment to your proposal submitted to the Chair of the D.Clin.Psychol. Research Review Committee (letter dated 14/12/16).

I can now confirm that your amended proposal (version 3.1, dated 14/12/16) and revised budget (version 2, dated 14/12/16) meet the requirements of the committee and have been approved by the Committee vice-Chair.

Please take this Chairs Action decision as ***final*** approval from the committee.

You may now progress to the next stages of your research.

I wish you well with your research project.

Dr Catrin Eames
Vice-Chair D.Clin.Psychol. Research Review Committee.

RRC Approval following substantial amendment

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Francine Washington
Clinical Psychology Trainee
Doctorate of Clinical Psychology Doctorate Programme
University of Liverpool
L69 3GB

27 September 2017

RE: Predictors of resilience in children and adolescents who have experienced major physical trauma: Working towards a systemic model of resilience
Trainee: Francine Washington
Supervisors: Julie Van Vuuren & Victoria Gray

Dear Fran,

Thank you for your notification of minor amendment to your proposal submitted to the Chair of the D.Clin.Psychol. Research Review Committee (*dated 13/09/17*).

I can now confirm that your amended proposal (*version number 3.4, dated 13/09/17*) meets the requirements of the committee and has been approved by the Committee Chair.

Please take this Chairs Action decision as ***final*** approval from the committee.

You may now progress to the next stages of your research.

I wish you well with your research project.

Dr Catrin Eames
Vice-Chair D.Clin.Psychol. Research Review Committee.

Appendix E

University of Liverpool Sponsorship Approval

LIVERPOOL HEALTH PARTNERS

Dr Julie Van Vuuren
D.Clin.Psychol. Programme
The University of Liverpool
Division of Clinical Psychology
The Whelan Building
Brownlow Hill
Liverpool
L69 3GB

Mr Alex Astor
Head of Liverpool Joint Research Office

University of Liverpool
Research Support Office
2nd Floor Block D Waterhouse Building
3 Brownlow Street
Liverpool
L69 3GL

Tel: 0151 794 8739
Email: sponsor@liv.ac.uk

13 January 2017

Sponsor Ref: UoL001254

Re: Sponsorship Approval

"Predictors of resilience in children and adolescents who have experienced major physical trauma: Working towards a systemic model of resilience"

Dear Dr Van Vuuren

After consideration at the JRO Non Interventional Sponsorship Sub Committee on 19th October 2016 I am pleased to confirm that the University of Liverpool is prepared to act as Sponsor under the Department of Health's Research Governance Framework for Health and Social Care 2nd Edition (2005) for the above study.

The following documents have been received by the Joint Research Office

Document title	Version	Date
Protocol	3.1	14th December 2016

Please note this letter does NOT allow you to commence recruitment to your study.
A notification of Sponsor Permission to Proceed will be issued when governance and regulatory requirements have been met. Please see Appendix 1 to this letter for a list of the documents required.

If you have not already applied for regulatory approvals through IRAS you may now do so at https://www.myresearchproject.org.uk/Home.aspx.

In order to meet the requirements of the Research Governance Framework 2nd Ed 2005, the University requires you to agree to the following Chief Investigator responsibilities:

1. Comply with the Research Governance Framework 2nd Ed 2005 and all relevant legislation, including but not limited to the Data Protection Act 1998, the Mental Capacity Act 2005 and the Human Tissue Act 2004;

2. Inform the Research Support Office as soon as possible of any adverse events especially SUSARs and SAE's, Serious Breaches to protocol or relevant legislation or any concerns regarding research conduct;

3. Approval must be gained from the Research Support Office for any amendments to, or changes of status in the study **prior to** submission to REC and any other regulatory authorities;

4. It is a requirement that Annual Progress Reports are sent to the NHS Research Ethics Committee (REC) annually following the date of Favourable Ethical Approval. You must provide copies of any reports submitted to REC and other regulatory authorities to the Research Support Office;

5. Maintain the study master file;

6. Make available for review any study documentation when requested by the sponsors and regulatory authorities;

7. Upon the completion of the study it is a requirement to submit and an End of Study Declaration (within 90 days of the end of the study) and End of Study Report to REC (within 12 months of the end of the study). You must provide copies of this to the Research Support Office;

8. Ensure you and your study team are up to date with the current RSO SOPs throughout the duration of the study.

The University also requires you to comply with the following:

University professional indemnity and clinical trials insurances will apply to the study as appropriate. This is on the assumption that no part of the clinical trial will take place outside of the UK. If you wish to conduct any part of the study in a site outside the UK or you wish to sub-contract any part of the study to a third party specific approvals and consideration of appropriate indemnity would be required;

If you have any queries regarding the sponsorship of the study or the above conditions, please do not hesitate to contact the Joint Research Office governance team on 0151 794 8373 (email sponsor@liv.ac.uk).

Yours sincerely

Mr Alex Astor
Head of Liverpool Joint Research Office

Appendix F

National Research Ethics Service Approval

Removed for confidentiality

Appendix G

Health Research Authority Approval

Removed for confidentiality

Appendix H

Capacity and Capability Confirmation from NHS Trusts

Removed for confidentiality

Appendix I

Invite Letters and Participant Information Sheets

Participants aged 11-15: Parent invite and information sheet

Removed for confidentiality

Participants aged 11-15: Young person information sheet

Removed for confidentiality

Participants aged 16+: Young person invite and information sheet

Removed for confidentiality

Appendix J

Online Consent and Assent Forms

Removed for confidentiality

Appendix K

Prompt Letters

Participants aged 11-15: Parent prompt letter

Removed for confidentiality

Participants aged 16+: Young person prompt letter

Removed for confidentiality

Appendix L

Data Screening to Test the Assumptions of Parametric Tests

Histograms

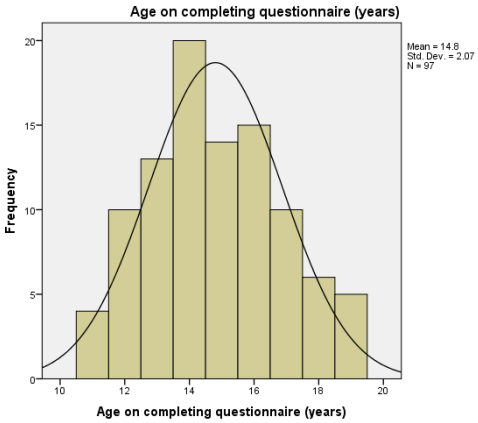

Figure L1. Distribution of ages

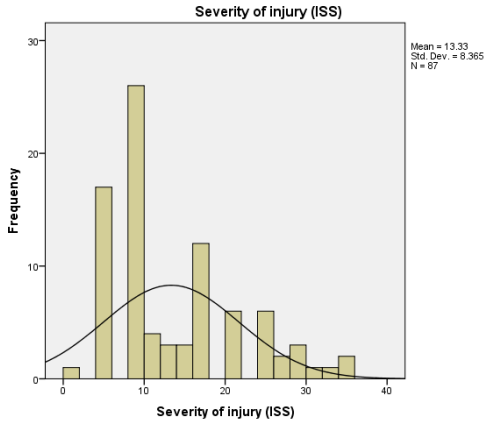

Figure L2. Distribution of severity scores (ISS)

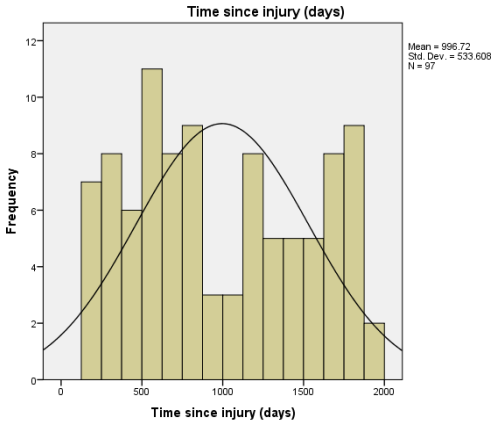

Figure L3. Distribution of time since injury

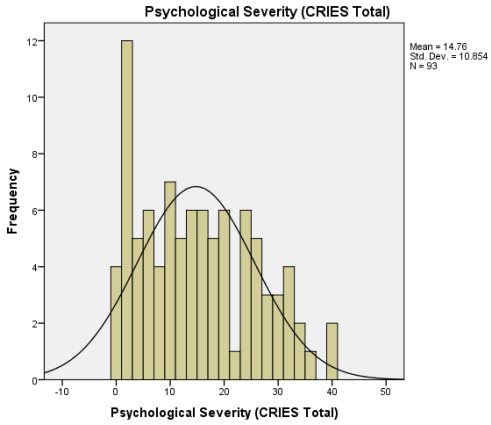

Figure L4. Distribution of CRIES-8 scores

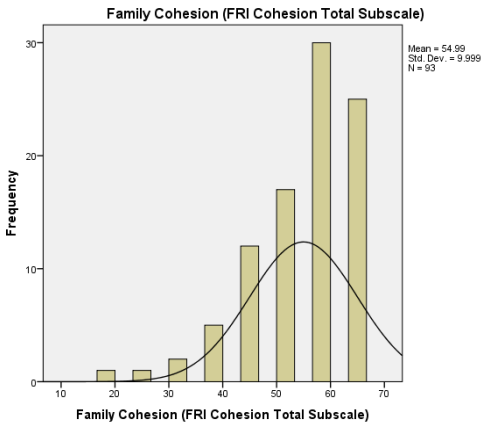

Figure L5. Distribution of FRIcoh scores

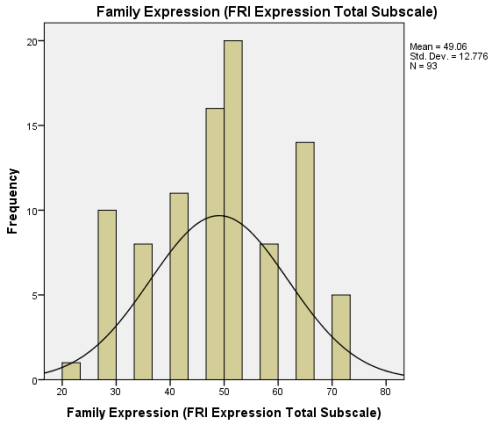

Figure L6. Distribution of FRIexp scores

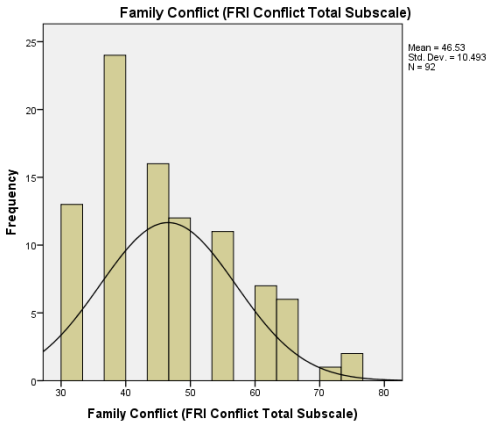

Figure L7. Distribution of FRIcon scores

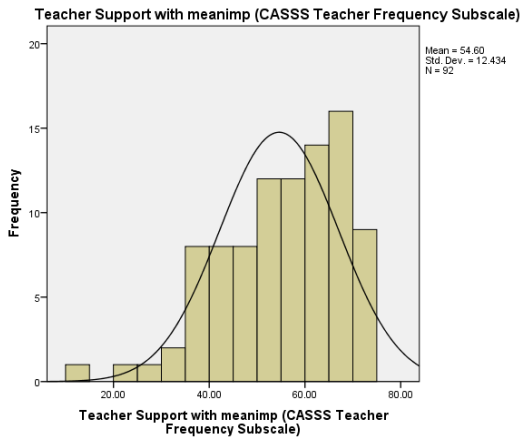

Figure L8. Distribution of CASSS-T scores

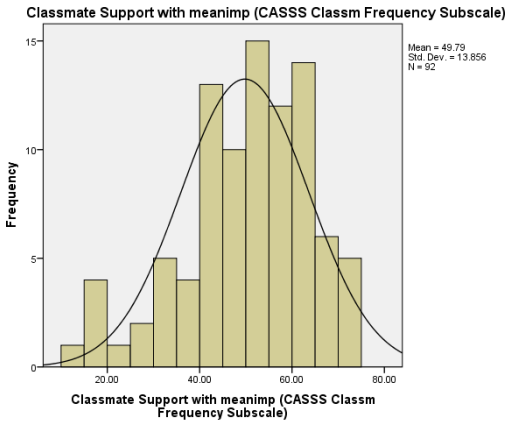

Figure L9. Distribution of CASSS-C score

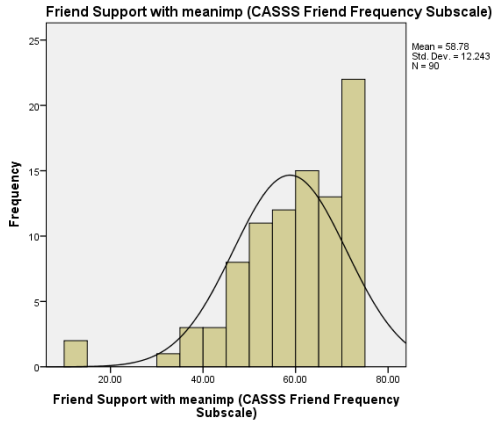

Figure L10. Distribution of CASSS-F scores

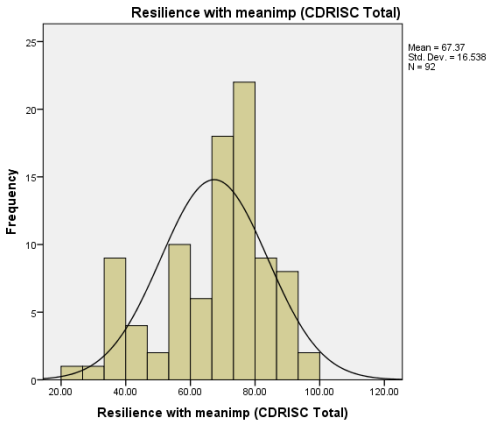

Figure L11. Distribution of CD-RISC scores

Skewness and Kurtosis

Table L1

Skewness and kurtosis z-scores

Variable	Skewness z-score*	Kurtosis z-score*
Age (years)	0.83	-1.35
Severity of injury (ISS)	3.25	-0.32
Time since injury (days)	0.62	-2.72
Psychological impact of event (CRIES-8)	1.66	-1.67
Family cohesion (FRIcoh)	-5.12	3.44
Family expressiveness (FRIexp)	-0.65	-1.75
Family conflict (FRIcon)	2.94	-0.21
Teacher support (CASSS-T)	-3.11	0.89
Classmate support (CASSS-C)	-2.63	0.25
Friend support (CASSS-F)	-5.72	6.30
Resilience (CDRISC)	-2.59	-0.35

* *Z*-scores > 1.96 and < -1.96 indicate significant skewness or kurtosis at $p < 0.05$ (Ghasemi & Zahediasl, 2012)

Statistical test of normality

Table L2

Shapiro-Wilks test of normality

Variable	Statistic	df	Significance*
Age (years)	.962	97	.006
Severity of injury (ISS)	.897	87	.000
Time since injury (days)	.934	97	.000
Psychological impact of event (CRIES-8)	.946	93	.001
Family cohesion (FRIcoh)	.848	93	.000
Family expressiveness (FRIexp)	.949	93	.001
Family conflict (FRIcon)	.917	92	.000
Teacher support (CASSS-T)	.947	92	.001
Classmate support (CASSS-C)	.961	92	.007
Friend support (CASSS-F)	.875	90	.000
Resilience	.952	92	.002

* $p < .05$ indicates a non-normal distribution (Pallant, 2010).

Inspection of histograms, skewness and kurtosis z-scores and the statistical test of normality indicated that the assumption of normally distributed data was not met by the outcome variable and a number of independent variables. Non-parametric analysis was therefore required.

Appendix M

Missing Data

Overall, 5% of values were missing across the data set. For nine variables, ≤ 7% of respondents had missing data. For the four remaining variables (resilience, injury severity, social support – classmates, social support – close friends), ≤ 11% of respondents had missing data.

Where respondents had ≤ 10% missing data within one measure or subscale, person-mean imputation was used for missing values; this was utilised for the CD-RISC (*n* = 2; both respondents had only one item missing), in accordance with manual scoring instructions (Connor & Davidson, 2003). As per manual guidance for the CASSS (Malecki et al., 2000, 2014), if ≤ 2 items were missing within a subscale, the mean of the participant's completed subscale items was used to substitute the missing item (teacher *n* = 1, classmate *n* = 4, friend *n* = 1; all respondents had only one item missing within a subscale).

Means could not be calculated for the FRI as item answers were either true or false. If a participant had any item missing on an FRI subscale, then that subscale was excluded from analysis via pairwise deletion. Where respondents had missed > 10% items on one measure (or > 2 items within a CASSS subscale), then data for that measure was also excluded via pairwise deletion within the analysis (Pallant, 2010).

Demographic details (age, injury cause, injury type, injury severity, time since injury) were missing for only one participant and were excluded via pairwise deletion. Ten other participants had ISS classified as 'not TARN'. As detailed previously, to receive an ISS within TARN, injuries must have occurred to a certain physical area and the person must have been hospitalised for a minimum of 72 hours. For the purpose of the sample, these participants were included as they still received input from the Major Trauma Pathway. For

the purpose of analysis, TARN stipulate that means should not be utilised for ISS, therefore severity data for these respondents was considered missing, and excluded from analysis under pairwise deletion.

Appendix N

Data Screening to Test the Assumptions of Multiple Hierarchical Regression

Multicollinearity

Inspection of the correlation matrix indicated that correlations between predictors were not considered too high (i.e., $r > .9$; Pallant, 2010). Correlations between independent variables in the current study were all below .6, suggesting multicollinearity was not an issue. Collinearity diagnostics were also conducted on the data set. Tolerance values were all above .5 (< .1 suggests multicollinearity) and variance inflation factors (VIF) were all below 2.0 (> 10 suggests multicollinearity). The results therefore indicated no concern regarding multicollinearity in the data set (Pallant, 2010).

Assumption of independent errors

Durbin-Watson value was 1.99, within expected range of 1 to 3.

Outliers

Mahalanobis distance values were all below the critical chi square value of 24.32 and Cook's distance values were all below 1, suggesting that no cases had undue influence on the regression model (Tabachnick & Fiddell, 2013).

Normality, linearity and homoscedasticity

Visual inspection of the residuals plots (Figs. N1 and N2) suggested no major deviations from normality.

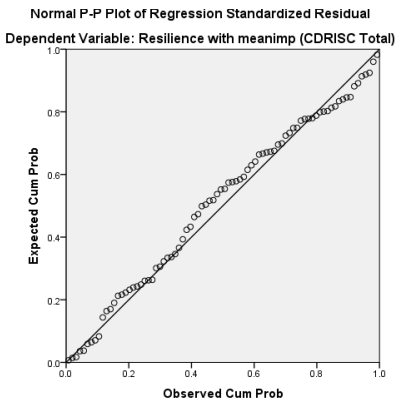

Figure N1. CD-RISC normal P-P plot

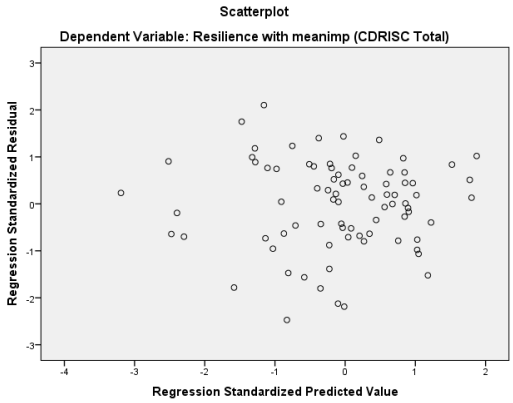

Figure N2. CD-RISC scatterplot